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and Its Practical Applications

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The Central Station's Strong Position

THE question as to relative efficiency of the electric central station and the isolated plant is squarely before the Fuel Administration. It is an unavoidable issue. No matter who objects, no matter how loudly any one cries, it is there for solution. It will be solved on war-time economic grounds.

We have not always agreed with Fuel Administration policies, but we have full and implicit faith in the patriotic love of country which is behind them. And in the main the Fuel Administration policies have worked to further the great serious aim of the nation. We are confident that while the present officials are responsible a patriotic determination will be followed conscientiously.

In developing and administering the large organization and duties connected with the coal problem it is inevitable that differences shall arise. Dealing with coal production, price, distribution and consumption, reaching in its wide influence almost every one in some degree, the Fuel Administration could not hope to get through the war without having its policies subjected to question and perhaps attack. It has a right to ask that its motives shall be accepted as clean. Beyond that —although the ELECTRICAL WORLD does not assume in any way to speak for it—probably all that the Fuel Administration asks is that its rulings shall be met in a true American spirit. The Fuel Administration is not trying to ruin any industry, it is trying to win the war. It is not there to promote inefficiency, it is there to stimulate efficiency by every lawful means within its power, for that is the only way to gain the victory.

In stimulating the highest possible efficiency in coal consumption the Fuel Administration necessarily runs counter to the practice of those who burn coal wastefully. In these times the thing which is efficient has a better claim to recognition than the thing which is wasteful. There is not a pound of coal to waste. The central station generating a tremendous volume of energy is beyond argument as an economical agency, and the isolated industrial plant which obtains relatively little power from its fuel consumption is without a shred of doubt wasteful. If the economical central station can carry the load of the wasteful isolated plant, it does not need the wisdom of a Solomon to decide what ought to be done. Conversely, if there is an economical isolated plant that can carry to public advantage all or any part of the load of a central station, its facilities should be used to the utmost, and we should expect to see that done under the acute war conditions of the future.

The nation at war must suppress waste in coal for the simple reason that our production of coal is less than our demand for consumption. It must stimulate production at points where production is most urgently required. The central-station industry lives and thrives because it is a daily demonstration of economy in production and distribution of electrical energy from coal. By superior service at low cost it earns the economic right to existence.

Misdirected Recruiting Activities

EFFORTS of the recruiting agent appear at times to have paradoxical effects, for, though he increases the general enlistments, he decreases the technical enlistments. This has undoubtedly been the case in the university cities. Here are found, naturally, representative youths of the nation, patriotic and impetuous, who are impatient to serve immediately. They are ideal warriors, young, healthy and courageous. They are even more than this. They are the storage battery of technical knowledge of the present war and a coming peace. Their potency in warfare, if properly utilized, will be inestimable, for this is a war of minds. Science fights science; one great invention battles against another. The universities appreciate the value of these youths, and the government is striving to conserve them by means of the engineers' reserves and other student reserves. The arrangement seems an effective, consistent and satisfactory one. It enables the student to complete his technical training and to perform his full patriotic service. When he enters the service he is doubly trained, as a soldier and as a technologist.

He is doubly trained, that is, if he has not hearkened to the call of a recruiting agent, for, even though the government has organized the reserves, the recruiting agent is not inclined to appreciate their importance. The latter recruits throughout the university year at the university itself, and he is constantly enlisting men for immediate service. Some youths listen to one agent, some to another, being influenced by their friends, their mood or contemporary conditions rather than by their aptitude and particular fitness. And thus the technical branches of the army lose men who would be invaluable later for highly specialized service. The youth is not to be blamed for the loss, because he is a patriot. The recruiting agent is not to blame, because he is doing his patriotic duty. Yet there is, undoubtedly, a loss somewhere. Perhaps the government, recognizing this fact, will make the student reserves more comprehensive or effect a more discriminating control of recruiting in university centers. Perhaps the recently organized Division of Engineering of the United States Employment Service, in its effort to conserve the technical men, will advise and guide the youths of the universities. Something should be done.

Maintaining Turbine Economy

AMONG the virtues of the steam turbine is its capacity when properly operated of maintaining its initial efficiency for long periods. It is found, however, that turbines fall off in performance, sometimes to a rather serious extent, and that the causes of such failures are not altogether obvious at first sight. They are, in fact, more difficult to diagnose than troubles in the more familiar reciprocating engine. J. Y. Dahlstrand's paper in this number of the ELECTRICAL WORLD gives an extremely useful summary of turbine troubles, both external and internal. First, perhaps, in order of importance is failure of vacuum, which may be due to various causes, chiefly air leaks and steam leaks, the former likely to develop in the exhaust piping, the glands or the condenser itself. It is well known that a turbine designed for high efficiency suffers acutely from lowered vacuum. The injury to the economic performance is generally particularly serious when the machine is operating at partial loads. On the whole, the lower the load the more the efficiency is impaired by a given drop in vacuum. In some instances this condition may be modified by the fact that the machine itself has been, as it were, overrated, so that in fact its best performance is given at a load below the rating, while at the latter figure the efficiency decreases.

This is quite analogous to what occurs in electric generators and motors. These may be designed for the highest possible efficiency at rated load or for a maximum efficiency at some lower point perhaps intended to represent average load conditions. There were regularly upon the market, and still are, machines corresponding intentionally to each of these classes—one designed at a certain price in lowered efficiency to stand serious overloads, the other with less overload capacity and maximum efficiency below the rating. Of course, the commercial tendency is to rate the machine for about all it will stand, and this to a certain extent holds for steam turbines as well as for electrical machinery. It behooves the purchaser therefore to ascertain definitely which kind of machine he is purchasing. That rated nearer its capacity may in point of fact be the more desirable for certain uses, but in any case a turbine designed to give its proper rate of performance on 28 in. (71.12 cm.) of vacuum should be kept up to this point as nearly as possible, and careful watch should be maintained for air leaks and steam leaks. The latter particularly should be watched for when the turbine is normally running considerably below load. Back pressure from careless operation is another external cause of trouble which must be taken into account and guarded against.

Internally there is danger of steam leakage due to excessive clearance, wearing of bushings and finally erosion of the diaphragms. Such leakage can be quickly traced by pressure gages applied between the stages to give a measurement of the actual pressure differences as compared with those of a new turbine. There may also be trouble due to excessive clearance between the stator and rotor parts of the machine. The steam turbine is essentially a machine requiring for its best performance very small clearances, and there may be both initial difficulty and subsequent trouble for maladjustment or, in case of turbines of very high steam velocity, erosion. Wet steam and steam carrying over mechanically deposits due to impure feed water may aggravate this trouble, and in the latter case cause a deposit in the blades decidedly inimical to high efficiency. Dry and superheated steam and the purification of the feed water minimize the difficulties due to this source. In operation the steam turbine, beautifully simple and efficient as it is when properly designed and worked, is not free from troubles of its own, and it must be skillfully and carefully operated to yield the best results. The fine points of turbine operation are not so commonly known as they should be, and Mr. Dahlstrand's article will serve a useful purpose in bringing them to the front.

The Oxide-Film Lightning Arrester

DR. STEINMETZ'S A. I. E. E. paper on this new and important form of arrester sets out in the plainest possible manner the requirements of lightning arresters and the particular advance which has been made in the production of the oxide-film type, of which details were given in the admirable paper by Crosby Field. In general terms he divided the art of lightning protection into three periods, characterized each by its own special problems. In the beginning were the telegraph and telephone circuits carrying insufficient power to lead to a continuance of trouble in case of a discharge. For these any convenient kind of gap arrester which would send the lightning to earth was sufficient. Following this came the development of the lighting, railway and power circuits, carrying considerable energy but of low electrostatic capacity and in general not tending to store energy to an embarrassing extent. Finally we have to deal with the long high-voltage modern circuits carrying and storing large amounts of energy.

So far as alternating circuits are concerned, the principal problem in most cases has been to check the discharge by the use usually of non-arcing metal which prevents the starting of the current from zero after the first discharge, so that whatever short circuit exists is limited to a half wave of the normal period. Such arresters have usually been built with many gaps in series, and in later times with shunted gaps the better to take care of moderate discharges through a direct resistance to earth, while leaving a clear track for the heavy lightning discharges. For circuits of great power and capacity multi-gap arresters soon proved insufficient, for on a discharge high-frequency oscillations were set up which kept up a repeating short circuit over the gaps, frequently burning up the arrester itself.

Following devices of this kind came the electrolytic arrester, which does not in any proper sense short-circuit at all, even for a small fraction of a period, but discharges abnormal voltages freely. In all ordinary cases the energy involved in these over-voltage discharges is not enough to damage the arrester or to lead to further trouble. But experience has taught that the electrolytic arrester has its failings, the chief of which is the fact that it requires forming and a considerable amount of attention and inspection in order to keep it in first-class working order. It also has to be abandoned in situations where it is exposed to very low temperatures, merely from the fact that it does contain an electrolytic. Practically, when in first-class working order, it becomes a self-repairing electrostatic condenser, letting over-voltage by while blocking the main discharge, which is the source of danger in lightning arresters. The new arrester operates very much on the same principle; that is, it works as a self-repairing condenser, but, containing no electrolyte, it does not require to be formed and is always ready for action. When installed it is already formed and keeps itself in condition. Essentially it is built up like a condenser of metallic electrodes and sheets of compressed lead peroxide, with contact films of a lower oxide to serve as an insulator. Ordinarily only a trivial leakage current can pass, but, attacked by overvoltage, the insulating film punctures and then repairs itself by the action of the discharge. The combined cells are hermetically sealed so that they can be used out of doors if merely protected from rain, and they have now in experimental use for several years shown a high degree of efficiency. The oxide-film arrester appears to be a very material improvement over the electrolytic type in compactness, reliability, and particularly in lack of need for the rather careful attention which in the earlier device was the price of security.

Training Inspectors in Illumination

AS WE have many times reiterated, good lighting is essential to good industrial results. A long step in advance in this direction was taken by the formulation of the code of factory lighting by the Illuminating Engineering Society and its substantial adoption already by several states as part of their factory legislation. No amount of legal regulation, however, will produce good lighting unless the code is actually enforced by the factory inspectors whose duty it is to look after the general welfare of workpeople with respect to operating conditions. It may be said, upon the whole, that factory managers have awakened to the importance of good lighting in a very gratifying manner and that the factory inspectors are anxious to see that the law is obeyed. Failure to do so results far more often from ignorance of the practical features of good lighting than from any intention to evade the law or overlook violations of it. It is therefore of fundamental importance that the factory inspectors should be instructed in the fundamentals of good lighting necessary for satisfactory industrial results, so that they may undertake their duties with full comprehension not only of what the law says but of what it really means. With such training it is safe to say that a very great improvement can be made in bad industrial conditions which have for the most part grown up through carelessness.

In this matter Prof. C. E. Clewell's article in the current issue is particularly informing, since it gives details of a course of instruction actually carried out at the University of Pennsylvania at the request of the Commissioners of Labor of Pennsylvania and New Jersey. The time allotted to such instruction—or, rather, practical demonstrations bearing on the subject—could only be short, and it was necessary to crowd into two days of instruction the main points involved in proper industrial lighting. Nearly 100 inspectors from the two states interested assembled for instruction, which was given by representatives of the university, and in addition several distinguished representatives of the I. E. S. took active part in the work. The four lectures on the fundamentals included a discussion of the things that led to the formulation of factory lighting codes and their present status, specification of the quantity of light, the relations of glare in factory lighting and the distribution of light in factory spaces. The sound and practical coaching thus given was emphasized by some admirable exhibits showing the characteristics of good and bad lighting and the usefulness of various lighting appliances.

The time available was, of course, too brief for anything like serious and thorough instruction, but it was amply sufficient to give a group of alert inspectors, anxious to learn the practical points of the lighting code, a large amount of highly useful and practical information which will undoubtedly go far toward bringing about a sensible enforcement of the codes and a direct improvement in industrial lighting practice. The example is one which certainly ought to be followed elsewhere, wherever in fact factory lighting codes are in force, as they should be universally. Even a simple law intelligently carried out can do very much toward the betterment of conditions, and if sound practical hints can be given to the inspectors on what to look for and what remedies to suggest, the manufacturers themselves can be trusted to carry on the work with the expert advice that they can very easily obtain. No one really wants his factory badly lighted, but existing faults which have gone on from year to year simply do not obtrude themselves on one's notice and the bad precedents are kept up until somebody who knows calls attention to them. We hope to see the good example of instruction here described carried out everywhere.

The Coming Issues

ANOTHER series of articles will be started shortly in the ELECTRICAL WORLD supplementing those which have already been printed on the application of motors to various industries and purposes. The new series will dwell on the solution of problems connected with the selection of controllers for motor-driven machinery. An analysis of distribution losses will be made with the object of indicating how they may be reduced by rearranging circuits or improving construction. The enumeration of advantages obtained by using higher steam pressures and superheats will be brought up to date in still another article, which, however, will dwell on the turbine phase of this subject only. As announced in the last issue of the ELECTRICAL WORLD, information will be presented on the results of tests conducted with a lightning arrester which works on a new principle.

Causes of Impaired Turbine Economy

Partial Loads and Other than Rated Vacua Increase Water Rate Considerably—Leaky Glands or Exhaust Pipes Also Detrimental—Deposits on Blades and Internal Leakage Should Be Avoided

BY JOSEF Y. DAHLSTRAND
Chief Engineer Kerr Turbine Company

IN ADDITION to its many other advantages the steam turbine has the characteristic of maintaining its original efficiency for a considerable length of time if operated intelligently and properly maintained. In the majority of cases it can also be restored to its original efficiency with a small expenditure compared to that necessary for the same purpose on an engine.

The causes of impaired steam economy with a turbine or turbo-unit in many cases lie entirely outside of the turbine itself. In certain instances, however, the causes are found to develop right in the turbine. When steam economy is impaired it does not necessarily follow that the thermo-dynamic efficiency of the turbine affected is decreased. In some cases the thermo-dynamic efficiency might actually be increased. In the following article the steam economy of the turbine only will be considered, rather than the thermo-dynamic efficiency.

To Save Coal Operate Turbines at Rated Vacuum

Probably the most common cause of decrease in steam economy, particularly with a small turbine, is the falling off of vacuum in the exhaust chamber. Furthermore, it generally results in the most serious loss.

The effect of vacuum on the thermo-dynamic performance of the steam turbine is well recognized. Various papers and books have been published with charts giving the percentage of steam saved for each inch of vacuum. As a matter of fact, that percentage varies greatly with varying steam pressure and varies somewhat with different types of turbines, with capacities, with operating speeds, with quality of steam and, last but not least, with the percentage of the designed load developed.

The charts are of two different and distinct types. One shows the difference in steam consumption obtained with turbines designed for different vacuums. The other type illustrates the difference in steam performance obtained with a turbine designed for a certain vacuum but operated at a different vacuum. Both types are subject to variations, due to all the causes mentioned. Naturally the latter is the one which should be considered in this article.

Certain curves are shown in Fig. 1 made by the writer from actual test data on a number of 1000-kw. Kerr turbines designed for 150-lb. steam pressure (dry and saturated steam) and operating at 3600 r.p.m. with varying vacua (27 in. to 29 in., or 68.58 cm. to 73.66 cm.) and loads. These curves may be used with fairly good accuracy for turbines rated at 500 kw. to about 3000 kw. Proper correction must of course be made for steam pressure, if this is not 150 lb.

These curves are of special interest on account of the fact that they show the effect of vacuum when operating at partial loads. It will be noted that a turbine designed for 28 in. (71.12 cm.) of vacuum, and operating at 27 in. (68.58 cm.), with 25 per cent load, will have a steam rate 12 per cent in excess of that which it would have if operating at 28 in. vacuum and 25 per cent load. If, on the other hand, it was operating at 100 per cent load and 27 in. vacuum, the steam rate will be impaired only 7 per cent compared with what it would have been if operated at the rated vacuum. The explanation of this lies, as will readily be understood, in the fact that when a turbine is operated at 25 per cent load the steam is throttled before entering the first stage nozzles to a pressure very much lower than 150 lb., and the number of heat units constituting the difference in available energy between 27 in. and 28 in. vacuum becomes a much higher percentage of the total energy available for use in the turbine.

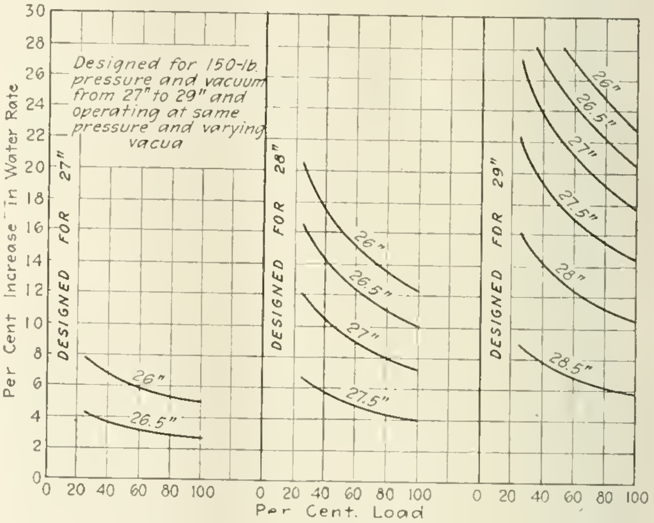


FIG. 1—EFFECT OF LOAD AND OTHER THAN RATED VACUUM ON WATER RATE

Consulting the entropy heat diagram for a verification of the correction figure, 7 per cent, between 28 in. and 27 in. vacuum, it will be found that from 150 lb. to 28 in. vacuum there is 323 B.t.u. available, excluding the effect of reheating and considering straight adiabatic expansion. From 150 lb. to 27 in. vacuum there will be found 301 B.t.u. on the same basis. According to this, there is 7½ per cent more heat available with 28 in. vacuum than with 27 in. vacuum. The correction figure for the latter water rate on this basis should be 7½ per cent.

There are certain factors which have a tendency to increase this correction figure. They are: First, the windage losses, which increase with the density of the steam; second, the fact that the nozzle passages in the last stages are too large for the lower vacuum, a circumstance equivalent to operating the last stages at a partial load. These circumstances, however, are generally more than outweighed by another fact.

As was mentioned before, an increase in steam consumption does not necessarily mean that the thermo-dynamic efficiency is decreased. On the contrary, it is sometimes actually increased. This happens to be true to some extent with nearly all commercial turbines of small and medium size. The thermo-dynamic efficiency is largely dependent on the "velocity ratio," or the relation between blade and steam velocities. For commercial reasons the turbine frames are actually in many cases somewhat smaller than those which would give the very best efficiency.

It might be stated here that future tendencies in steam-turbine building will probably follow somewhat different lines from recent practice. Instead of rating a turbine frame at its maximum capacity, without regard for a small loss in efficiency, indications are that the future policy will be to get the maximum efficiency even if at higher cost.

As has already been stated, low vacuum is far from uncommon, particularly in small power plants. It is not unusual to find that a turbine designed for 28 in. (71.12 cm.) of vacuum is actually operating at 25 in. (63.5 cm.) vacuum for months, owing to leaks in the exhaust line or some similar cause, with a loss of no less than 16 per cent in steam consumption. The same percentage loss will be found in coal consumption if the low vacuum is due to air leaks, as this does not lighten the work of the auxiliaries but rather increases it.

Leaky Glands or Exhaust Pipes Reduce Vacuum

The falling off of vacuum in the exhaust chamber of the steam turbine may be due to a number of different circumstances. The foremost of these are air leaks. These may develop in the exhaust piping between the turbine and condenser, in the condenser itself or in the turbine glands. Air may also enter through the piston-rod and valve-stem packing on condensate pumps. In addition, air may enter the condenser through the circulating water.

The exhaust-end gland of the steam turbine is generally sealed with water or steam, the simplest form of this gland for condensing service being shown in Fig. 3. This gland is commonly used for impulse turbines. It has three carbon rings with a high-pressure connection. The valve throttling the high-pressure steam is opened sufficiently so that the pressure at the point *A* is high enough to keep the air from leaking in and at the same time not high enough to cause any excessive leakage along the shaft toward the outside of the turbine. If too great an amount of high-pressure steam is necessary to seal the gland, it is evident that the packing needs to be replaced. Assurance that there is no leakage of air into the gland may be had by adjusting the seal valve so that a very slight mist of steam escapes along the shaft.

In certain cases with low-pressure turbines, where the steam supply comes from the exhaust of a non-condensing engine, steam leaks sometimes develop in the turbine steam line. These are especially common when operating turbines at low loads, in which cases the pressure on the first-stage nozzles is generally below atmosphere. In such cases it is often advisable to install a so-called flow valve in the low-pressure steam line. This valve is so made that it will maintain ahead of itself a constant pressure, no matter what the pressure may be on the opposite side of it. It will hence prevent vacuum from entering the engine exhaust pipe, which, as stated above, generally results in infiltration of air through pipe joints or piston-rod and valve-stem packings.

The air leaks in piping and condenser are easily detected. The most common method of detecting air leaks at these points is that of bringing the flame of a candle around the joints and noting at what points the flame is drawn toward the point.

While air leaks are the most common cause for impairment in vacuum, there are others as well. A condenser which has been in service for a considerable length of time and which has been allowed to accumulate a large amount of dirt on the surfaces will not be able to maintain the vacuum it could give in its original condition.

Excessive back pressure is just as detrimental with non-condensing machines as impaired vacuum with condensing units. This is not so common as impaired vacuum, but may be caused through carelessness on the part of operating engineers in leaving exhaust valves partly closed, etc. The effect of increased back pressure on the steam economy of non-condensing turbines may be realized from the following table.

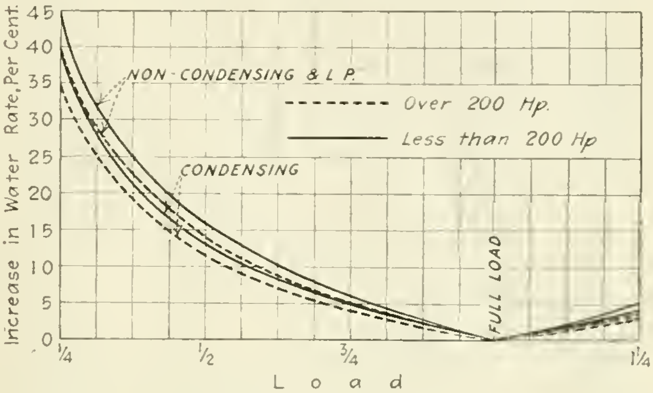


FIG. 2—EFFECT OF LOAD ON WATER RATES OF CONDENSING AND NON-CONDENSING TURBINES

Initial Steam Pressure (lb.)	Increase in Steam Consumption for Each Pound of Back Pressure (per cent)
200	1
175	1¼
150	1½
125	2
100	2½
75	3

Operation at Partial Loads Is Uneconomical

Next in its effect on the steam economy of a turbine comes the operation of turbines at partial loads. In a great many instances steam turbines are ordered for certain loads and designed for these loads. Later on it develops that they are required to operate at points very much below the full load rating of the machine. In such cases there generally results a considerable loss in steam economy. The curves shown in Fig. 2 illustrate these losses as found in tests on Kerr steam turbines.

The reason for the increased steam consumption at partial loads is obvious. The losses in the turbine do not change in proportion to the load but remain nearly constant for any load. Consequently the relation of these losses to the energy available increases for partial loads. The throttling of the steam which is found necessary for partial loads, unless hand valves are used, robs the steam turbine of some of the energy otherwise available.

The fact that a turbine is operating at partial load may be seen by observation of a steam gage which is tapped into the ring chamber ahead of the first-stage nozzles. If the pressure under normal operation at this point is considerably below boiler pressure, it is an indication that the turbine is operating under a partial load, provided of course that it was designed for only a reasonable pressure drop through the valve. The power developed with any type of turbine is very nearly proportional to the pressure at that point.

Turbines should be made to operate normally under the conditions for which they are designed. If it is necessary that they should carry overloads, overload valves—either automatic or hand operated—should be used.

Internal Leakage Should Be Avoided

Up to this point only those circumstances which arise through steam conditions and from outside sources have been considered. Certain mechanical conditions inside of the turbine may also cause a thermo-dynamic loss in the steam turbine. Foremost among them is internal leakage. This is caused by the wearing out of the packing rings or bushings or the excessive clearance of labyrinth packing between the various stages in the steam turbine.

Internal leakage is, of course, most liable to develop where the pressure differences are very great. Therefore, in certain makes of turbines the high-pressure steam space is separated from the vacuum chamber with an internal gland. In cases of this kind it is always advisable to watch this gland carefully, as leaks may readily develop through it, causing a considerable loss in steam economy. Internal leakage is particularly detrimental in the high-pressure stages of a machine on account of the low specific volume of the steam in these stages, which results in a large discharge of steam through a small opening.

Leakage may also take place between the stages along the horizontal joints of the diaphragms in a multistage turbine. The steam and moisture may erode the surface of these diaphragms to such an extent that a considerable amount of steam will pass through from stage to stage.

Leakage between stages as well as internal leakage may be detected by placing a gage in each stage of the turbine to give the pressure in that stage. Comparing these figures with the pressures which the turbine had when originally installed will give a good indication as to the condition in which the packings installed in the turbine are.

Steam leakage through the high-pressure gland or through the leakage piping on this gland is generally negligible. It is usually sufficiently annoying to the operating engineer, however, to lead him to try to overcome this condition. Generally losses due to this cause are greatly exaggerated by operating engineers.

Among the causes for impaired steam economy is excessive clearance between stationary and rotary elements. When this condition exists, Rateau, Curtis and other impulse turbines lose slightly in power. It would be difficult to formulate any definite rule as to the degree in which steam economy is influenced by clearance, as this varies with capacity of machine, nozzle and blade angles, etc. It is advisable, however, to bear it in mind if it becomes necessary to manipulate the thrust bearings. In general, it may be said that the rotary element should not be farther away from the stationary element than is necessary for the mechanical safety of the machine. Each case should be considered separately, however, so turbine users should consult with the manufacturers of their machines if information regarding axial clearances is desired.

With certain makes of turbines, particularly single-wheel impulse turbines, where the total pressure drop is utilized in one single expansion, considerable trouble has been experienced with erosion. This has been the case particularly with turbines in which the relative steam velocity was high—in other words, turbines having small wheel diameters or low speeds and operating condensing. Some difficulties have been experienced even with non-condensing turbines as well, particularly where the steam has been wet. If superheated steam is used, erosion is less common. Blade materials now being used in various types of steam turbines utilizing high steam velocities are being improved so as better to resist the erosive action of the steam. Erosion is absolutely unknown with other types of turbines on account of the low steam velocities employed. Through erosion of the blade edges the axial clearance between the rotary and stationary elements is increased, which tends to cut down the power developed. Through the fact that these edges are made dull less perfect steam action is attained, which in turn causes a loss in power and efficiency.

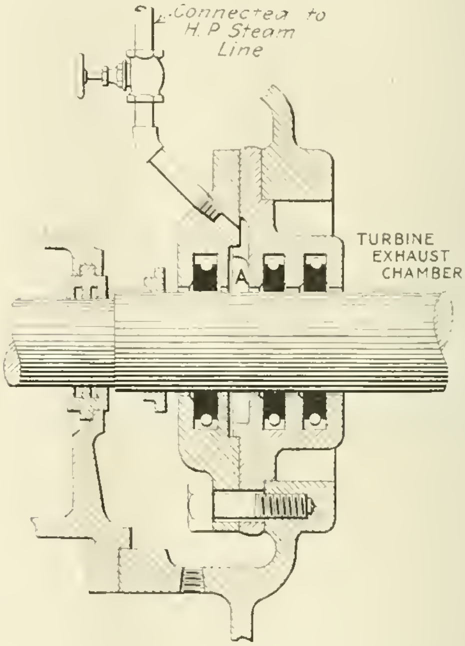


FIG. 3—GLAND FOR CONDENSING SERVICE

Deposits on Blades Liable When Forcing Boilers

The deposits of foreign substances in the turbine blades, blocking or partly blocking the passages, might be mentioned as another cause of impaired steam economy in turbines.

This trouble usually occurs when a turbine is being fed by one or more boilers which are giving about their maximum capacity. It is more serious with some types of boilers than others. In both fire-tube and water-tube boilers there is such active circulation of water that the mud and foreign material are prevented from settling in the boiler and are mechanically lifted to the top and carried through the steam lines.

In some steel-mill districts the deposit consists principally of a muddy material which is bound together by chemicals existing in the water. At the velocity at which steam enters the blades any slight material carried in the steam will be impelled against the blades with such a velocity that it will form a very compact deposit. In a great many instances the boiler-feed water supply contains large portions of vegetable matter, as well as boiler scale-forming materials. Where this is the case the combination produces a tough, rubber-like deposit which rapidly fills the turbine blades and causes serious trouble.

Owing to the immense quantity of steam passing through large turbines a rapid increase of deposits may result even though the amount of material mechanically carried over by the boiler is very small per unit of power. It is, therefore, frequently astonishing to note the accumulated deposits when the steam is apparently quite pure and clean. Sometimes turbine blades become so clogged that sufficient power cannot be produced and the turbine has to be dismantled and cleaned.

Steam that is very wet, when made from water containing scale-forming material, such as magnesia and other salts, will invariably deposit a scale-like substance over the turbine blades. This is somewhat distinct from the deposits mentioned previously. There are other deposits which are more local in character, such as, for instance, deposits which occur in paper-mill districts, where a considerable amount of pulp is discharged in a finely divided state into rivers adjacent. The result is that this finds its way into some neighboring power plant where, owing to its fine and light nature, it is carried over by the steam and very rapidly blocks up the turbine blades. Several cases have come to the writer's attention where this occured, the turbine having to be dismantled at regular intervals and the blades cleaned out three or four times a year.

There are various means of combating the clogging of blades from the above-mentioned causes which are effective in different degrees. One which is frequently used, particularly for non-condensing turbines, is the placing of a lubricator in the turbine steam line. The oil vapor in the steam lubricates the blade surfaces and prevents the substances from becoming attached. Even for condensing turbines this method is frequently used, although it would appear not to be entirely advisable in installations where surface condensers are used, on account of oil deposits which would be found on the tubes. The writer knows of two instances where this method is used with turbines rated at 10,000 kw.

Undoubtedly the most effective means of preventing this trouble is that of installing a large receiver in the steam line. The steam velocity will be decreased greatly while passing through this receiver and the foreign substances will be deposited on the walls. In addition to the receiver there should be installed near the turbine throttle a steam separator which will serve the double purpose of removing from the steam any remaining foreign substances and extracting a great deal of moisture from the steam. It might in some cases be advisable to combine these two apparatus and install a so-called receiver-separator, in which case the foreign materials will be deposited on the baffles.

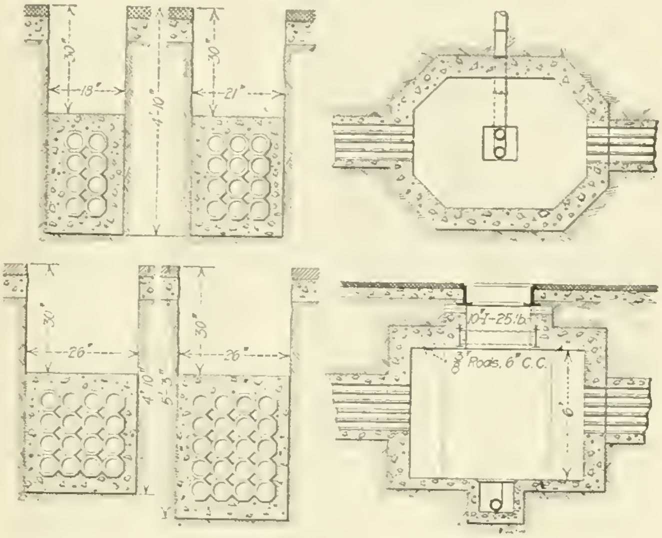
ESTIMATING THE COST OF UNDERGROUND CONDUIT

Time Spent on Preliminary Work Will Be Profitable Because Sub-surface Structure Interference May Double the Original Estimate

BY JOHN F. MAHONEY

PRESENT-DAY conditions have resulted in considerable variation in the price of labor and material, and to such an extent that careful estimates based upon previous costs are rendered valueless. However, if estimates of construction work are based on any prices, they should be usable for all times if applied to the costs prevailing at the time of construction. The data presented here are actual costs required in New York City at the present time, and with slight changes it is believed that they may be used on similar work.

The calculations for ducts given herewith are based on the use of 3.5-in. (8.9-cm.) single ducts, laid with an average cover of 30 in. (76 cm.). Where existing sub-surface structures cause the new ducts to be laid below this level the cost per duct foot given for excavation will increase accordingly. The proposed formations of ducts are shown in Fig. 1, and estimates are given in Table I. The cost of removing sheet asphalt, wood or granite block on a 6-in. (15.2-cm.) concrete base is calculated as rock, which results in the unit of prices given. The cost of laying conduit is estimated on the basis that a bricklayer and helper can lay 1200 duct ft. (366 duct m.) a day, with 2 cents per foot (6.4 cents per meter) additional for cement mortar and breakage. Repaving costs are taken from recent lettings of contracts for new work.



FIGS. 1 AND 2—PROPOSED FORMATION OF UNDERGROUND DUCTS AND TYPE OF MANHOLE MOST COMMONLY USED

No provision is made in this table for replacing existing sub-surface structures which may have to be disturbed. In Table II, however, the prices for such replacement are given as bid by three different contractors on sections of the subway now building. This table includes gas and water pipes, wrought-iron pipe conduit and Edison tube. The figures given are for relaying only and do not include new material necessary. As prices for new material vary greatly, they are not produced.

It will be noticed in Table II that there is considerable variation between the unit prices bid by different contractors. Contracts A and B were cut-and-cover work, C was open-cut. Contract C was in a section where very few sub-surface obstructions were encountered. For this reason there was little likelihood of extra costs under these items, and the contractor could afford to bid low and build up his estimate under other items. The average of all three bids is probably the most correct estimate of the work.

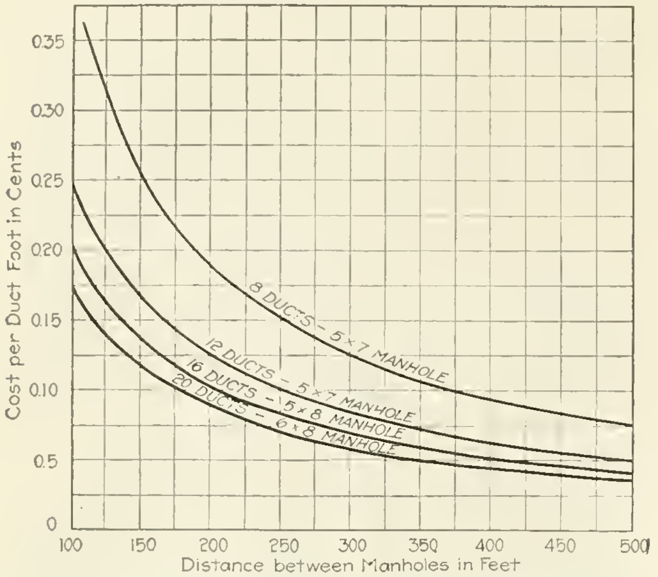


FIG. 3—CHART FOR DETERMINING COST OF MANHOLES PER DUCT FOOT FOR SEVERAL TYPES OF UNDERGROUND SYSTEMS

In Fig. 2 the type of manhole most commonly used is shown, the cost estimates being given in Table III. Three different sizes are included under four kinds of pavement. The cost of installing a drain is omitted as it varies considerably, depending on the distance between the manhole and sewer. This figure will seldom be less than $50 and should be added to the estimated costs given in the table. When the length of drain is known its total cost can be estimated from units given for removing the pavement, excavation, etc.

TABLE I—UNIT AND TOTAL ESTIMATES FOR DUCTS IN FORMATIONS AS SHOWN IN FIG. 1

Work Items	Unit	Cost	Eight Ducts per Duct Foot	Twelve Ducts per Duct Foot	Sixteen Ducts per Duct Foot	Twenty Ducts per Duct Foot
Removing pavement:						
Sheet asphalt	Sq. yd.	$2 50	$0 052	$0 04	$0 038	$0 031
Granite block on sand	Sq. yd.	1.25	0 026	0 02	0 019	0 015
Granite block on concrete	Sq. yd.	2 50	0 052	0 04	0.038	0 031
Wood block on concrete	Sq. yd.	2.50	0 052	0 01	0.038	0 031
Excavation, including sheeting, grading trench, carting surplus and backfill	Cu. yd.	4 00	0.116	0.092	0 084	0.074
Concrete	Cu. yd.	15 00	0.147	0 093	0.079	0 069
Conduit	Duct ft.	0.10	0.10	0 10	0.10	0 10
Laying conduit	Duct ft.	0 03	0 03	0 03	0.03	0 03
Repaving:						
Sheet asphalt	Sq. yd.	2 50	0 052	0 04	0 038	0 031
Granite block on sand	Sq. yd.	1 25	0 026	0.02	0.019	0.015
Granite block on concrete	Sq. yd.	3 00	0 062	0.018	0 046	0 037
Wood block on concrete	Sq. yd.	4 25	0.088	0.068	0.065	0.053
Total cost per duct foot:						
Sheet asphalt	...	...	0 497	0 395	0 369	0 335
Granite block on sand	...	.	0 445	0 355	0.331	0 305
Granite block on concrete	..	.	0 507	0 403	0 377	0 341
Wood block on concrete	....	.	0 533	0.423	0.396	0.357

The chart reproduced as Fig. 3 is of value when the location and number of manholes are approximately known. Knowing the average distance between manholes, the cost per duct foot for manholes can be determined from the curves. For example, a twelve-duct line, with the average distance between manholes about 320 ft. (97.54 m.), would cost 7.8 cents per duct foot (25.6 cents per duct meter) for manholes.

TABLE II—COST OF REPLACING SUB-SURFACE STRUCTURES

Kind	Size, In.	Contract A, per Linear Foot	Contract B, per Linear Foot	Contract C, per Linear Foot
WATER	4	.....	$0.50	......
	6	$0.75	0.60	$0.45
	8	0.90	0.75	0.65
	12	1.50	.....	..
	16	2.50	1.00	1.50
	20	....	1.00	....
	30	5 00	......	.....
	36	7 00	......	3.50
GAS	3	...	0.40	......
	4	0.75	0.60	0.25
	6	1.00	0.75	0.45
	8	1 25	0.80	0.65
	10	1.50	1.00	...
	12	1.50	1.25	1.00
	16	.	......	1.50
WROUGHT-IRON CONDUIT	2	0.50		....
	2½	0.50	0.80	0.25
	3	0 60	0.90	0 30
	3½	0.70	1.00	0.35
	4	0.80	1.10	0.40
	4½	0 90	1.20	......
EDISON TUBE	1¼	0 50	....	.
	1½	0 50	. .	...
	2	0.50	0.60	0.20
	2½	0 60	0.80	0.25
	3	0 70	1.00	0.30

Estimates for new duct work based on these figures will be conservative rather than high. The average cover of 2.5 ft. (0.76 m.) on which duct costs are based will generally be exceeded. Contractor's profit is included in each item given, but in congested underground sections of the city the necessity of avoiding or replacing other sub-surface structures will sometimes double the estimated total cost for all other items. For this reason alone, where an important installation is proposed, the time spent on preliminary work is always profitable. By means of surface surveys and examinations of the records of city departments and public-

TABLE III—UNIT AND TOTAL ESTIMATES FOR TYPE OF MANHOLE SHOWN IN FIG. 2

Work Items	Unit	Cost	5 Ft. by 7 Ft.	5 Ft. by 8 Ft.	6 Ft. by 8 Ft.
Removing pavement:					
Sheet asphalt	Sq. yd.	$2 50	$20 00	$22.20	$24 00
Granite block on sand	Sq. yd.	1 25	10 00	11 10	12.00
Granite block on concrete	Sq. yd.	2 50	20 00	22.20	24 00
Wood block on concrete	Sq. yd.	2 50	20 00	22 20	24 00
Excavation, including sheeting, grading trench, carting surplus and backfill	Cu. yd.	3 50	93 10	103 60	112.00
Concrete, including forms	Cu. yd.	15 00	135.00	147.00	156.00
Frame and cover casting	Ton	80.00	19.60	19 60	19.60
Steel (beams and rods)	Lb.	0 045	14.57	14.57	17.64
Repaving:					
Sheet asphalt	Sq. yd.	2.50	20 00	22.20	24.00
Granite block on sand	Sq. yd.	1.25	10 00	11.10	12.00
Granite block on concrete	Sq. yd.	3.00	24 00	26 67	28.83
Wood block on concrete	Sq. yd.	4.25	34 00	37.78	40.80
Total:					
Sheet asphalt	....	....	302.27	329.17	353.24
Granite block on sand	....	....	282.27	306.97	329.24
Granite block on concrete	.	....	306 27	333.64	358.07
Wood block on concrete	.	....	316.27	344.75	370.04

service corporations a definite plan may be laid out along the most economical lines.

No set of figures given for estimating purposes is entirely accurate when used in localities or under conditions varying even slightly from those under which the figures were compiled. It is hoped, however, on account of the method of presentation of costs in itemized form, that the matter in the preceding paragraphs will be of value to any one whose work includes the layout of underground conduit lines.

Increasing Demand Factor of Residence Consumers

Nine Years' Records from Ten Groups Averaging 125 Customers per Group Show Growth in Demand from 20.1 Kw. to 31.4 Kw., or 56 per Cent, with an Increase in Energy Use of 50 per Cent

BY H. B. GEAR
Commonwealth Edison Company, Chicago

THOSE who are in touch with the demands made by groups of residence consumers upon the transformer and distributing system from which they are supplied are familiar with the fact that such demands have shown a tendency to increase slowly from year to year.

In Chicago records have been kept of the demand of a number of typical groups of residence and apartment customers since 1909, and it has been found possible to select from these ten groups in localities where no additional buildings have been erected and where the character of the neighborhood has not materially changed. The observations on these groups may therefore be taken as a fair indication of the change which has taken place in the manner of use of electricity by these groups of consumers during these eight years.

The essential data for these ten groups appear in the accompanying table, showing the connected load, number of consumers, demand in 1909 and 1917, demand factor and percentage of increase. The average values for these ten groups are as follows:

Number of customers per group	125
Connected lighting load, kw., per group	122
Demand in 1909, kw	20.1
Demand in 1917, kw	31.4
Per cent increase in demand	56
Per cent demand factor, 1909	16.5
Per cent demand factor, 1917	25.2

The demand factor is taken as the ratio of the maximum load on the transformer to the connected lighting load of the group.

During this same period there has been kept a record of the energy consumption of all apartment and residence consumers as billed during the month of October each year, the month of October being selected as being a representative month. The average values which appear in the curve for the energy consumption in October were taken from the meter records of about 200,000 consumers. This curve indicates that with apartment consumers the average energy consumption has increased from 16.6 kw.-hr. in 1909 to 25 kw.-hr. in 1917, an increase of 50 per cent. The increase in the consumption of energy of the average consumers making up these groups having been 50 per cent and the increase in the demand of the ten groups having averaged 56 per cent, it is evident that the average load factor of the groups taken by themselves has been slightly reduced.

An analysis of the causes responsible for this increase reveals a variety of influences, some due to local conditions and others arising from developments which are common to the entire central-station industry in America.

Passing over the local influences, there are two lines of development which have been common to nearly all communities and are of general interest. These are (a) the more liberal use of electric lighting, and (b) the widely extended use of household electrical appliances of all kinds.

FUNDAMENTAL CHANGES HAVE TAKEN PLACE

The reductions in rates for electricity during the past decade and the development of higher standards of lighting resulting from the introduction of the tungsten lamp have brought about fundamental changes in the manner of use of electric lighting equipment on the part of all lighting consumers. Where it was formerly customary for the average householder to be careful to keep lights turned out in rooms where they were not immediately in use and to avoid any use of electricity which was unnecessary, it is now not unusual for the residence consumer to burn a lamp in his front window or on his porch throughout the evening, to regard the use of a hall lamp burning all night as a desirable form of protection from burglars, and to be more liberal generally in his employment of the electricity supply.

The effect of this longer-hour burning is to cause more overlapping of the demands of individual consumers and hence a somewhat reduced diversity factor and an increased demand upon the transformer supplying a group of such consumers. This tendency to an increased group demand is materially augmented in the better class of residence consumers by the installation of many thousands of percolators, toasters, irons and other appliances, some of which are used in connection with the preparation of meals and which during the winter months therefore add to a noticeable extent to the demand.

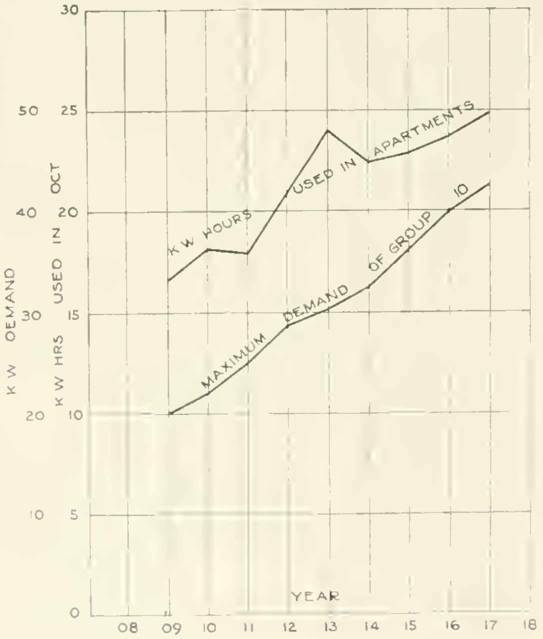
These devices, however, are used for a short period of time as comparable with the lighting equipment, and it is therefore probable that such reduction as may have taken place in diversity factor due to more continuous use of lighting equipment has been largely offset by the introduction of these appliances. It is doubtful whether, if it were possible to ascertain the individual demands of the consumers of a residence group many of whom are using appliances, there would be any material change in the ratio of the sum of the demands of the individual users to the total coincident demand. In other words, the diversity factor has not been greatly altered if the demand due to appliances is taken into account.

Referring to the table, the data for group 10 is of interest. Group 10, the largest of those which have been kept under observation, consists of 177 apartments, three residences and thirty hall-lighting installations in the apartment buildings. There are thus 210 meters within the limits of this city block.

TYPICAL DATA FOR TEN GROUPS OF APARTMENT AND RESIDENCE CONSUMERS

No.	No. of Customers	Kw. Light Connected	Kw Demand		Per Cent Increase	Demand Factor	
			1909	1917		1909	1917
1	75	63	13	14	8	20.7	22.3
2	107	108	18	32	78	16.7	29.6
	114	103	19	27	42	18.4	26.2
4	51	65	18	21	17	27.7	32.4
	180	124	20	34	70	16.0	27.4
6	219	320	18	75	56	15.0	23.4
7	53	78	12	19	58	15.4	24.1
8	144	130	23	29	26	17.7	22.3
9	99	65	10	21	110	15.4	32.3
10	210	162	20	42	110	12.0	26.0
Average	125	122	20.1	31.4	56	16.5	25.2

Measurements of the demand on the transformers supplying this block have been made almost every year during the period, and the steady growth of the demand in this block is illustrated in the curve above. This curve shows that the demand of this block increased from 20 kw. in 1909 to 42 kw. in 1917, an increase of 110 per cent. This rate of increase is considerably higher than that of the average of other groups, as this block lies in a neighborhood where the apartment rentals are higher than the average and presumably the purchasing power of the consumers is above the average.



TEN YEARS' GROWTH OF DEMAND IN BLOCK OF GOOD-CLASS APARTMENT HOUSES

What Consumers' Meter Records Show

An examination of the meter records of the consumers in this block indicates a very wide range of difference between the use of electricity by the tenants of the less expensive apartments along one side of the block and those of more expensive apartments on another side. The energy consumption of the ordinary apartment is about 250 kw.-hr. per annum, with a demand of 0.6 kw. This represents a load factor of about 7 per cent for the individual user. Among the better apartments are some forty consumers whose annual consumption ranges from 500 to 1100 kw.-hr. Their lighting demand being 0.8 to 1 kw., they have an apparent load factor of 10 to 20 per cent. This large consumption can be due only to the use of appliances which, while increasing the kilowatt-hour consumption, are not taken into account in the lighting demand. The high percentage of increase in the demand of this block as compared with the average of other blocks is further evidence of the general use of appliances by these consumers.

Data as to the number of appliances connected to the lines are, from the nature of the case, very inaccessible, since these appliances are purchased from various sources by consumers, and as a matter of practical operation it is necessary in most cases to consider the lighting load only as the connected load in the premises. Such being the case, the demand and diversity factors to be used in selecting transformer capacities for such consumers must be materially increased if lighting load only is considered in determining the individual demand and connected load.

THERE are certain tendencies which we ought to face frankly in our consideration of a policy for land to the home-coming soldier. First, the drift to farm tenancy. The experience of the world shows without question that the happiest people, the best farms and the soundest political conditions are found where the farmer owns the home and the farm lands. The growth of tenancy in America shows an increase of 32 per cent for the twenty years between 1890 and 1910. Second, the drift to urban life. In 1880 of the total population of the United States 29.5 per cent of our people resided in cities and 70.5 per cent in the country. At the census of 1910 46.3 per cent resided in cities and 53.7 per cent remained in the country. It is evident that since the war in Europe there has been a decided increase in the trend toward the city because of industrial conditions. The adoption by the United States of new policies in its land development plans for returning veterans will also contribute to the amelioration of these two dangers to American life.—*Franklin K. Lane, Secretary of the Interior.*

Factory Inspectors Study Industrial Lighting

Pioneer Movement Is Under Way in the States of Pennsylvania and New Jersey for Better Factory Lighting—The University of Pennsylvania Co-operates in Furtherance of the Object Sought

BY C. E. CLEWELL

Assistant Professor of Electrical Engineering, University of Pennsylvania

This article describes the work accomplished at the University of Pennsylvania during the past months connected with a course of instruction to state factory inspectors of Pennsylvania and New Jersey. The steps leading up to this instruction course are outlined and reasons are given as to why it has been looked upon as an important development in the industrial lighting field. For the benefit of other states which may undertake similar courses of instruction, some of the details in the plans for the lectures at Philadelphia are given.

DURING the last few months an event of considerable importance to the lighting field in particlar and to the industrial welfare of the country in general has been the course of instruction in industrial lighting for state factory inspectors of the Departments of Labor of Pennsylvania and of New Jersy held recently at the University of Pennsylvania in Philadelphia. This instruction work came about as a result of requests made by the two state departments concerned, and hence the event may properly be looked upon as an indication of a new interest in the practical aspects of industrial lighting on the part of representative state labor departments.

Whether or not similar efforts to improve the efficiency of state inspection in matters of factory lighting will be made in other states is of course problematical, but should work be undertaken elsewhere the following notes may be useful.

Steps Leading Up to the Work

As a historical note it may be stated that carefully prepared codes of factory lighting were adopted in Pennsylvania and New Jersey several years ago, the code itself in each case being prepared along the lines of the code of factory lighting issued by the Illuminating Engineering Society as part of the work of its committee of lighting legislation, under the chairmanship of L. B. Marks. Although these state codes have since been in effect, the authorities of the two state departments concerned have realized that the enforcement of the rules included has involved a knowledge of certain principles of lighting and illumination which were naturally new and sometimes poorly understood by the state inspectors, whose duties heretofore were in other lines.

More recently it was felt desirable to revise the original codes of both Pennsylvania and New Jersey in order to take advantage of developments in the art, and at the time of these revisions the question of systematic instruction for the inspection forces of both states was taken up. Requests were then sent to the provost of the University of Pennsylvania by the Commissioner of Labor and Industry of Pennsylvania and by the Commissioner of Labor of New Jersey asking whether the facilities of the university might be used to accomplish the instruction felt to be desirable at this time, with the result that the university placed the facilities of its electrical engineering department at the disposal of the two states.

Letters of the State Departments of Labor indicate an attitude of promise to the field of industrial lighting. This field, as is commonly known, has in years past received little or no attention from similar departments in many other states. From the standpoint of the university the whole program was strictly a co-operative one.

Details of the Work

The work of instruction, as planned by representatives of the two state departments in conjunction with a representative of the university, consisted of two allday sessions with instruction periods of about an hour and a half both in the morning and afternoon of each day. On the days in question the inspection forces of the entire State of New Jersey and those from Pennsylvania assembled to the number of nearly 100 in the Engineering Building of the Towne Scientific School. In addition to the inspectors themselves, several representatives of the Illuminating Engineering Society were present, notably G. H. Stickney, president of the society; Dr. C. H. Sharp and C. O. Bond, past-presidents, and Dr. George A. Hoadley.

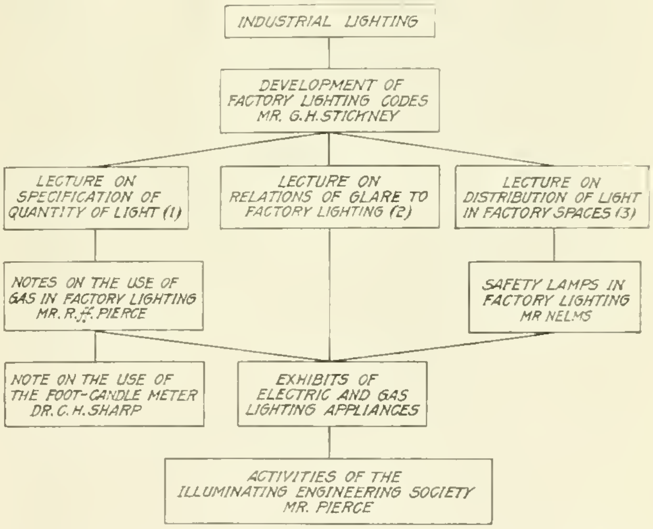

INDUSTRIAL LIGHTING
DEVELOPMENT OF FACTORY LIGHTING CODES MR. G.H. STICKNEY
LECTURE ON SPECIFICATION OF QUANTITY OF LIGHT (1)
LECTURE ON RELATIONS OF GLARE TO FACTORY LIGHTING (2)
LECTURE ON DISTRIBUTION OF LIGHT IN FACTORY SPACES (3)
NOTES ON THE USE OF GAS IN FACTORY LIGHTING MR. R.ff. PIERCE
SAFETY LAMPS IN FACTORY LIGHTING MR NELMS
NOTE ON THE USE OF THE FOOT-CANDLE METER DR. C.H. SHARP
EXHIBITS OF ELECTRIC AND GAS LIGHTING APPLIANCES
ACTIVITIES OF THE ILLUMINATING ENGINEERING SOCIETY MR. PIERCE

FIG. 1—OUTLINE OF THE INSTRUCTION WORK FOR STATE FACTORY INSPECTORS

In order to connect the lectures as closely as possible with the factory lighting codes now in force in these two states, they were planned to follow the rules of the codes, and the revised 1918 rules of the codes of each state were printed in the program as a guide during the progress of the course. Fig. 1 has been prepared for this article to give some idea of the plan of subjects discussed in the various sessions, and a few remarks concerning this outline will indicate for those particularly interested just why this lay-out of the work was decided upon.

In the opening session President G. H. Stickney of the Illuminating Engineering Society presented a formal discussion of the various efforts which have led to the formation of factory lighting codes and the present status of such codes throughout the United States.[1]

Three subsequent sessions were devoted to the technical treatment of the principles of factory lighting. The principal items which constitute the revised codes of Pennsylvania and New Jersey relate to the intensities of illumination required for various classes of work, to the shading of lamps so as to minimize glare, to the distribution of light on the work, and more or less incidentally to emergency lighting, switching and controlling apparatus. For this reason the three major lectures of the course, as indicated by the numerals (1), (2) and (3) in Fig. 1, relate respectively to the "Specification of the Quantity of Light," to the "Relations of Glare in Factory Lighting," and to the "Distribution of Light in Factory Spaces."

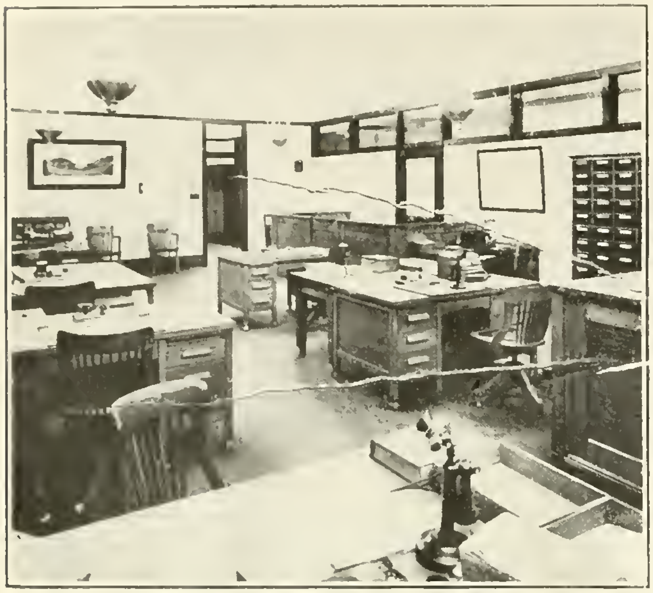


FIG. 2—SLIDE SHOWING GOOD LIGHTING PRACTICE

In the first technical lecture emphasis was placed upon the fact that the entire instruction course was to be looked upon as a series of coaching lessons rather than as formal lectures, and that the importance of good factory lighting would be emphasized rather from the standpoints of accident prevention and eye protection than from that of economy to the plant, as the latter feature does not directly enter into the legislative side of state lighting codes. The "foot-candle" was defined as the unit of illumination intensity, and considerable emphasis was placed upon the usefulness of the new "foot-candle meter" for practical and convenient measurement of intensity under factory conditions.

Similarly, in the second technical lecture attention was called to the very great difference in the brilliancy of modern lamps as compared with older types, with a consequent necessity for proper shading of these modern lamps for the purpose of minimizing glare. This feature was demonstrated by means of a lighted carbon-filament lamp and a "Mazda C" lamp using a translucent glass reflector to soften the harsh effect of the latter. The points of advantage in the overhead or general system of illumination were contrasted with the limitations of the strictly local system, but at the same time cases were cited to show that sometimes a local lamp is the only solution in lighting some particular industrial operation. Numerous types of reflectors were at hand to serve as examples of the kind of equipment now available for use under factory conditions.

In the third technical lecture the meaning of uniform illumination was discussed, and methods were explained whereby uniformity may be secured under given conditions of spacing between lamps and height of mounting above the floor, some emphasis being placed upon the increase of accident risk about a plant where the differences in the illumination intensity on the work and on surrounding spaces are too great.

THE EXHIBITS

In any instruction work of this kind there is a good deal to be gained by having available various types of apparatus and equipment related to the subjects under discussion. In this case the university had the co-operation of a number of manufacturers, who installed exhibits of unusual value in illustrating the possibilities of good industrial lighting. These exhibits, under the direction of G. B. Regar of the Philadelphia Electric Company, were unified so as to be suited to the space limitations of the large lecture hall where the work was conducted.

A feature of special interest was the installation of two lathes equipped to show good and bad local lighting and a booth showing a stairway with bad glare lighting conditions and an improved arrangement. Ample opportunity was given between sessions to study these exhibits in detail under the guidance of special representatives assigned to this duty.

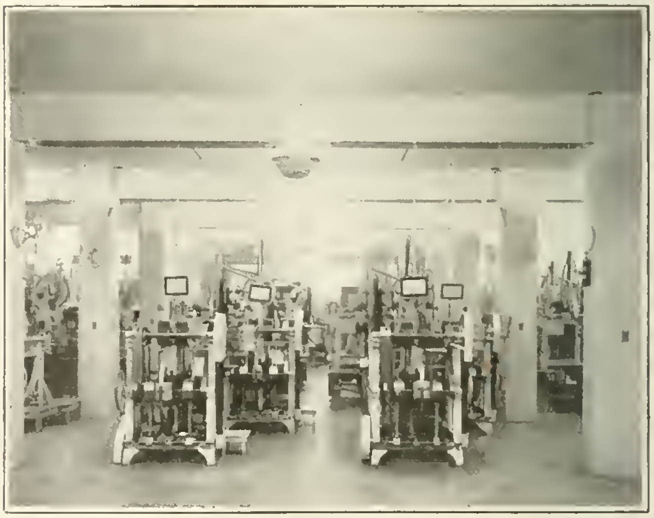


FIG. 3—SLIDE ILLUSTRATING THE PRINCIPLES DISCUSSED

The material of the lectures was supplemented to some extent by lantern slides showing various aspects of well-designed factory-lighting systems somewhat as in Figs. 2 and 3, and attention was directed to books now on the market dealing more or less closely with practical phases of the shop-lighting problem.

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[1] The substance of these remarks by President Stickney is found elsewhere in this issue.

Extensions of Lines in War-Time

Conditions Are Abnormal, Public Utility Business Will Continue After Abnormal Conditions Have Ceased, and on the Return of Normal Times the Demands of Former Normal Times Will Be Made

BY ALEX DOW

President Detroit Edison Company

This was contributed to the discussion on the subject before the National Electric Light Association, Atlantic City, on June 13 and 14. The long experience of Mr. Dow, his high standing as an operator, his well-known maintenance of friendly public relations and his earnest anxiety to render service to his community and nation, make this discussion particularly valuable.

LET me condense my four premises into four short sentences, as follows:

(1) War conditions are abnormal.

(2) Public utility business will continue after abnormal conditions have ceased.

(3) The public, through commissions and courts, demanded in normal times before the war that public utilities should be managed and financed with extraordinary skill and capacity.

(4) On the return of normal times we may expect that the demands of former normal times will again be made upon us.

Now consider any construction expenditures which we may make or propose to make during the war period. If, indeed, our consideration is not forthwith ended by the evident impossibility of doing anything, we shall see, first, that the return for any expenditure in the present market will be abnormally small; that is to say, that any thing or service which the public utility is likely to purchase during these war-times will cost in money from one and a half to two times the average price of the five years preceding the war. Second, we shall see that the money which must be raised to pay for the thing or the service will likewise cost us from one and a half to two times the normal price for money.

It follows that the least cost of capital for any net result will be two and a quarter times normal, and in the extreme case of "double cost of money times double cost of construction" it will be four times normal. The moral is obvious.

Let us forget for a minute the unreasonableness of requiring that the public utility management be superhumanly wise and powerful, and let us accept the underlying truth that each of us is called on to consider and wisely guard the permanent interests of the community which he serves.

EXTREME ATTITUDES MUST BE AVOIDED

He must not let his optimism burden that community with an overdeveloped plant, neither must he lag behind the growth of the community and delay meeting its needs until these become clamorous. The problem which he must solve, in normal and in abnormal times alike, as to every proposed extension of his service is whether that extension is one which will continue to be used and useful. If it is obviously temporary, every commission and court will uphold him in refusing to make the extension unless the return of its entire cost is guaranteed during the period of its use.

The theory of that refusal is that the future service of a community should not be burdened with the capital costs of a past temporary need or use, but that each service should during its own life pay its own total costs. This economic rule may be concealed by a franchise or contract clause under which the utility is compelled to give service to any applicant within a certain area, the theory thereof being that the interest of all inhabitants of that area should, with reference to this particular service, be consolidated or pooled for the common good. That theory is, of course, the fundamental theory of every organization having territorial limits, whether it be village, city, state or nation. But the economic rule is not nullified thereby, and in these times it simply must be recognized.

LOCAL VERSUS NATIONAL INTERESTS

This leads to the consideration of our local territorial interests as against the interests of the greater territorial community—in the present instance the interest of city or other service district as against the nation. If anything has been made clear by the discussions and proclamations and laws and taxes of the last twelve months, it is that the war is a national affair and the distribution of the duties and costs of the war pro rata among the lesser territorial communities is to be made by the nation according to rules and methods existent in our constitution and laws before the war or established for the special occasions of this war.

Without volunteering any opinion as to whether the incidence of taxation or of the selective draft upon one community or another is as just as it might be, I submit that there is no dispute that the total cost of producing war materials is intended to be paid for out of the national funds raised by national taxes or bond issues, and that no community is required or even invited to tax itself specially for the purpose of producing or aiding in the production of munitions.

Now may be considered the special case of extensions of our lines or of additions to our plants for the purpose of furnishing electric service to munitions-making establishments—whether these establishments be owned or operated by the government or by firms working under government contracts.

It appears from the premises that to make these extensions under present conditions will entail capital costs from two and one-quarter to four times normal. This condition will not be changed by any possibility of using the extensions or additions for peaceful purposes after the war. It is also reasonably certain that there will be immediately following the war a period when these extensions or additions will be only partially used and useful, or it may be that they will be absolutely idle.

Moreover, no wise management, even if it were assured that in the year of grace 1921 and thereafter it would be able to find employment for an additional turbo-generator or for an extension of conduits and cables, would undertake to go into the present market for the material or for the money to make that extension. To do so would only be to provoke condemnation in some future rate-making or valuation case for incurring excess cost of capital and for making premature developments, and for gross error of judgment.

Remembering that our decisions made in haste in these abnormal times will certainly be examined at leisure by the duly ordained authorities some time in the future, we are, I hold, just in insisting that we be protected against adjudication of fault in these three respects. Let us consider the three, in sequence.

EXCESS COST OF CAPITAL

The present extraordinary cost of capital to provide a given service—to wit, the difference between normal cost and the two and a quarter to four times normal cost now ruling for the useful value of the purchase—should be held to be a part of the cost of the proposed production of munitions and should be forthwith and finally paid by the government as part of that cost. Notice the finality of the payment.

A certain legal gentleman who has been studying the question on behalf of one branch of the United States government has arrived at the conclusion that this excessive cost should be advanced to the utility by the government—or by the government contractor, who would, of course, recover it from the government—but that the utility should repay this extraordinary cost of capital in installments and after peace is declared. It does not matter how the utility might ultimately finance such a payment—whether by capitalizing it or by amortizing it—the payment of this excess cost by the utility would be to impose upon its community more than a just share of the cost of making that particular lot of munitions.

And it is neither the right nor the intent of the nation to burden any community with more than its just share of any national expenditure. As public utilities it is our duty to see that our particular community does not become so burdened through laches on our part.

After the excess cost has been paid by the national government and presumably amortized over the munitions output of that factory, the question remains as to whether the extensions will continue to be useful to the local community. We all of us know communities that insist on unwise expenditures and then complain of the consequences. Witness the unreasonable undergrounding of lines which has been called for in many cities. But most communities will back up a utility in a wise protest against avoidable costs of service.

GRAVE ERROR OF JUDGMENT

This is the least simple proposition of the three. In a broad way, I question whether certain electric power extensions made or proposed are wise even as aids in winning the war; but the decision to make or not to make these extensions does not lie with us, but with the national government, and their wisdom must be proved or disproved by history. Contrarywise and in an equally broad way, I believe that many electrical developments which have been encouraged by the war—such as the rapid increase in number of electric furnaces for metal working—are eminently wise and are but little ahead of peace-time progress of the art.

Speaking to our own public utility case, I doubt whether some communities have done well in reaching out for certain war contracts. These communities, some of them small, will inevitably suffer a serious recession when peace arrives. The reverse of this case is the wisdom shown in a few large communities which, by concerted action of the manufacturers and bankers and leading citizens of other index markings, have been systematically transferring their peace-time manufacturing abilities over to the production of war materials, and are adding little or nothing more to their present factory capacity than would be warranted by their growth in normal times.

In the one case an overdeveloped public utility whose management has erred in judgment by not protecting itself against the inevitable slump will certainly be subject to criticism hereafter. In the other case the public utility may expect, with its community, to be very little disturbed by either change—the change to abnormal war conditions or the change back again.

Good judgment, therefore, will dictate widely different policies in different cases, ranging from insistence that the nation shall carry the entire cost of the extensions, with no obligation whatever on the utility to take these over even at a depreciated value, all the way to the other extreme, where good judgment may decide on the assumption of the entire cost of the extensions actually needed. But if there be any extension large enough to require the issue of securities, the abnormal cost thereof should not be assumed, the normal cost being the maximum burden acceptable by the community.

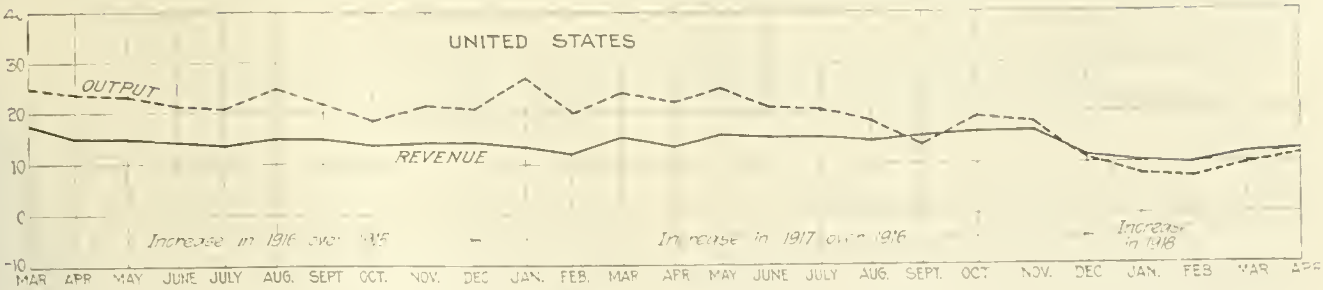
SUMMING UP THE CONCLUSIONS

To sum up, the minimum contribution which should be made by the nation, as a part of the cost of war, toward expenditures for public utility extensions or additions to be made for war purposes is the abnormal cost of the extension in terms of the cost of new capital required to produce the same. From the minimum the contribution to be made by the nation may range upward to the entire cost in the case where the extension or addition is made for some extraordinary and temporary purpose—such as, for instance, the production of nitrates from air by electricity generated by steam power. Between these limits the utility management must exercise its judgment. The penalty for error of judgment may be severe, therefore it is well to play somewhat safe.

This audience knows that our membership, both corporate and individual, has from the beginning of the war served the government gladly in small matters and in great—that we have met every call, whether to sell thrift stamps or to donate the services of highly skilled and highly paid engineers and executives or to release our best employees to special military and naval duties.

Lest the printed record should come under the notice of some critic ignorant of our attitude, I now say that we have given willingly of our own, and that we expect to continue giving. But we are not free to give that which is not our own—and that is exactly what we shall be doing if, in exuberance of patriotism, or in failure to perceive the equities, we shall burden our future service to our communities with an undue share of the present costs of war. We are, in effect, trustees for our own communities and this talk is a reminder of the terms and limits of our trusteeship.

Central-Station April Operations



CENTRAL STATIONS CONTINUE STEADILY TO DEMONSTRATE THEIR STRONG POSITION AS ESSENTIAL INDUSTRIES

THE most striking fact in regard to the April returns of central stations is that revenue and output still show a greater rate of increase than in the previous months of this year. April returns to the ELECTRICAL WORLD from companies representing 58 per cent of the industry indicate gains of 12.3 per cent in revenue and of 11.3 per cent in kilowatt-hour output as compared with April, 1917.

This year's record started in January with an increase of 8.2 per cent in revenue and of 6.1 per cent in output. The percentage of gain was larger in February; it was larger in March than in February; now with April it is substantially the same rate of gain that was reported for last December. This ascending scale is highly gratifying, for it means that in spite of serious influences and uncertainties business mounted steadily during the first one-third of the year. At a time when many industries were abruptly curtailed because of lack of coal, lack of labor or other influences having to do with war or the unsettled conditions of the times, the central stations continued steadily to demonstrate their strong position as highly essential industries.

It is difficult to draw any accurate inference from the close approach in the percentage rates of gain for revenut and output. In the earlier months of this year the fact that the rate of increase in revenue was greater than the rate of increase in output indicated on the surface that the effect of rate advances was being felt. That this tendency is less sharply accentuated in one month scarcely justifies hasty conclusions, although it should be watched closely.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE-MONTH PERIOD

Month	Percentage of Industry Represented	Revenue from the Sale of Energy			Kw.-Hr. Output		
		1917	1916	Per Cent Increase	1917	1916	Per Cent Increase
May....	62	23,369,006	20,307,000	15.2	1,459,085,000	1,163,483,000	25.3
June	63	23,279,000	20,168,000	15.6	1,407,860,000	1,165,629,000	20.8
July.	63	22,768,000	19,680,000	15.8	1,397,482,000	1,159,410,000	20.5
August...	63	22,718,000	19,972,000	13.8	1,451,928,000	1,223,373,000	18.7
Sept......	63	23,861,000	20,896,000	14.3	1,376,370,000	1,219,117,000	13.0
Oct......	62	25,748,000	22,334,000	15.4	1,522,149,000	1,279,140,000	19.0
Nov......	62	26,665,000	23,183,000	17.0	1,485,370,000	1,292,113,000	15.1
Dec......	58	28,144,000	25,026,000	12.4	1,517,001,000	1,362,299,000	11.3
		1918	1917		1918	1917	
January..	62	27,035,000	24,977,000	8.2	1,508,353,000	1,422,121,000	6.1
February.	60	24,690,000	22,307,000	10.6	1,254,217,000	1,168,288,000	7.4
March..	60	25,396,000	22,702,000	12.3	1,418,222,000	1,294,561,000	9.5
April.	58	24,821,000	22,103,000	12.3	1,392,928,000	1,250,613,000	11.3

Based on the returns, the ELECTRICAL WORLD estimates that the April revenue for the entire industry was $42,793,000 and the output 2,401,600,000 kw.-hr.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	New England States				Atlantic States				Central States				Pacific and Mountain States			
		Percentage of Industry Represented	1917	1916	Per Cent Increase	Percentage of Industry Represented	1917	1916	Per Cent Increase	Percentage of Industry Represented	1917	1916	Per Cent Increase	Percentage of Industry Represented	1917	1916	Per Cent Increase
REVENUE	May.	64	$2,640,000	$2,253,000	17.[illegible]	65	$9,495,000	$8,118,000	16.9	52	$6,912,000	$5,914,000	16.9	86	$4,173,000	$3,883,000	7.5
	June.	64	2,641,000	2,290,000	15.4	65	9,281,000	8,017,000	15.7	53	6,718,000	5,563,000	20.9	86	4,480,000	4,174,000	7.4
	July...	64	2,634,000	2,205,000	19.4	65	8,919,000	7,687,000	16.1	53	6,690,000	5,643,000	18.6	86	4,482,000	4,110,000	9.2
	August	64	2,352,000	2,025,000	16.2	65	9,021,000	7,881,000	14.5	53	6,910,000	5,718,000	20.9	87	4,819,000	4,270,000	21.9
	Sept .	64	2,811,000	2,362,000	19.0	64	9,139,000	7,963,000	14.7	53	7,232,000	6,177,000	17.1	87	4,636,000	4,355,000	6.4
	Oct.	64	3,057,000	2,530,000	20.7	66	10,683,000	9,173,000	16.5	52	7,422,000	6,304,000	17.8	85	4,586,000	4,327,000	6.1
	Nov.	64	3,391,000	2,834,000	19.7	65	10,159,000	8,873,000	14.5	52	8,454,000	7,063,000	19.7	84	4,661,000	4,410,000	5.9
	Dec.	64	3,483,000	2,999,000	16.1	58	10,834,000	9,949,000	8.8	48	8,935,000	7,464,000	19.7	82	4,892,000	4,614,000	0.6
			1918	1917			1918	1917			1918	1917			1918	1917	
	Jan.	63	3,393,000	2,990,000	13.8	64	9,677,000	9,517,000	1.6	53	8,862,000	7,639,000	16.8	86	5,113,000	4,831,000	5.8
	Feb...	62	2,995,000	2,272,000	8.0	57	9,473,000	8,658,000	8.6	53	7,779,000	6,746,000	15.3	84	4,443,000	4,131,000	9.5
	March	62	2,985,000	2,724,000	9.2	59	9,904,000	8,922,000	11.0	53	7,947,000	6,735,000	.18	84	4,560,000	4,321,000	5.5
	April.	59	2,776,000	2,482,000	11.8	58	9,873,000	8,785,000	12.3	50	7,762,000	6,557,000	18.3	82	4,410,000	4,279,000	3.06
			1917	1916			1917	1916			1917	1916			1917	1916	
KW.-HR. OUTPUT	May.	64	110,991,000	86,675,000	28.3	65	527,004,000	405,719,000	30.3	52	415,795,000	325,986,000	27.7	86	394,554,000	336,541,000	17.3
	June.	64	106,817,000	87,345,000	22.4	65	496,784,000	392,905,000	26.5	53	393,770,000	318,316,000	23.6	86	399,622,000	358,727,000	11.2
	July	64	109,399,000	83,451,000	31.4	65	494,965,000	396,538,000	24.8	53	379,087,000	311,931,000	21.5	86	412,635,000	366,237,000	12.7
	August..	64	105,848,000	85,113,000	24.5	65	514,254,000	420,806,000	22.3	53	415,966,000	333,549,000	24.7	87	413,462,000	381,353,000	8.3
	Sept ..	64	114,339,000	92,319,000	24.0	64	482,112,000	405,070,000	19.0	53	399,480,000	345,953,000	15.5	87	379,221,000	374,685,000	1.4
	Oct	64	121,666,000	94,853,000	28.5	66	589,242,000	472,619,000	24.5	52	417,018,000	351,713,000	17.0	85	394,223,000	359,955,000	9.6
	Nov...	64	130,311,000	108,561,000	20.0	65	532,301,000	445,537,000	19.6	52	443,374,000	384,480,000	15.2	84	379,384,000	357,535,000	6.1
	Dec.....	64	135,703,000	111,342,000	21.8	58	548,316,000	486,368,000	12.7	48	437,264,000	367,534,000	12.8	82	395,518,000	377,058,000	4.8
			1918	1917			1918	1917			1918	1917			1918	1917	
	Jan . ..	63	125,212,000	111,339,000	12.4	64	477,200,000	466,158,000	2.3	53	486,291,000	453,009,000	7.3	86	419,651,000	391,624,000	7.3
	Feb	62	110,454,000	102,562,000	7.7	57	438,721,000	403,122,000	8.3	53	358,276,000	342,257,000	4.5	84	346,766,000	320,025,000	8.4
	March .	62	121,518,000	111,576,000	8.9	59	501,320,000	452,250,000	10.8	53	398,166,000	356,860,000	11.5	84	397,218,000	373,875,000	6.2
	April..	59	113,847,000	98,968,000	15.0	58	490,215,000	426,482,000	14.9	50	402,990,000	364,600,000	10.5	82	385,876,000	360,563,000	7.1

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

WASTE SOLUTION UTILIZED FOR ORSAT APPARATUS

Liquid Potassium Hydroxide Taken from Edison Batteries Saves Time and Money in Testing Boiler Flue Gases

By using the waste solution from Edison batteries for the liquid potassium hydroxide usually required for a CO_2 device, the Citizens' Light & Power Company of Adrian, Mich., has found that great economy can be effected. One filling of this solution will last for a month of testing and represents an amount of potassium hydroxide that costs about $2.75, whereas the return value of the battery solution is only about 10 cents. Furthermore, the time and trouble required for making up the solution are eliminated.

* * *

METHOD OF MAKING SECONDARY GROUNDS

One Ground on Each Secondary Not Far from Transformer and Near Customers' Service Entrance

On the Memphis (Tenn.) Gas & Electric Company's secondaries grounds are not made to water systems and the practice of grounding at frequent poles is not used. Instead one ground is placed on each secondary, not more than 200 ft. (61 m.) from the transformer and at the side or back of a house near the service entrance, said C. K. Chapin, superintendent of distribution, before a recent meeting of the Western Society of Electrical Inspectors. The ground is made by placing a 12-in. (30.2-cm.) square of sheet zinc 7 ft. (2.1 m.) or 8 ft. (2.4 m.) below the surface of the earth and connecting it to the secondary with No. 6 B. & S. gage weatherproof wire inclosed in a 0.75-in. (19-cm.) pipe. The pipe extends about 9 ft. (2.7 m.) above the surface of the earth, thus putting the ground wire out of reach of curious persons. The zinc-plate ground used in Memphis will discharge the entire system satisfactorily, and in doing so the maximum voltage between secondary system and the earth reaches 500 volts at a distance of 300 ft. (92 m.) from the ground plate. The ground plate is compelled to dissipate only from 400 watts to 700 watts, thus a very small current has to pass through the ground wire.

The grounds are tested when installed for maximum resistance of 20 ohms at 1 amp. Many tests show that a secondary ground when crossed with the primary will increase its internal resistance three or four times. When two such crosses do not occur on different phases at the same time, the system will continue to discharge through the ground without surging such as would probably occur in the case of ground to water mains. A ground properly installed will probably last from ten to fifteen years, but rigid inspection and maintenance are made on all grounds. Failure of the zinc-plate ground can only occur when the trouble is not located and removed promptly. The time to bake out a good ground depends greatly upon the weather conditions, but usually is two to five hours, which gives adequate time for the location and removal of trouble.

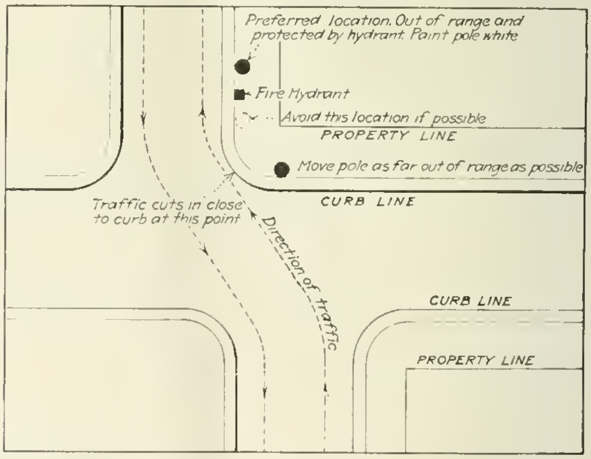
* * *

LOCATING LINE POLES TO PREVENT AUTO COLLISIONS

Fire Hydrant Used as Shield—Poles in Hazardous Positions Should Be Painted White—Most Dangerous Cause of Line Failures

Owing to the increasing number of automobiles in recent years the possibility of speeding cars coming into collision with poles has become very great. In fact, it is of such consequence that in certain districts where the number of auto owners is high line failures from this cause are more frequent than those from any other.

Pole destruction by motor cars is not due to congestion of traffic, but to speed. Congested districts are usually clear of poles, and accidents are few owing to the average slow speed of vehicular traffic. On the other hand, outlying streets, especially those which form connecting links with intercity and state highways, are becoming increasingly hazardous as locations for overhead lines. Little can be done to reduce the danger except by complete removal of the line, which is usually impossible. Poles located at particularly hazardous points, such as at turns and offsets in main-travel highways, may be reinforced with railroad iron. At offsets they should be set back as far as possible from the turn, as shown in the accompanying illustration. If there is a fire hydrant at this point, the pole should be set beyond it so that it will act as a shield. Poles at these dangerous corners should be painted white, regardless of the color used on the rest of the line.


Preferred location. Out of range and protected by hydrant. Paint pole white
Fire Hydrant
Avoid this location if possible
PROPERTY LINE
Move pole as far out of range as possible
CURB LINE
Traffic cuts in close to curb at this point
Direction of traffic
CURB LINE
PROPERTY LINE

"SAFETY" DIAGRAM FOR POLES ON STREET CORNERS

Most of the accidents occur at night, and a white pole may be seen at a far greater distance by the speeding motorist than an unpainted pole or one painted with the customary green. The striped effect employed by railroads on crossing barriers may also be used to advantage. A white signboard has also been found efficacious in preventing accidents. Poles in locations such as have been described should be well guyed, preferably in four directions.

A collision which will not injure a wooden line pole but may cause serious damage to cast-iron or concrete electroliers is that which may result from trucks backing up to the curb. Wherever possible electroliers should be a foot or more back from the curb. They should not be placed directly opposite the delivery entrances of buildings. Collisions of this type, if they do not shatter the post, will break the globes.

FUEL SAVED BY REPAIRING LEAKS IN BOILER SETTINGS

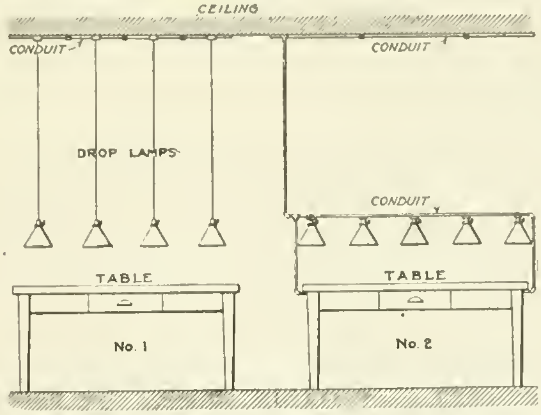
Twenty-five per Cent of Fuel May Be Wasted Through Cracks Caused by Heating and Cooling of Furnace Walls

An actual saving of fuel can easily be accomplished if a small amount of time is given to inspecting and patching leaks that occur in boiler settings. Heating and cooling of furnace walls is continuous and cracks are bound to form. Boiler settings should be inspected at least once a month with a candle flame to find the leaks, especial attention being paid to the joints around the fire and clean-out doors and around the breeching. These leaks should be marked and filled with asbestos, rope or old pipe covering. They should then be sealed over with a flexible cement made of 10 lb. (4.5 kg.) of asphalt, 10 lb. magnesia-asbestos, 10 lb. Portland cement and ½ gal. (1.9 l.) benzine. The cement is made by heating the asphalt until fluid and then removing it from the fire and mixing it with the benzine. This mixture is then stirred in the cement and magnesia-asbestos that is already mixed and heated to 300 deg. Fahr. High-temperature surfaces to be repaired should have a covering that has a greater proportion of cement and magnesia. These leaks should also be inspected often, as they are apt to leak again. A saving of 10 to 25 per cent of fuel may easily be made by following up these leaks. These suggestions were given by the Jones Stoker Company in its official house organ.

HOW TO PREVENT NECESSITY OF MOVING FACTORY WIRING

Expense of Rearrangement of Industrial Equipment Reduced by Placing Fixtures and Conduit on Benches Instead of Ceiling

Quite frequently in industries doing light manufacturing it becomes necessary to move the tables, benches or machines at which the workers stand or sit. If the scheme of illumination includes a combination of general and localized lighting, it then becomes necessary to move the localized lighting equipment to accommodate the new location of the tables or machines, which adds considerably to the expense of making the change. In some of the manufacturing industries operated by Marshall Field & Company of Chicago a large part of this expense has been eliminated by attaching the conduit, wiring and lighting fixtures to the tables instead of to the ceiling above the tables. With this scheme, which is illustrated herewith, the only change in wiring that needs to be made when the tables are moved is the one connection from the overhead conduits to the conduit above the table.

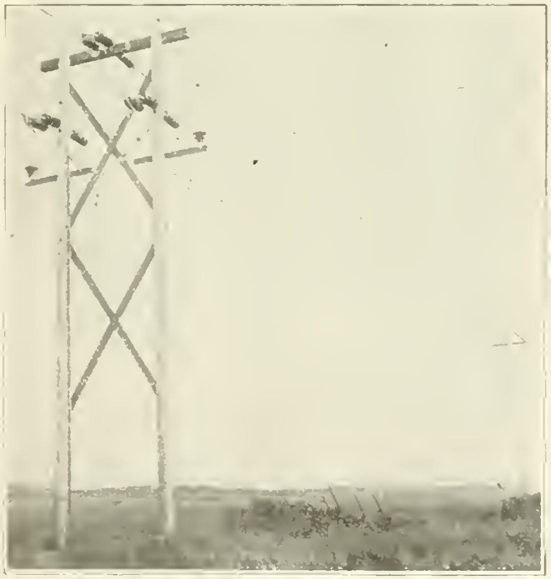


TWO WAYS OF WIRING FOR LOCALIZED LIGHTING, SHOWING NO. 2 AS THE LESS EXPENSIVE

OVERCOMING DIFFICULTIES ON TRANSMISSION RIGHT-OF-WAY

Inability to Secure Ground Space for Double-Pole Line Necessitates Use of One-Pole Structures

Owing to lack of space on the right-of-way of a double-pole transmission line, a power company on the Pacific Coast adopted a method shown in the accompanying illustration in order to maintain the lateral spacing. The tower in the foreground represents the standard structure of the line, whereas the line in the distance is supported on single poles. Two cross-arms are attached to the poles, one horizontal and the other inclined at an angle of about 30 deg. but attached to one end of the horizontal cross-arm. This arrangement permits adequate spacing of conductors and only requires that rights to set single poles be secured.



LATERAL SPACING OF CONDUCTORS MAINTAINED BY TRIANGULAR RELATION OF CROSS-ARMS

CENTRAL STATION SERVICE

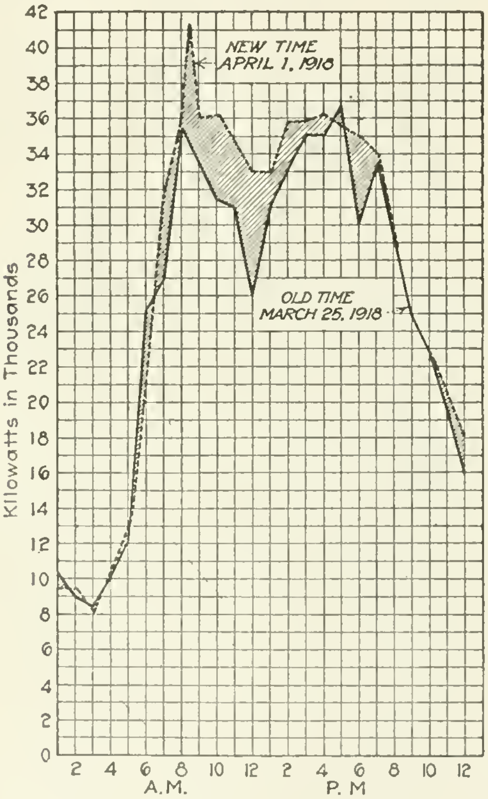
A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

DAYLIGHT SAVING CLOSES UP NOON VALLEY IN LOAD

Owing to Large Number of Power Customers Added to Georgia Company's Lines, It Is Difficult to Show Tangible Results

BY J. E. MELLETT
Georgia Railway & Power Company, Atlanta, Ga.

The accompanying load curves of the Georgia Railway & Power Company are not characteristic, as observations show that the peak as registered at 8.30 a. m. shifts periodically and may occur any day between 8 a. m. and 3 p. m. The load as illustrated includes railways, commercial retail lighting and power and high-tension power, but does not include the widely varying demand of another large utility taking power from the system.



LOAD CURVE OF A SOUTHERN COMPANY BEFORE AND AFTER DAYLIGHT-SAVING LAW BECAME EFFECTIVE

While the railways, the underground system and the commercial 2300-volt circuits indicate curve lines which vary little from day to day, the high-tension industrial load is the greatest and therefore overshadows the general tendency of the other loads. So far no explanation of the shifting demand has been found other than the fact that some of the larger customers' power requirements change from time to time. Since the daylight-saving plan has been in effect the old noon valley has filled in considerably, with a slight decrease in the evening peak.

Total generation on April 1, 1918, new time, shows an increase of 20,000 kw.-hr. over March 25, 1918, old time, one week earlier, but with a decrease in daily load factor of approximately 4.5 per cent. As a number of large power customers are being added, no tangible evidence of the effect of the daylight-saving law is discernible.

A WIDE CAMPAIGN OF CUSTOMER EDUCATION

The Plan Includes Reaching the Children in the Schools, the Men at Civic Organizations, and the Women in the Home

BY RALPH ELSMAN,
General Manager Kings County Lighting Company

The question of how much to tell the public about the so-called "inside affairs" of a public utility company is always a debatable one, but the Kings County Lighting Company has decided that no move of vital importance to its consumers shall be made without first explaining the reason to them. With this idea in mind, a definitely planned campaign has been started to reach the man in the street, or rather the woman in the home, for it is to the women that we believe we must appeal.

One of the first points of contact with us is to reach the children. Accordingly we have arranged with the schools to reach the young people by means of short talks delivered by young women in our employ. In addition, special days have been set aside on which, accompanied by their teachers, they make a tour of inspection of the plant.

There are two reasons for the attention which we pay to children. First, they are enthusiastic spreaders of propaganda. They return to their homes filled with the sights they have seen, and the company is presented to the parents in a new light. Second, every word or sight which we impress on the mind of the children is so much education, and this education will make better consumers of them, for it is the boys and girls of today who will be the men and women of to-morrow.

Another ground which we find in common with the public is in the meetings of the civic organizations. These meetings are better attended than formerly, and in most cases the members are eager to get the view of the man behind the public utility company. To meet this demand we have organized a speakers' bureau. The men attached to this bureau are connected with the various departments of the company and are equipped to answer most of the general questions which are asked. These talks, which we try to keep as informal as possible, are illustrated and prove of real interest to the public. They have the effect of giving the company a personality and transform it from a "soulless corporation" into a living organization with red-blooded men and women in charge. These meeting places afford a social basis that no office can possess, no matter how great an effort is made to break down the barrier that almost surely arises. In these meetings men feel at home and are more inclined to discuss the subjects presented to them.

But it is to the women that the greatest attention has been given. We have carefully checked the circulation of the newspapers in our district. To these papers we furnish news of real interest in the home—news that we know attracts the attention of the housewife because she comes to us and asks questions. This gives us just the opportunity we have been seeking and we lose no time in taking advantage of it.

Furthermore, no matter what project the women are interested in we also become interested, and this interest is more than passive. We are active in carrying out the details of all enterprises, and many times we have turned over our publicity department to them in an effort to make their social affairs successful. Thus their problems are our problems and our problems become theirs automatically. These champions, once won over to our side, are valiant in their defense of our cause and ever ready to help us fight our battles.

As to how long a campaign must be continued, the answer always is that the public is short of memory and the good deeds of last year are soon forgotten, but the promise of more to come keeps the consumers interested constantly.

APPLIANCE OUTLETS BRING 50 CENTS A MONTH REVENUE

Middle Western Company Planning to Put on Special Men to Promote This Desirable Class of Business

John G. Learned of the Public Service Company of Northern Illinois, Chicago, who has been foremost among central-station men in promoting the sales of additional baseboard and wall outlets, estimates that a baseboard outlet in the dining room of the average home is worth 50 cents per month in revenue to the central station on the lines of which it is connected. He is of the opinion that the day will come when the business of selling additional outlets through specialists trained in that work will be as common as the business of selling house wiring under the same plan is now among central-station companies.

Looking forward to this development, Mr. Learned is thinking about placing men in some of his territories assigned to the specific duty of selling baseboard outlets. It is his belief that this can best be accomplished by employing the type of salesman who can go to the door of a residence and inform the mistress of the house in a well-bred manner that he has come to see whether all of the electric service is performing its function properly. Once inside, he can, by adroit suggestions and statements concerning neighbors' installations, sell the idea of baseboard and wall receptacles to the housewife.

It is Mr. Learned's belief that the same man who conducts the canvass for additional outlets should also sell appliances.

DISTRIBUTION OF LINE EXPENSE IN HOUSE MOVING

Ordinance in Successful Operation for a Number of Years Provides Also for Proper Maintenance of Interfering Lines

Moving of buildings along city streets often causes serious interference with overhead electric supply and communication lines. Such lines must be systematically taken care of along the route of a house being moved; otherwise damage to lines and derangement of service will result. Where matters of this kind are not provided for by city ordinance much friction results between house movers and public service companies. The moving contractors are liable to be lax in notifying the companies of lines to be cleared; they will, in fact, frequently tear down services and secondaries which cross their path. Furthermore, they usually assume that the company should stand all expense involved in caring for its property.

An ordinance providing for the proper maintenance of interfering lines and the distribution of the expense involved on an equitable basis is most desirable from a company standpoint. An ordinance of this form which has been in successful operation in one city for a number of years contains the following provisions:

1. Forty-eight hours before removal begins the contractor must notify in writing each public service corporation involved, giving the route to be followed, a schedule of points at which lines interfere and the approximate time at which each interference must be cared for. The latter point is important, as it allows the company to lay out the work better. House-moving jobs are slow, particularly where intersecting trolley lines can be crossed only at night, and often the supply company trouble crew is required for a short time only on several successive days. In addition to notifying the public service companies, the building inspector (or other suitable official) of the city should also be notified.

2. Crossing of street railway lines is permitted only between 1 and 5 o'clock a. m., except by special agreement between the contractor and the street railway company.

3. The allocation of expense is on the following basis: The expense of raising or otherwise giving clearance through trolley wires, regardless of height, is divided equally between the railway company and the moving contractor. Supply and signal lines, other than trolley wires, having a clearance of less than 25 ft. (7.6 m.) from the ground are taken care of at the expense of the public service corporation; if the clearance exceeds 25 ft., the expense is divided equally between the corporation and the contractor.

4. After a corporation has been notified of a proposed building removal, if the building as mounted on the transportation trucks exceeds 25 ft. in height, each corporation involved inspects the points of interference and estimates the maximum liability of the contractor under the terms of the ordinance. The contractor is then required to advance his half of the estimated cost before the work can proceed. Provision is made for refund in the case of overestimate.

5. The city council (or other suitable body) is made a court of appeal and arbitration in cases where disputes arise.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

New Solution of the Problem of Regulating Groups of Generators.—L. BARBILLION and P. CAYÈRE.—In regulating generating units operated by hydraulic turbines, indirect regulators furnished with auxiliary motors are necessarily employed. The turbine gates may be operated at a constant or almost constant rate of speed, or the speed may be made proportional to the angular acceleration of the unit, or to the divergence between the instantaneous speed and the speed of the system. Each of these solutions is incomplete, and the authors have tried to realize the advantages of the last two and to exclude their defects by means of a new mixed regulator, in which, by an ingenious method, both the divergence of speed and the angular acceleration are taken as criterions in a manner variable at will, thus making it possible to adapt the apparatus to each particular need. A long explanation with numerical example is given to show how this principle, complex as it seems, lends itself to practical requirements.—*Revue Générale de l'Electricité*, May 25, 1918.

Lamps and Lighting

Flickering of Electric Lamps.—This paper deals with tests to determine what conditions favor flickering, the lowest frequency permissible with modern metal-filament lamps, the greatest voltage variation allowable, the best method of measuring the frequency of flickering and the mechanical reasons that give rise to variations of engine speed and thus cause flickering.—London *Electrician*, May 17, 1918.

Generation, Transmission and Distribution

Artificial Line for High Voltages.—The line consists of three coils of wire having 240 turns each, the capacity being given by thirty-six Moscicki condensers, uniformly distributed at every twentieth turn. The frequency of resonance is about 9000, and the natural wave length of the complete line is 33 km. Two coils, excited at the mid-point, can be employed as a symmetrical antenna, having a fundamental wave of 11 km. and responding to various odd harmonic waves. The essential feature of the line is its adaptability to experiments with very high voltages, the condensers having been tested at 30,000 volts, and the necessary provisions made for the connection of every two in series, so as to give to the coils a potential of 60,000 volts. The first experiments performed on the line were with the object of demonstrating the surging waves produced by suddenly connecting or short-circuiting the line when fed at one end by a transformer, the other end being open, or connected to appropriate coils so as to give resonance for the surging waves. It was easy in this way to excite surges of 50,000 to 100,000 volts at the open end, starting at the other end with 5000 to 10,000 volts, and to measure the steepness of the waves along the line by sphere gaps. Analogous experiments could be performed by connecting to the charged line a battery of condensers, so as to obtain a sudden discharge, the danger of which is practically increased by the inversion of the charge, as explained by Sarfert. A second set of experiments was performed on modern protective devices, and was sufficient to demonstrate the action and to compare the efficacy of resistances, reactance coils, capacities and different combinations thereof. All the experiments were repeated at a lecture before the Electrotechnical Association and will be fully published in the Italian *Electrical Review.* Professor Lombardi, who constructed the artificial line, proposes to extend his experiments by the use of high-frequency oscillations, for which purpose an arc generator will be used.—London *Electrician*, May 10, 1918.

Some Transient Phenomena in Electrical Supply Systems.—E. W. MARCHANT.—A number of oscillograms taken on the Liverpool Corporation electric supply system are presented. In order to explain the results observed on the central-station records, a number of tests are included of similar phenomena observed under laboratory conditions at the instant when the circuit was closed. The theories regarding various transients are discussed.—London *Electrician*, May 24, 1918.

Power Factor and Its Improvement.—E. W. DOREY.—The author discusses the causes of low power factor and whether the cost of its improvement should be borne by the consumer or by the supply authority. He expresses the opinion that the consumer should pay for this improvement, and in order that he should have some inducement to do so a special tariff is suggested for power consumers. Finally, the means available for improving the power factor are considered, and examples are given showing the financial results obtained.—London *Electrician*, May 24, 1918.

Electrophysics and Magnetism

Thermo-Electric Properties of Fused Metals.—CHARLES ROBERT DARLING and ARTHUR W. GRACE.—Generally the thermo-electric properties of metals are unaffected by change of state from the solid to the liquid and vice versa. The exceptional behavior of bismuth and antimony may be due to the formation of allotropic modifications during the melting period. This view may be substantiated by the fact that both of these metals expand upon solidification—an exception to the ordinary rule. In the case of iron an allotropic change is accompanied by an alteration in thermo-electric properties, and it is possible that the one change is always accompanied by the other. It is possible that molecular changes occurring in molten alloys may be detected by the authors' methods.—London *Electrician*, May 24, 1918.

Electrochemistry and Batteries

New Form of Primary Battery.—A recent French patent (No. 484,436) describes a new method of treating the positive electrodes of primary batteries with a view to introducing metallic oxides as depolarizers. The electrode consists of a shallow plate of copper or iron presenting numerous conical points to the alkaline element in the cell. The edges of the plate are bent over so it forms a shallow box in which the depolarizing oxide is retained. This material is mixed in a powdered state with a suitable alkaline hydrate or alkaline earth and introduced into the interior of the box formed by the positive and a zinc plate as negative. The whole is sealed with rubber and incased in metal stiffening bands, a small vent being inserted to permit the escape of the gases that are formed.—London *Electrician*, May 24, 1918.

Large Batteries for Power Purposes.—E. C. MCKINNON.—The following factors are cited as having hindered the development of storage batteries: (a) Irreconcilable prejudice against batteries; (b) difficulty in providing the necessary capital; (c) attitude adopted by government departments; (d) reluctance to provide adequate space for batteries; (e) inadequate training of engineers on battery subjects; (f) misconceptions about batteries, their functions, etc.; (g) lack of technical supervision over battery operators; (h) improper working conditions; (i) want of appreciation of the possibilities obtainable with batteries; (j) absence of standards.—London *Electrical Review*, May 3, 1918.

The Electrical Resistivity of Porcelain and Magnesia at High Temperatures.—P. H. BRACE.—This paper contains results of tests on the electrical resistivity up to 1000 deg. C. of calcined magnesite completely fused in an arc furnace and free from cracks and blow-holes, molded calcined magnesite baked at 1700 deg. C. and porcelain such as is suitable for spark-plug insulators by the use of direct current. A diagram of connections, the materials and test pieces required and methods of making tests are given. Curves are given for tests on fused and molded magnesia as well as porcelain. The magnesia was found to have a higher resistivity than porcelain at all temperatures investigated. Applying direct current, the apparent resistivity was a function of the duration of the application of the test voltage. Porcelain was found to exhibit a polarization electromotive force, which at the two highest temperatures was near 0.7 volt.—Extracted from paper presented before the American Electrochemical Society, April 28-May 5, 1918.

Electrolytic Refining of Tin.—EDWARD F. KERN.—A record of experiments to determine the best electrolyte, the best current density and the best addition agent to use in electro-refining impure tin bullion, with the object of saving precious metals and getting pure tin, is given. Addition agents were found necessary in all cases. Aloin and boric acid were good in specific electrolytes, and peptone in all those tried. A comparison of the cathode of the preliminary run with no addition agents present and experiments with the use of various addition agents are given in tables.—Extracted from paper presented before American Electrochemical Society, April 28-May 5, 1918.

Units, Measurements and Instruments

Measuring Energy by Electrolytic Means.—A device is described which is intended to take the place of the direct-current watt-hour meter for small customers, with the object of eliminating the expense of reading the meter and calculating the bill at monthly intervals. No deposits have to be weighed, no delicate balances maintained, and no moving mechanical parts adjusted. The electrolytic action upon which its operation is based is far more sensitive and accurate than that of meters hitherto employed.—London *Electrician*, May 17, 1918.

Loop Tests for Fault Localization.—G. W. STUBBINGS.—The simplest case of a loop test occurs when a return cable of cross-section the same as that of the faulty cable is available. If current is available at each end of the faulty cable, a test is easily carried out by making the ordinary test first from one end and then from the other. If current is available only at one end of the faulty cable, the problem is not quite so simple. It frequently happens, however, that in three-wire systems two return cables are available. Difficulty arises when a high fault resistance is not obtained, when there is only one return wire and current is available at only one position, and the fault in concentric cables takes the form of a short-circuit and an earth on the outer conductor.—London *Electrician*, May 17, 1918.

Miscellaneous

The Vom Baur Arc Furnace.—J. H. VOM BAUR.—This furnace consists of a polyphase, solid-bottom arc furnace, and has a two-phase, three-wire connection with three electrodes in a straight line, all contained in an oval-shaped hearth which has an equal heat gradient at the slag line. In the larger furnaces the rolling features of the Wellman type have been adopted, whereas with some of the smallest the tilting is accomplished, keeping the spout almost stationary, by having the fulcrum directly beneath it. When burning in a basic bottom, as the electrodes are in a straight line, the heat of the arcs can be transmitted to a scrap-carbon electrode lying horizontally on the bottom directly beneath all three vertical electrodes, and thence to the basic layer being sintered. When the charge is thrown into the furnace piles it forms into a natural heap, with its apex directly underneath the central electrode. This electrode carries 41 per cent more heat into the furnace than either of the two end electrodes. Should metal freeze on the bottom or sides, owing to partially pouring and recharging some cold metal, the end electrodes can be shifted to remove the offending spot. As the rate of refining steel depends not only on the temperature at the point of contact between the hot charge and the slag, but also on the amount of slag in contact with the metal, it is evident that the additional area of bath surface afforded is an advantage when refining. This furnace is especially adaptable for making low phosphorous pig iron from steel turnings or high-grade gray-iron castings, low in sulphur, from cast-iron borings, etc.—Extracted from paper presented before the American Electrochemical Society, April 28-May 5, 1918.

Wood for Boiler Fuel.—G. T. BAKER.—Relative heat values, use of thermometer in uptake, and delivering wood on truck or cars, are among the subjects discussed. The article includes two tables showing the comparative costs of oil, coal, wood and slabs as fuel.—*Industrial Engineering*, May, 1918.

Electric Furnace Advantages.—Experience shows that deoxidizers are unnecessary in electric furnaces, even in the preparation of the finest steel. The atmosphere in the furnace is reducing in character, and it is only necessary to add the various ferro-alloys needed to yield the desired final composition. The elimination of deoxidizers means a reduction in manufacturing costs. Often it is possible to secure the desired analysis of steel by adding scrap and turnings. Starting from cold ingredients, high-grade alloy steels can be produced, ready for pouring, at a total cost ranging from £4 to £6 or £7 per ton, including the cost of electrodes, materials, electrical energy, slag and labor, but not capital charges.—London *Electricity,* May 3, 1918.

Electricity for Medical Purposes.—In a paper on the limitations and possibilities of single-impulse radiography Dr. Robert Knox referred to the disadvantages attaching to time exposures in X-ray work and explained the tendency to shorten the time of exposure in order that sharp details of the moving part of the body may be obtained. Raising the temperature of the human body by passing high-frequency currents of relatively great magnitude through it was discussed by Dr. E. P. Cumberbatch.—London *Electricity,* May 3, 1918.

Electric Steel Castings.—R. F. FLINTERMAN.—Continuation of a report of foundry experience making electric steel castings, in which a considerable saving of power and quicker running of the furnaces, giving greater output, was attained. Very fine mechanical qualities in special alloy steels are shown as obtainable, exceeding the requirements of army and navy specifications. Reverse duplexing is discussed and advantages are given. Tests made on electric steel castings show that the army and navy specifications were not written for electric steel.—Extracted from paper presented before the American Electrochemical Society, April 28-May 5, 1918.

Book Reviews

POWDERED COAL AS A FUEL. By C. F. Herington. New York: D. Van Nostrand Company. 211 pages, 77 illustrations. Price, $3.

The material in this book largely comprises the information obtained by the author while employed as assistant engineer for the New York Central Railroad Company. It covers the entire field of pulverized-fuel preparation and application. The opening chapter gives relative costs of powdered-coal plants and those operated on fuel oil and water gas, showing the former to be the least expensive to operate and not the most expensive in first cost. The second chapter deals with the kinds of coal suitable for pulverizing, paying particular attention to the ash content, which is a vital factor. The chapter on preparation describes various forms of crushers, dryers and pulverizers, and this is followed by descriptions of furnaces and burners for feeding and burning powdered coal. Applications to cement kilns, reverberatory furnaces, metallurgical furnaces, steam boilers and locomotives are taken up in separate chapters, and the concluding chapter explains the precautions necessary to prevent explosions in the storage and handling of pulverized coal. Although the book itself is comprehensive in its scope, a very full bibliography of the subject is given at the end.

POWER WIRING DIAGRAMS. A Handbook of Connection Diagrams of Control and Protective Systems for Industrial Plants. By A. T. Dover. New York: Whittaker & Company. 208 pages, 254 illustrations. Price, $2.25.

The schematic diagrams contained in this handbook cover the subject in the following sequence: Section 1, continuous-current motors and control apparatus; Section 2, continuous-current generators and balances; Section 3, continuous-current switch panels; Section 4, control apparatus for alternating-current motors; Section 5, power transformers; Section 6, instruments, instrument transformers and relays; Section 7, leakage protective systems for continuous-current and alternating-current circuits; Section 8, alternating-current switch gear and switch panels; Section 9, automatic voltage regulators; Appendix I, tables, curves and data relating to control apparatus; Appendix II, illustrations of control apparatus. The publication is of convenient size to place in the pocket and forms an excellent compilation of diagrams which cover the majority of cases likely to occur in practice and are clearly presented. The diagrams could be improved by making the free-hand lettering more uniform in spacing and size. The cross-indexing also is open to some criticism. The book being written for engineers and advanced students, a knowledge of the principles of electrical engineering is assumed.

ELECTRICITY METERS, THEIR CONSTRUCTION AND MANAGEMENT. By C. H. W. Gherardi. London: Benn Brothers, Ltd. 504 pages, 406 illustrations. Price, 15s.

This is a practical treatise on the design, construction, operation, repairs and tests of ampere-hour and watt-hour meters, as used on customers' premises in the distribution of electric light and power, and especially in England. This is the second edition of the book, revised and enlarged. The treatment is essentially practical and descriptive. Only elementary mathematics is employed, and then only on rare pages. The book is copiously illustrated, mostly with pictures of the uncovered apparatus, or of parts, or of electrical connection diagrams. The work is divided into sixteen chapters, dealing with the following topics: Introductory, single-phase alternating-current meters, polyphase alternating-current meters, continuous-current or direct-current meters, meters for either alternating-current or direct-current service, prepayment meters, double-tariff and maximum-demand meters, tramcar meters, choice of a type of meter, arrangement of a meter department, instruments and apparatus, meter testing, testing of meters *in situ,* installation of meters and their reading, meter repairs and meter bookkeeping. There are also a short table of doubled square roots and a list of the meters approved by the Board of Trade. An excellent index terminates the volume. Although many of the instruments described are of similar type to those used in America, yet there are also many types unfamiliar to Americans. There are also various noticeable differences in technique and procedure. For example, it is customary to read meters once every month in America, whereas the British meter is generally read once every quarter. The book will be of value to metermen and also to the interested public.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

CONFERENCE WITH THE WAR INDUSTRIES BOARD

Electrical Manufacturers Prepare Recommendations on Preference Listings for Steel—Jobber's Function Important

A meeting of electrical manufacturers was held at the Hotel Powhatan, Washington, on June 24, preceding a conference with representatives of the War Industries Board.

At the gathering of manufacturers Clarence L. Collens, 2d, a member of the General War Service Committee of the Electrical Manufacturing Industry, stated that the meeting was called to consider and pass upon recommendations to be presented to the War Industries Board in regard to preference listings for steel. Mr. Collens presented several specific recommendations, which were accepted by those present.

RECOMMENDATIONS OF THE MANUFACTURERS

In brief these recommendations provide:

That individual manufacturing companies in the electrical industry be given some form of preference listings for the supply of steel products.

That on the basis of proper information as to current business and of any necessary general guarantee or pledge as to ultimate use of finished products manufactured from steel so supplied, priority certificates be issued on application of individual manufacturers covering steel to be used in manufacturing for stock.

That any extension by the War Industries Board of government regulation to other raw materials be properly co-ordinated with any plan adopted or perfected for steel.

In addition to deciding to present these recommendations to the War Industries Board the meeting also approved the submission to that board of several specific problems for discussion.

These questions dealt with (a) the possibility of stocking up on raw steel and finished electrical products before winter so as to lessen transportation difficulties; (b) what information regarding distribution of small electrical supplies through dealer or jobber for essential uses would permit such distribution through dealer and jobber, and (c) whether the granting of an export license by the War Trade Board carried recognition of the supply of required steel.

As stated, a conference was held on the afternoon of the same day with representatives of the War Industries Board.

The attitude of the representatives of the War Industries Board was that in principle the recommendations could be accepted, but that considerable detailed information would have to be furnished before the matter could be passed on definitely.

It was suggested that the industry be divided into general groups and the percentage of products used be shown in the three classifications which follow:

1. Directly in connection with the war.
2. Important, but not directly in connection with the war.
3. For conveniences and luxuries.

On the specific questions mentioned at the morning meeting and given above, it was stated that (a) was impracticable at this time; (b) that the function of the jobber was more important at present than ever before, that steel jobbers had taken the same pledge as steel manufacturers, that it would be well for electrical jobbers to follow their example and assist the War Industries Board and the manufacturers in policing the industry; (c) that the granting of an export license did not carry recognition that steel would be supplied.

It was decided that the electrical manufacturing industry should be bound by the pledge which follows nere:

"For myself, my corporation or my firm, I pledge the prompt production and delivery of the largest possible quantity of material that is or shall be required by the United States government for the interests of itself or its allies and agree that all other lines of our business shall be subordinated to this pledge: and that all this at the suggestion of the War Industries Board."

CHANGE IN MANUFACTURERS' WAR SERVICE COMMITTEE

Robert K. Sheppard Resigns as a Member and Chairman—A. W. Berresford Is Elected as Successor

Robert K. Sheppard, Simplex Wire & Cable Company, has resigned as a member of the General War Service Committee of the Electrical Manufacturing Industry. He was one of the two representatives of the Associated Manufacturers of Electrical Supplies on this committee. Mr. Sheppard found that the pressure of company and personal business prevented him from giving the work of the committee the attention that he would like to give to it.

At a meeting of the board of governors of the Associated Manufacturers of Electrical Supplies at New London, Conn., on June 28 the resignation of Mr. Sheppard as a member of the General War Service Committee was accepted with expressions of regret that it was necessary for him to withdraw from the work to which he had given such devoted effort.

A. W. Berresford, Cutler-Hammer Manufacturing Company and president of the Associated Manufacturers of Electrical Supplies, was appointed by the board of governors to succeed Mr. Sheppard as a representative of the association on the General War Service Committee of the Electrical Manufacturing Industry. Subsequently the General War Service Committee elected Mr. Berresford chairman to succeed Mr. Sheppard.

WAR-TIME PROBLEMS ARE DISCUSSED IN NEBRASKA

Nebraska Electric Association Considers Fuel Economy, Interconnection and Rates—Standpoint of the State Fuel Administration

The annual convention of the Nebraska Electric Association was held in the Loyal Hotel at Omaha on June 26 and 27. The convention was well attended and great interest was taken in the timely topics presented.

President J. E. Davidson of Omaha pointed out the necessity for increased efficiency and economy in the use of fuel and the need of most utilities for increased rates. He called attention to the opportunity to secure increased loads by interconnection with small inefficient plants and by pushing the sale of household appliances.

The address by John L. Kennedy, State Fuel Administrator of Nebraska, aroused much interest as a large number of the plants in Nebraska are operated by steam and there are competing utilities in a number of the cities. Mr. Kennedy explained that it was the object of the Fuel Administration to eliminate all duplications and encourage the production of the largest amount of energy at the least expense. In order to save fuel the national administration proposes the elimination of uneconomical isolated plants, the introduction of the skip-stop system on street railways, the economic utilization of power and light in factories, the interconnection of power systems and the utilization of water power, the operation of the most efficient plants, and economy in refrigeration and ice manufacturing. In answer to questions as to what the Fuel Administration would do regarding the elimination of duplications and the help it would give to secure adequate rates for utilities where city councils are indisposed to grant increases, he stated that the government is going to provide engineers to make investigations and bring about necessary changes.

R. L. Hall, chairman of the Nebraska Railroad Commission, in his address on "Reserve Surpluses in the Public Utility Business," stated that it should be the object of every public utility to give the best possible service to the community and that the rate charged for the service should be adequate to pay all expenses, including dividends, and provide a surplus account. The surplus account may then be used to pay expenses, including dividends, when operating expenses rise to such a point that existing rates will not pay an adequate return. If the abnormal conditions continue for a considerable period of time, the rates should be raised, and if the surplus account gets too large, the rates should be lowered.

R. E. Crockett, chief engineer for the Union Power & Light Company of Omaha, in his paper on "Plant Economy and Fuel Conservation," stated that the place to start to improve the efficiency of a plant is in the boiler rooms, for if coal is lost there it cannot be regained in the engine room. He recommended the installation of indicating and recording instruments to show the performance and operation of the boilers. He regarded the fireman as one of the most important men in the plant because he can waste more than the other can save.

Emmet Tinley, counsel for the Citizens' Gas & Electric Company of Council Bluffs, Iowa, stated that the electric men are engaged in a business which is essential to the winning of the war and are as much entitled to an adequate return upon the capital invested as the laborer is to an adequate return for his labor.

Other papers presented were "Credits in War Times," by Walter W. Head, vice-president of the Omaha National Board, and "Revenue Producers Under War-Time Conditions," by H. M. Beal of the Nebraska Power Company. C. J. Snyder, engineer of the Nebraska Power Company, gave the report of the committee on inductive interference and overhead-line construction.

The following officers were elected: J. E. Davidson, president, Electric Building, Omaha; T. H. Fritts, vice-president, Grand Island, J. E. Shuff, secretary and treasurer, Lincoln.

Illuminating Engineering Society Convention

The council of the Illuminating Engineering Society has decided to hold a one-day convention in New York on Oct. 10. This follows the report of the committee on time and place recommending that such action be taken.

Electric Signs Play a Part in Getting People to Save Food

This food conservation sign was erected on the city hall in Waco, Tex., following the suggestion of the Food Administration. The sign was erected by the city department of electricity on the order of the Board of Commissioners. E. F. Copley, city electrician, writes to the ELECTRICAL WORLD that Mr. Hoover's representative, who visited Waco, said that the sign deserved publicity.

ELECTRICAL CREDIT MEN INDORSE TRADE ACCEPTANCE

Meeting Held in Conjunction with National Association of Credit Men at Chicago Is of an Unusual Character

The nineteenth annual meeting of the National Electrical Credit Association was somewhat different in character from those usually held in the past. The date was made to coincide with the date of the twenty-third annual meeting of the National Association of Credit Men, so that the electrical credit men might enjoy the advantages of hearing discussions and addresses presented at the National Credit Men's meeting. The usual addresses and papers were therefore omitted from the program of the electrical association.

Two reports, however, were heard, and officers were elected. The report of the committee on trade acceptances, of which B. P. George of Chicago was chairman, showed that 70 per cent of the members who had answered the questionnaire were already using the trade acceptance. The association went on record as favoring the use of the trade acceptance. A report on contractors' accounting methods was presented by George J. Murphy. It is expected that the work of Mr. Murphy's committee will do much to make the contractor a better risk for jobber and manufacturer.

The following officers were elected: President, Charles C. Hillis, Electric Appliance Company, San Francisco; vice-president, Benjamin P. George, Beardslee Chandelier Manufacturing Company, Chicago; general secretary-treasurer, Frederic P. Vose; assistant secretary-treasurer, Walter S. Vose.

BOSTON EDISON STRIKE PROVES A FLAT FAILURE

H. B. Endicott of the Massachusetts Committee on Public Safety Vigorously Condemns the Threatened Walk-out

Union linemen and generating-plant employees on the Boston (Mass.) Edison system who struck for increased wages not long ago have found it impossible to interrupt the company's service or to extend the walk-out to other central stations in the Boston district in any effective manner.

On June 6 an arbitration finding was handed down by Henry B. Endicott, executive manager of the Massachusetts Committee on Public Safety, to the effect that no increase in wages should be granted at this time in view of the fact that the Edison employees receive wages as good as or better than many employees in similar lines of work. The union employees thereupon broke their agreement to abide by Mr. Endicott's decision, and about fifty employees out of a total of about 500 in the generating and line departments walked out. The testimony before Mr. Endicott showed that, while the wages of the Boston Edison employees were large, they had been raised voluntarily May 1 by 10 per cent. Some changes were made in regard to working conditions. In a statement Mr. Endicott said in part:

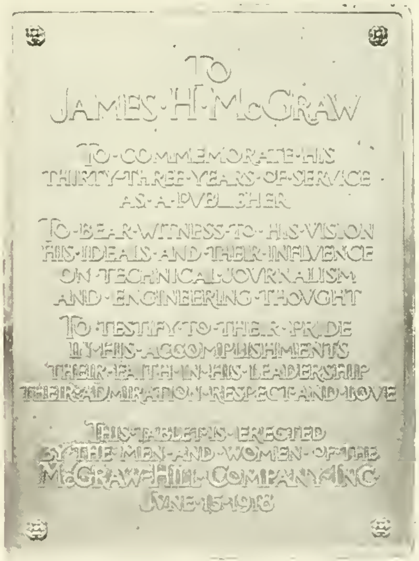
> A strike was threatened unless I reopened the case. There was no suggestion that there was new testimony to submit, therefore there was no reason why the case should be reopened, and I refused to reopen it. There has been an attempt to call out the men. This attempt has not been a success nor will it be, nor do I believe for a moment it is possible for the dissatisfied men to make this a success. They agreed to leave the decision to me. When they refuse to accept my decision they go back on their agreement, and under those circumstances they are not likely to succeed. I have arbitrated between 100 and 150 different important labor differences, and out of probably 350,000 men and women working under my arbitration these few dissatisfied men are the only ones that have refused to live up to their agreement. It is only fair to the Edison employees to have the public understand that as a class they have shown their determination to live up to their agreement.

To a representative of the ELECTRICAL WORLD Mr. Endicott stated further that there could be only one outcome to the strike, and that favorable to the company and its loyal employees. The hearings were privately held, the employees being represented by a committee of union and non-union men and the company by its counsel, Frederick Manley Ives, who was given full power of attorney to act for the utility. It was agreed by the company in advance that no employee should be deprived of his position merely on account of his attendance and share in the hearings.

HONOR ANNIVERSARY OF JAMES H. McGRAW

Completion of His Third of a Century as a Publisher of Technical Newspapers Is Commemorated in New York

James H. McGraw, president of the McGraw-Hill Company, Inc., who has completed a third of a century as publisher of technical newspapers, was the guest of employees of the company and associates in the publishing industry on June 29.

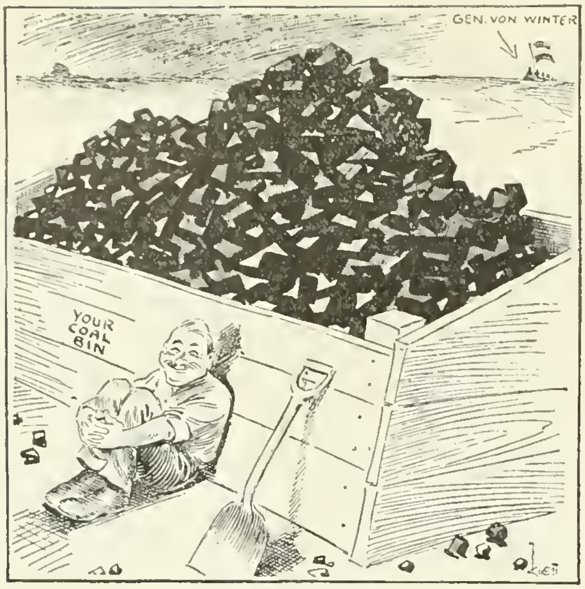


TO
JAMES·H·McGRAW
TO·COMMEMORATE·HIS
THIRTY-THREE·YEARS·OF·SERVICE
AS·A·PVBLISHER
TO·BEAR·WITNESS·TO·HIS·VISION
HIS·IDEALS·AND·THEIR·INFLVENCE
ON·TECHNICAL·JOVRNALISM
AND·ENGINEERING·THOVGHT
TO·TESTIFY·TO·THEIR·PRIDE
IN·HIS·ACCOMPLISHMENTS
THEIR·FAITH·IN·HIS·LEADERSHIP
THEIR·ADMIRATION·RESPECT·AND·LOVE

THIS·TABLET·IS·ERECTED
BY·THE·MEN·AND·WOMEN·OF·THE
McGRAW-HILL·COMPANY·INC
JVNE·15·1918

To commemorate the event the employees of the company presented a bronze tablet, which will be mounted in the building at Tenth Avenue and Thirty-sixth Street, New York. A photograph of the tablet is reproduced herewith.

At a dinner given to Mr. McGraw by associates in the publishing business speakers gave reminiscences of early days and described the growth in influence and power of the business press. Mr. McGraw in responding touched on the large opportunities for service and the serious responsibilities of the publishers in these times.



ARE YOU INTRENCHED?

—*Knott in the Dallas News*

FUEL ADMINISTRATION WANTS EFFICIENCY IN POWER PLANTS

Appointments Made to Facilitate Inspection of 250,000 Steam Plants in Interest of Conservation of Coal

The United States Fuel Administration has announced the appointment of Henderson W. Knott to manage the field force of engineers and inspectors which is at work among power plants of the country, carrying out a campaign of instruction and inspection designed to bring the use of fuel for the production of power to the highest possible efficiency and economy.

Mr. Knott has been the general manager of the Morgan Crucible Company, New York. His appointment is a part of the plan, originated by David Moffat Myers, advisory fuel engineer of the Fuel Administration, to have each of the 250,000 steam plants in the United States visited by a competent man who can make suggestions and report in connection with the questionnaire originated by Mr. Myers, working with committees from the four great engineering societies. This work will naturally require a large number of inspectors who will devote their time to traveling among the steam plants.

This field force will be organized by states in order to give it greater strength and efficiency. Many of the state heads who work directly under the state fuel administrators have already been appointed, and Mr. Knott, co-operating with Mr. Myers, will complete the list of state appointees. Mr. Knott will at an early date visit the states already organized to study the work being done by the men in the field and to speed up the inspection program.

The United States Fuel Administration has announced the appointment of administrative engineers as follows:

Thomas R. Brown, Pittsburgh, for the western half of Pennsylvania. He was formerly special engineer with the Westinghouse Air Brake Company.

George R. Henderson, Philadelphia, for the eastern half of Pennsylvania. He was formerly consulting engineer with the Baldwin Locomotive Works.

Edward N. Trump, New York, for the State of New York. He has been the vice-president of the Solvay Process Company.

W. R. C. Corson, Hartford, for New England. He has been engaged in practice as a consulting engineer.

These engineers, with others who are awaiting formal appointment, were in Washington last week in consultation with officials of the Fuel Administration in charge of conservation. Others attending the conference were M. S. Hopkins, Columbus, Ohio; O. P. Hood, chief mechanical engineer of the Bureau of Mines, Pittsburgh; Prof. H. P. Breckenridge, Yale University, and H. H. Stoek, professor of mine engineering, University of Illinois.

The principal question under consideration at this conference was the waste of coal in the 250,000 industrial power plants of the country and the means of cutting this waste off, in order that approximately 20,000,000 tons of coal may be available for war and non-war industry in domestic consumption.

The system extends into all states east of the Mississippi River and all of Louisiana, Missouri and Minnesota. In laying the foundation for the organization—work which has been in progress for many months—it has been anticipated that this work will be a permanent service of the government. From 10 to 20 per cent of the coal now used can be saved by correct operation of the steam power plants, using their present equipment, and without the delay or expense involved in the installation of new or improved apparatus.

State fuel administrators, in their judgment, may entirely or partially shut off the consumption of coal by any needlessly wasteful plant in their territory. Inspectors are furnished from one or more of the following sources: (a) Inspectors of steam-boiler insurance companies; (b) state factory inspectors; (c) engineering students from technical colleges; (d) qualified volunteers.

FURTHER RESTRICTIONS TO BE MADE IN LIGHTING

Order Is in Preparation to Take the Place of the "Lightless Night" Order—Announcement of the Fuel Administration

The following announcement is from the United States Fuel Administration:

The United States Fuel Administration is confronted with the immediate necessity for further conserving coal used in the manufacture of electrical energy and illuminating gas.

An order is in preparation which is to take the place of the so-called "lightless night" order of Nov. 13, which was suspended by the Fuel Administrator on May 1 by reason of the daylight-saving law and the fact that the general conservation program of the administration was deemed sufficient notice to the country that coal and the power derived from coal must be conserved in every possible way.

It now appears that in every city and village of the country from which statistical and other reports have been gathered electricity is being wasted in large quantities in the production of light for advertising, street and store illumination and other similar purposes. The country needs now—and for the whole period of the war will need—more coal than it can possibly produce and transport.

Confronted by this condition, the Fuel Administrator will order radical reductions in the quantity of coal consumed in the manufacture of electricity and illuminating gas used for the purposes specified. While the official order has not yet been signed, it is expected that it will provide for closer restrictions in the New England States, New York, Pennsylvania, New Jersey, Delaware, the District of Columbia and Maryland than in other states where the transportation of coal is not such a tremendous problem.

In any case, it is expected, the order will provide that no theater or other outdoor lights shall be turned on until the street lights shall have been lighted. Unnecessary daylight use of electric lights and electric advertising displays will probably be shut off altogether. The order will deal also with store-window lights and will extend to all kinds of fuel, including gas and oil.

The amount of public lighting in any city, village or town shall be only so much as may be necessary for safety, and the use of lights commonly known as cluster lights for purposes of display or decoration shall be discontinued.

PROGRAM ISSUED FOR DISTRIBUTION OF FUEL

War Industries Board Will Decide What Consumers Shall Have Preference—Public Utilities Stand Fourth on List

A program of fuel distribution has been issued by the Federal Fuel Administration to state and district representatives. In order to insure that there shall be no interference with the country's war program, it is necessary, in view of the threatened shortage, to recognize that certain consumers must have preference in the distribution of coal. The War Industries Board will decide what consumers shall have this preference, but the Fuel Administration at Washington has been asked to assist in the compilation of complete preference lists by obtaining reports and recommendations from the state and local fuel administrators.

These preference lists will be the crux of the entire coal-distribution plan. To facilitate assembling these lists all consumers of coal, except domestic consumers, will be recorded under the following classifications:

(a) Railroads.

(b) Army and navy, together with other departments of the federal government.

(c) State and county departments and institutions.

(d) Public utilities.

(e) Retail dealers.

(f) Manufacturing plants on War Industries Board's preference list.

(g) Manufacturing plants not on War Industries Board's preference list.

(h) Jobbers.

(i) Lake.

(j) Tidewater.

The distribution of coal to consumers in classes (a) and (b) will be handled from Washington. Washington will also supervise shipments to certain plants in classes (d) and (f), and in such cases proper notification will be given the state fuel administration in whose state the plants are located.

A list of class (d) consumers in his state will be furnished each state fuel administrator by the statistical section of the United States Fuel Administration at Washington, of which C. E. Lesher is the manager. This list will give the name, location and requirements for each plant by counties. The state and local fuel administrators will be required to check these lists and make such additions or deductions as they may find necessary to keep the lists complete and accurate. They shall report any such additions or deductions to the statistical section.

Each consumer in classes (c) to (g) inclusive is required to make a weekly report in duplicate in regard to his coal situation, one copy going to his state fuel administrator and one copy going to the statistical section of the Fuel Administration at Washington. This report will show the amount of coal on hand at the first of each week, the receipts during the week, the consumption (or, for retail dealers, the distribution) during the week, the amount of coal on hand at the end of the week, the number of days' supply which this amount of coal on hand represents, and the producing district from which the consumer is receiving coal.

FUEL ADMINISTRATION ON POOR COAL SHIPMENTS

Complaints Invited from Public Utilities as to Improperly Prepared or Relatively Inferior Bituminous Coal

The United States Fuel Administration, according to a letter written by Charles M. Means, manager inspection division, to the National Committee on Gas and Electric Service, will be pleased to receive complaints from public utility companies as to improperly prepared or relatively inferior bituminous coal received at their plants by direct barge or railroad shipments.

In making complaints, the name of the producing company, the mine at which shipment originated, the name or number of barges, and the initials and numbers of cars should be stated. All communications should be addressed to Mr. Means at Washington.

"When these reports are received," writes Mr. Means, "an inspector will be sent to the mine and investigation made, and such action taken as each case seems to merit. Such reports will materially assist the Fuel Administration in locating mines that are not producing coal of proper commercial value, and it is hoped that a very material improvement in the situation will result."

FUEL ADMINISTRATION PROSECUTES OFFENDERS

Refers 200 Cases to Department of Justice, a Majority Being Jobbers Who Profited in Excess of Prescribed Allowance

Approximately 200 cases involving violations of its orders have been referred by the United States Fuel Administration to the Department of Justice for prosecution. A large majority of the offenders in these cases are jobbers who have made a profit in excess of that prescribed by the Fuel Administration. There are other cases in which operators have charged more than the government price for coal.

In some instances the charges complained of were made by mistake. In a majority of cases, however, the overcharges were apparently made intentionally, in the expectation that they would escape the attention of the authorities.

In every case the offender was given ample opportunity to refund his illegal profits before his case was turned over to the Department of Justice.

DELEGATES AND GUESTS AT THE ATLANTIC CITY CONVENTION OF

A. I. E. E. Hears Full Administration Aims

Report of the Discussions on the Papers That Were Presented at the Concluding Sessions of the Atlantic City Convention, in Which Various Engineering Problems Were Considered

LAST week's issue of the Electrical World contained abstracts of the principal papers presented before the convention of the American Institute of Electrical Engineers held at Atlantic City on June 26 to 28 inclusive and also an account of the first day's session. The discussions which took place at subsequent sessions are now reported. Among the subjects considered were maximum utilization of America's power supply, developments in lightning arresters and spark gaps, nitrogen fixation by the arc process, solution of complex engineering problems by mathematics, sustained short-circuit phenomena in alternators and the determination of their transient reactance, protection of direct-current apparatus against flashover, and automatic operation of hydroelectric plants. Prevention of inductive interference between power and telephone lines by co-ordinating transpositions and the part that engineers are playing in actual warfare were also discussed. In addition, the aims of the Fuel Administration were outlined by one of its representatives, C. E. Stuart, who also pointed out how engineers in general can help.

Protecting Against Impulse Voltages

A paper by C. T. Allcutt* on "Lightning Arrester Spark Gaps" and the discussion which followed brought out some interesting points regarding means of protecting apparatus and systems against impulse voltages.

P. M. Lincoln pointed out that lightning arresters must not only discharge abnormal surges but must interrupt the discharge of dynamic energy which ensues.

Elaborating still further on this requirement, F. W. Peek, Jr., referred to three types of disturbances—(1) gradual increase of voltage, (2) high-frequency disturbances, such as are caused by arcing grounds, and (3) steep wave-front and high-voltage surges caused by lightning. The sphere gap is the quickest to respond to any of these disturbances, the speed depending on the rate at which voltage is applied, since a certain amount of energy is required to ionize the air in the gap. Two sphere gaps in series have considerable lag. With the gap described by Mr. Allcutt, Mr. Peek pointed out, the high frequency across the reactance shunting one-half the gap has the effect of cutting out half the total gap. The gain in this gap is not due to the speed, however, but to getting started sooner, so to speak. To supplement the tests made by Mr. Allcutt he showed curves indicating that there are certain rates of voltage increase at which the time lag of the impulse gap under consideration offsets the feature of quick start it possesses, making the spark-over voltage higher. When subjected to rain the 60-cycle gap voltage is reduced 10 per cent or more. Covered gaps have been devised to avoid this difficulty. The phenomenon of time lag can be used to advantage by making it high for the spark-over portions of apparatus to be protected.

In a written discussion by Percy Thomas it was pointed out that certain high frequencies may not be harmful and hence need not be guarded against. Furthermore, most impulses on commercial lines are less than 500,000 cycles, the frequency at which the impulse gap was tested, and the energy involved in some surges may be so small that it can be easily absorbed.

L. W. Chubb contended that repeated applications of impulse voltages on dielectrics cause permanent injury, hence the gap described by Mr. Allcutt is particularly valuable in discharging less than double-voltage surges occurring in opposition to the 60-cycle peaks.

In closing the discussion on this subject, Mr. Allcutt said that the possibility of time lag being a serious factor is remote since extreme wave fronts are not obtained ordinarily. At high frequencies the equivalent spark gap of the shunted auxiliary-electrode gap is more like 25 per cent of normal than 50 per cent, he said.

Aims of Fuel Administration

Charles E. Stuart, speaking for the Fuel Administration, outlined its aims and explained how individual engineers and the Institute as a body can help. Referring

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*See abstract on page 1370, Electrical World, June 29.

ICAN INSTITUTE OF ELECTRICAL ENGINEERS, ON JUNE 26 TO 28

to the increased demand for coal, amounting to 100,000,000 tons, and the shortage of 50,000,000 tons, he said that while congested transportation was once the cause of the shortage it is now due to reduced production. Therefore curtailment of power supply and coal consumption and maximum economy in the use of coal are the only hope for relief from serious shortage next winter. He explained that the Fuel Administration recognizes the objections to curtailing power supply and does not wish to resort to this drastic measure unless absolutely necessary. First, it will endeavor to promote increased economy in the use of coal and the power generated from it. Canada is compelling economy by a penalty of $5,000 fine and six months in the penitentiary, but this country has not reached that point yet. In fact, it shrinks from such measures, favoring relief through voluntary effort first. If this does not suffice, other methods may have to be adopted.

Referring to the criticism that the Fuel Administration is playing into the hands of the central stations, Mr. Stuart contended that this accusation is unfounded since, while central generation and distribution are being favored because of their inherent economies, a hardship is being put on central stations in asking them to handle loads which may exist only for the period of the war.

Mr. Stuart urged that every isolated plant and central station consider co-operation and arrange contracts even to the point of sacrifice, and thus make it unnecessary for the Fuel Administration to adopt extreme measures. Essential and less essential industries will be discriminated between first in the matter of coal curtailment, when it comes to that, and efficient and less efficient plants will constitute the next line of division. It is the administration's hope to enlist volunteer fuel administrators in every town and city. As a further step toward efficient utilization of coal, the administration will prevent the installation of new plants where a surplus of power is already available unless the new ones are absolutely essential. In closing, Mr. Stuart welcomed suggestions and co-operation.

OXIDE-FILM ARRESTER REQUIRES LITTLE ATTENTION

The details of construction and performance of an oxide-film lightning arrester† were discussed in a paper presented by Dr. C. P. Steinmetz and Capt. Crosby Field.

Among those who took part in the discussion which followed were the authors of the paper and N. A. Lougee, L. W. Chubb and C. T. Allcutt.

Since the papers were written, Dr. Steinmetz pointed out, the resistivity of the arrester has been reduced so that the carrying capacity is considerably greater. In two or three years' actual experience with the apparatus the resistance has been found to increase with time, but there is no deterioration. The leakage current is low and the discharge current is fully as high as for aluminum-cell arresters. Investigations are now being made with a view toward making the oxide-film arrester effective with steep wave fronts, high-frequency disturbances, etc.

Mr. Chubb called attention to the interrupter effect which may be caused by a puncture spot healing up and breaking down again, causing the same objectionable disturbances as an arcing ground. He also expressed the belief that the oxide-film arrester would break down on much higher voltages unless capacity effect is present in the disks.

Among those who took part in the discussion of H. S. Osborne's paper on "Design of Transpositions for Parallel Telephone and Power Circuits" were Prof. V. Karapetoff, C. L. Fortescue and H. E. Chaplain.

WAR SESSION ON THURSDAY EVENING

On Thursday evening three papers were presented on war-time subjects,—"Engineers and the War," by General William M. Black, chief of engineers, U. S. A.; "Electric Power for Nitrogen Fixation," by E. Kilburn Scott, and "America's Power Supply," by Dr. C. P. Steinmetz.

General Black told of the duties of engineers in army service and described some of the work they are doing, illustrating his remarks with motion pictures. He also referred to the training that engineer soldiers must have to be most effective and gave an idea of the magnitude of the work in the Engineer Corps. In closing, he said: "Let each of us, then, do his bit as and where it presents itself, knowing that if each does his best, with love of country and forgetfulness of self as guides, the results are sure."

In discussing the subject of Mr. Scott's paper, Dr. Steinmetz said that it is a great mistake not to consider the direct process of nitrogen fixation as an emergency measure. Now it is a question of obtaining a big output in a short time. Energy consumption in the direct process should not be compared directly with that in the indirect process, because it is the only constituent in the arc process and hence may be greater without necessarily increasing the total cost. While the arc process has not been found economical in some cases, conditions abroad should not be compared with those here, as it is not so difficult to secure money here. Among the obstacles to fixing nitrogen by the arc process is the instability of nitrous oxide in the presence of the arc. This is due to electrical effects, however; therefore there is a big opportunity, in Dr. Steinmetz's opinion, to increase the efficiency of operation.

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†Abstract appears on page 1368, ELECTRICAL WORLD, June 29.

Closing the discussion, Mr. Scott said that in comparing the direct and indirect methods cost of transportation should also be considered, this being considerably lower for the direct method.

Friday Morning's Session

Some highly technical contributions were presented at Friday morning's session: "Pre-charged Condensers in Series and Parallel," by Prof. V. Karapetoff; "Method of Symmetrical C-oordinates Applied to the Solution of Polyphase Networks," by C. L. Fortescue, and "Sustained Short-Circuit Phenomena and Flux Distribution of Salient Pole Alternators," by N. S. Diamant.

In commenting on Professor Karapetoff's paper, C. O. Mailloux protested against the spelling of noted engineers' names backward, as "mho." "daraf," etc., to express certain units, saying that other words can be used which would be less objectionable than the ones so formed.

L. T. Robinson said that while the point made by Mr. Mailloux may seem relatively unimportant, it is important to start right as it is difficult to change terms after they become used extensively. He suggested building up the names of units on the same basis as "resistor," "resistance" and "resistivity."

L. W. Chubb considered the paper valuable because it outlines an electrostatic method of obtaining potentials higher than the source of emf.

Professor Karapetoff closed by saying that the method has not been used because of the simplicity of hot-cathode valves. He also emphasized the need of standardizing electrical nomenclature.

Solution of Complex Engineering Problems

In the paper presented by Mr. Fortescue it was pointed out that any unbalanced polyphase system can be represented by two balanced systems of opposite phase rotation, after which problems can be solved with relative simplicity.

This paper aroused considerable discussion, many noted engineers speaking of it in the highest terms. It was referred to as one of those classical papers which give the Institute prominence and also as a work of practical importance.

Among those taking part in the discussion were Dr. C. P. Steinmetz, Prof. V. Karapetoff, C. T. Allcutt, A. M. Dudley, B. A. Behrend, Prof. C. F. Scott and C. O. Mailloux.

Prof. Karapetoff said that the practical importance of the method described will increase as its application becomes better understood. He then went on to explain how it can be simplified for practical use and generalized for any N-phase system with or without residue, as he expressed it.

Mr. Allcutt, in commenting on Prof. Karapetoff's simplifications, said that while the operators might possibly be eliminated when one became familiar with the method, they are necessary at the present time.

Mr. Dudley referred to the method as providing a good tool for practical work and said that the highest development of practical engineering cannot be reached without such papers.

Mr. Behrend called attention to the need of absolute accuracy in such highly technical contributions as their value will depreciate considerably unless the conclusions can be used without fear. Emphasizing this point, he said that knowledge must be of a type which can be wielded. He pointed out that most theoretical contributions come from England and France and urged that American engineers get in the front rank.

Professor Scott spoke on the value of mathematical engineering papers in general and Mr. Fortescue's in particular. Questioning whether mathematics is a groundwork which all engineers should have or whether it is a specialty, he concluded that it is the latter. He expressed the belief that Mr. Fortescue's paper was based on an engineering need and that the author worked it out mathematically because other adequate methods were not available.

Mr. Mailloux agreed with Professor Karapetoff that the method could be simplified, saying that it would be well worth while to rewrite it to make it more accessible to the practical man.

In closing, Mr. Fortescue said that he believed a mathematical paper is not justified unless it has practical purposes.

Short-Circuit Phenomena

N. S. Diamant's paper on "Sustained Short-Circuit Phenomena" was discussed by F. D. Newbury, R. E. Doherty and W. F. Dawson.

Mr. Newbury expressed the opinon that the author has made the phenomena more complex than English authors and that the conclusions apply only to one machine. He said that high harmonics in flux and emf. waves may possibly be due to a certain relation between the slot pitches in the stator and rotor. Tooth ripples are only important in connection with telephone interference, while the effect of harmonics is reduced because they buck each other in series circuits. The loss on short circuit, which is increased by distorted flux, is important since the A. I. E. E. rules require that short-circuit loss shall be included in the efficiency of alternators.

Mr. Doherty pointed out that the value of the paper is in its qualitative results rather than its quantitative ones. He also referred to the emphasis of harmonics and the suppression of the fundamental on short circuit.

Closing Session

The last session of the convention was devoted to the presentation of the following papers: "Reactance of Synchronous Machines and Its Application," by R. E. Doherty and O. E. Shirley; "Protection from Flashing for Direct-Current Apparatus," by J. J. Linebaugh and J. L. Burnham, and "The Automatic Hydroelectric Plant," by J. M. Drabelle and L. B. Bonnett.

In discussing the first paper, C. J. Fechheimer told of seven ways in which to estimate the internal reactance of alternators. He expressed the belief that the authors have overestimated the importance of tooth-tip leakage as it is seldom more than 25 per cent of the total in an induction machine and varies inversely as the air gap.

Professor Karapetoff criticised the indiscriminate use of terms and the failure to qualify and express units. More papers should be written so that they will serve for ready reference, he pointed out.

F. D. Newbury said that before discussing reactance engineers should decide on a definite way of measuring it. In commenting on the paper he said that test results obtained with Westinghouse machines differ by about 50 per cent from those given by the authors' formulas. He expressed the belief that the authors overemphasize the mutual inductance of tooth-tip leakage. He contended that reactance can be measured most accurately by making no load and zero-power factor load saturation tests. It is not advisable to add armature reactance to field reactance in calculating short-circuit current as saturation affects armature reactance and may be offset by the added field reactance shielding the effect caused by eddy currents in the laminations.

Mr. Fortescue expressed some hesitation to use information of an empirical nature. H. R. Summerhayes also took part in the discussion.

Prevention of Flashing on Direct-Current Apparatus

The paper by Messrs. Linebaugh and Burnham was discussed by C. L. Fortescue, Mr. Handler, H. B. Dwight, F. Wunsch, F. D. Newbury, W. F. Dawson and J. F. Tritle.

Mr. Fortescue referred to a number of methods which have been developed by the Interborough company to prevent flashover on direct-current machines. In one case a condenser was put in series with the trip magnet so that the latter would be actuated when there was an instantaneous drop in voltage. He called attention to the disadvantages of a high-speed breaker, saying that it is easier to use a choke coil with a trip coil shunted across it. With this arrangement the switch will open when there is an impulse voltage impressed.

Mr. Handler expressed the opinion that the method described by Burnham and Linebaugh is the logical one as it supplements existing apparatus. He referred to another method of attacking the problem which consists of short-circuiting the windings of the machine through collector rings to reduce the voltage below the flashover point and at the same time to reduce the field flux.

Mr. Newbury called attention to the disadvantages of barriers between brushes, saying that the commutator and brushes are made inaccessible thereby.

After Mr. Tritle had pointed out some of the details of the second high-speed circuit breaker mentioned in Messrs. Linebaugh and Burnham's paper, Mr. Burnham closed the discussion by calling attention to some of the disadvantages of the method outlined by Mr. Handler.

MUNICIPAL PLANT ASKED TO BUY CENTRAL-STATION ENERGY

New England Fuel Administration Requests Marblehead (Mass.) Authorities to Consider It in Order to Save Coal

The municipal electric lighting plant at Marblehead, Mass., has been requested by the New England Fuel Arministration, headed by James J. Storrow of Boston, to consider the policy of purchasing electrical energy from adjacent central stations as a means of saving fuel. The Marblehead authorities have taken up the matter along the lines requested and have asked the Lynn Gas & Electric Company and the Salem Electric Lighting Company to submit figures as to the supply of energy to the town system.

It appears that neither the Lynn nor the Salem company is seeking to acquire the Marblehead plant or distribution system, and it is probable that if a satisfactory arrangement for the purchase of electricity is made, the financing of the necessary line will have to be handled as a war measure looking toward the conservation of coal. The peak load at Marblehead is less than 500 kw.

CALIFORNIA COMPANIES AGREE ON INTERCONNECTION PLAN

Increase in Capacities of Interconnection Links to Add 8000 Kw. in Central Group Will Cost $775,000

The joint agreement carrying into effect the plan for additional power outlined on page 998 of the Electrical World for May 11 was signed in San Francisco on June 13. The plan involves co-operation of the California-Oregon Power Company, the Northern California Power Company and the Pacific Gas & Electric Company. The original estimate of the cost of adding this power to the central group of interconnected systems was $640,000, but more recent figures place the actual outlay required at about $775,000. Of this, $225,000 represents the amount to be expended by the Pacific Gas & Electric Company and $550,000 that to be provided by the California-Oregon Power Company.

The terms of the contract are that the Pacific Gas & Electric Company will finance the construction of its own lines to Colusa, while the California-Oregon Power Company will find the necessary capital to care for its own construction and that of the Northern California Power Company. The résumé of the work to be done by the three companies respectively is as follows:

1. The California-Oregon Power Company is to reinforce or reconstruct its transmission line from Copco to Costella and construct a 70,000-volt line from Costella to Kennet so that sufficient capacity will be provided to transmit 8500 kw. to the Northern California Power Company at Kennet.
2. The California-Oregon Power Company is to finance the Northern California Power Company to the extent required to build anew or reconstruct that company's lines from Colman to near Hamilton so that 8000 kw. can be delivered throughout the year to the Pacific Gas & Electric Company at Colusa.
3. The Pacific Gas & Electric Company, in order to provide the necessary transmission-line capacity, will have to reconstruct or build anew a total of 43 miles of line. In addition, this company will require a substation of 12,000 kw. capacity for stepping up from 60,000 volts to 100,000 volts in order to deliver into the Drum-Cordelia line.

W. S. S. Plus Central-Station Energy Equals Machine Guns

The Hartford (Conn.) Electric Light Company booms the sale of war savings stamps by a window display in which the company's monogram is the only electrical advertising visible. Vickers & Colt machine guns, made by central-station power, are featured at left and right.

DEVELOPMENT OF CODES FOR INDUSTRIAL LIGHTING

Address at University of Pennsylvania Before Pennsylvania and New Jersey State Factory Inspectors by G. H. Stickney

G. H. Stickney, president of the Illuminating Engineering Society, made an address on "Industrial Lighting Codes" at a meeting at the University of Pennsylvania recently. The address was made before state factory inspectors of Pennsylvania and New Jersey and was in connection with the course of instruction in industrial lighting described by Prof. C. E. Clewell on page 11 of this issue.

Mr. Stickney remarked that the regulation of illumination for workers is not exactly new. Attempts have been made from time to time in various countries and in several states to prevent some of the worst conditions. Notable among these have been the regulations in England and orders of the Wisconsin commission. But it remained for the States of Pennsylvania and New Jersey to adopt the first comprehensive codes of rules. Wisconsin is adopting a similar code. Ohio and New York have committees now at work along essentially similar lines. The Bureau of Standards, the safety inspectors of federal establishments and the Council of National Defense are working to this end.

That such codes were not adopted earlier, added Mr. Stickney, was undoubtedly due to the difficulty of the problem rather than to the lack of necessity for them, although it must be admitted that the necessity has been rapidly growing greater because of the gathering of larger and larger groups of workers together in mills and factories and the perfection of more and more complete processes in the presence of powerful and dangerous machinery and under conditions which have demanded sustained effort of close vision.

Some of the data indicate that not only is poor lighting responsible for accidents but also that artificial lighting is commonly poorer than the day lighting. This, of course, is not inherent but is due rather to the impression that artificial light is expensive.

The Illuminating Engineering Society took the matter up as a duty to help along the movement and to help avoid mistaken regulations which either would be ineffective or would produce unnecessary hardship on manufacturers, or both. Such instances have not been uncommon. They are illustrated by some laws on railway headlighting and more recently on automobile headlighting. Proper regulations must be based upon the natural laws of light and its relation to eyesight.

In speaking of the work of the committee on factory lighting, of which Professor Clewell was chairman, Mr. Stickney said in part:

> The first draft of the code was prepared by Professor Clewell's committee and I suspect was largely Professor Clewell's personal work. While the code has been changed considerably since, the first draft was the foundation of its structure and was a very creditable piece of work.
>
> No one who has not seen the growth of the code can realize how much effort has been exerted, how many difficulties have been overcome, in producing the comparatively brief rules which you have before you. Many conferences of the committee on factory lighting and the committee on lighting legislation brought out new points of view and many changes. A meeting with the American Society of Mechanical Engineers in New York developed improvements, as did a meeting in Philadelphia. The Philadelphia meeting accomplished the very important effect of interesting the Commissioners of Labor of Pennsylvania and New Jersey, and resulted in the movement to adopt the code in those states. The representatives of the Pennsylvania and New Jersey commissions gave much information especially as regards the matter of practical application and enforcement.
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> We do not look upon the code as a perfected instrument. We expect to see further changes and improvements. We are all too conscious of its limitations. We expect to learn more about the needs and the ways of meeting them. Remember that industry is changing; illuminants are being improved.
>
> Some of the specifications are not so definite as we would wish, especially that regarding glare. But in codes, as in machinery, there comes a time in development when efficient progress can be made only by putting them in practical use. The same thing is true of the laws on the statute books; we provide legislatures to keep developing the laws.
>
> It is not the province of these codes to enforce the most efficient or most effective lighting. They can only demand such provisions as will reasonably insure the necessary welfare of workers by preventing accidents and eye-strain. This has been one of the embarrassing features of the problems to us as illuminating engineers. The limits set are far below what we consider desirable practice, and we would not as engineers recommend a manufacturer to adopt so low a standard. In general, the requirements are so low that a manufacturer is not justified in equivocating about the class in which a particular process falls. His own best economy will be served by adopting a higher class. Do not let him make the mistake of confusing glare with "over-lighting."

Declaring that manufacturers who study their lighting problems intelligently for the purpose of complying with the codes will end by adopting higher and more efficient standards, Mr. Stickney said:

"There have been recent evidences that some manufacturers, through a misinterpretation of the attitude of the Fuel Administration, are tending to adopt low standards. It will be unfortunate if such a move should result in a sacrifice of human energy. Where power or heat are employed, it is not even good fuel economy, for it may actually increase the fuel consumption per unit of output. It would be better to shut down or divert unnecessary industries. It is possible that under the demands of the war authorities interested in production and conservation may require better lighting than it is justifiable to enforce in a safety code."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Commission Jurisdiction and Procedure.—All presumptions are indulged in favor of the jurisdiction and regularity of procedure of the Public Service Commission, it was held by the Supreme Court of Indiana (119 N. E. 212).

Defective Appliances.—An employer is not required to provide the newest and best appliances but fulfills his duty when he provides machinery of ordinary character and reasonably safe, the Supreme Court of Washington held in Griffith versus Washington Water Power Company (172 P. 822). Employees are not insured, and the law recognizes that absolute safety is unattainable. An employee assumes the risk incident to the employment. The rule that an employee assumes the risk of apparent danger applies with special force to electrical appliances when he is experienced in their use.

Injuries Growing Out of Employment.—Where an employee was required to handle a conduit in a vise and while temporarily absent another employee connected wires carrying electricity to the conduit, so that when the first employee returned he was killed in touching the conduit to begin work, he was performing a service growing out of and incidental to his employment at the time of his death and his dependents were entitled to compensation, the Supreme Court of Wisconsin has held (167 N. W. 749). In such case the mere fact that the wires were adjusted by a fellow workman did not preclude recovery. Furthermore, the fact that the employee had jokingly suggested that a fellow workman touch wires carrying electric current did not preclude recovery of compensation for his death due to such current when the fellow workman later attached wires to metal on which deceased was working, when he had abandoned the joking and had no part in the fatal joke.

Purpose of Use of Right-of-Way.—Generally where a right-of-way is granted or reserved without limitations upon its use it may be used for any purpose to which the land accommodated thereby may naturally and reasonably be devoted, and the grantee thereof is entitled to vary his mode of enjoying the same and from time to time avail himself of modern inventions if by so doing he can more fully exercise and enjoy or carry out the object for which the easement was granted or reserved, the Supreme Court of West Virginia held (95 S. E. 1042). Agreeably to this principle, the owner of such a right-of-way may, without imposing upon the servient estate any additional burden not reasonably within the contemplation of the parties to the grant or reservation, erect poles and wires along and over such way for the use of a private telephone at his residence on the dominant estate. An injunction will not lie against a telephone company employed by the owner of such right-of-way to restrain it from erecting poles and wires along and over such way to provide the owner thereof with private telephone service at his place of residence on the land to which such way is appurtenant.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 47 of this number.

Oregon Society of Engineers.—At the June 20 meeting of the Oregon Society of Engineers R. J. Grace spoke on the "Design, Construction and Behavior of the Reinforced-Concrete Ship."

A. I. E. E., Utah Section.—The final meeting of the Utah Section of the American Institute of Electrical Engineers was held on May 28. The event was celebrated by a dinner and a short business meeting.

Allied Engineers' Association of Charleston, S. C.—T. M. Gregg was elected president and John McCrady secretary-treasurer of the Allied Engineers' Association of Charleston, S. C., at its annual meeting held June 17.

A. I. E. E., Spokane Section.—At the annual meeting of the Spokane Section of the American Institute of Electrical Engineers recently Prof. M. K. Akers gave an address on "The Fundamental Mathematics of an Alternating-Current Circuit" and Major P. T. Acland made some remarks on "Recollections of the Ypres Salient."

A. I. E. E., Denver Section.—"Wireless Communications and Signaling with Lamps," by R. C. Mann, and "The Phenomenon of Existence from the Sun," by O. G. Lester, were the papers presented before the Denver Section of the American Institute of Electrical Engineers recently. Fred J. Rankin was elected chairman and Robert B. Bonney was elected secretary-treasurer of the section for the next year.

Automotive Electric Association.—On July 10 to 13 inclusive the Automotive Electric Association will hold its semi-annual meeting at Lake Placid, N. Y., at the Lake Placid Club House. Among the important papers are one to be presented by B. M. Leece, chairman standardization committee, on "Standardization in the Starting and Lighting Industry," and another by C. F. Gilchrist, chief engineer Electric Auto-Lite Corporation, Toledo, Ohio, on "Size and Performance of Batteries in Relation to the Size of Engines or Work to Be Done."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Increase in Rates in St. Joseph, Mo.—The Missouri Public Service Commission has granted to the St. Joseph Railways, Light & Power Company an increase of rate for its lighting department. The flat increase of 1 cent on each of its schedules was allowed, the charges after June 15 to be 10, 8 and 5 cents for 25 kw.-hr., an additional 45 kw.-hr. and beyond 70 kw.-hr. respectively. The Public Service Commission heard the applications of the company for higher street-car fare and also for readjustment in its heating schedule, but rendered only the decision with reference to the lighting rate, making the statement that the company obviously should have higher rates. The commission has arranged for a valuation of the property used in lighting service, the rate being ordered for one year within which the valuation will be made.

Rates Advanced by Municipal Plant.—In explaining why electric and water rates are advanced the Board of Water and Light Commissioners of Wellsville, N. Y., announced to consumers that it was extremely reluctant to make any increase. The statement issued by the board adds that the village owns the water and light plant in the same way that a young farmer owns a large farm which he has purchased but which he has not yet paid for. "Quite likely, however, the farmer has made a cash payment toward the price, but the village has paid mighty little toward the price of its water and light property." The village took over the properties on Sept. 1, 1915. The first move was to make a reduction in electric rates. Water rates were not reduced. "The average weekly payroll for October, 1915," say the commissioners, "was $159. The average for April, 1918, was $326. . . . The station force in August, 1915, under the old company, consisted of two engineers and one fireman. Each man worked twelve hours and the payroll for the three was $44 per week. The plant is now operated by three engineers and two firemen, who work eight hours and nine hours respectively, and the weekly payroll for these five months amounts to about $99." Coal in 1915 cost $2.25 per ton at the plant. From present indications it will average this year about $5. There has been some increase in water revenues and a very large increase in the electric business. After providing for expenses for the last year and making the "necessary allowance for depreciation," the commissioners were able to put aside only a few thousand dollars toward bond payment. The water and electric rate advances amount to 10 to 15 per cent.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Water Power in Maine.—The Maine State Fuel Administrator called upon the Public Utilities Commission recently for a statement as to the amount of water in the main storage basin or reservoirs at the present time, with a view to ascertaining how many of the industrial plants which are run by water through the spring could depend on the water to run through the season. The commission reported that with one exception, and with a normal rainfall during the coming summer, there is enough water in the reservoirs to run the various plants depending on water for power for the rest of the year.

Demand in Scotland.—The total output of electrical energy from the Glasgow Corporation for the year ended May 31, 1917, was 147,000,000 kw.-hr., or 34,000,000 kw.-hr. more than in 1916. New power houses planned to be erected by the corporation after the war are being rapidly pushed forward, as all available service is being employed. The new plant will be equipped with two 25,000-hp. turbo-alternators with boilers, condensing plants and transformers. The demand for electric supply for power purposes has increased to such an extent that 86 per cent of the total output is required, and the remaining 14 per cent is far short at times of meeting the demand for lighting purposes.

Wisconsin-Minnesota Company Applies for Increase.—The Wisconsin-Minnesota Light & Power Company, Eau Claire, Wis., has made an application for increase in electric service and electric railway rates affecting thirty-four cities and villages. This is an emergency application. The company is asking for a 2-cent increase on residential and commercial lighting and a 1-cent increase on commercial and industrial power, as well as on energy sold to other public utilities and municipalities for resale. An increase of ½ cent per kilowatt-hour is being asked on primary electric energy and on special power contracts. The increase asked on all municipal and "white way" lighting is 10 per cent. Six-cent straight car fares are asked, and interurban fares are to be increased to a straight 3 cents per mile.

Hauling Ice Electrically.—A. Jackson Marshall, secretary Electric Vehicle Section, National Electric Light Association, writes that ice dealers have carefully investigated electric vehicles and as a result they are being installed in increasingly large numbers, particularly in wholesale delivery. A Philadelphia manufacturer has developed a special type of electric truck for meeting conditions that cannot be economically handled with the ordinary 5-ton equipment. The special electric truck is arranged to drive on front wheels only, the large rear wheels being steel-tired. The speed is lower and the battery smaller, resulting in a materially reduced first cost and a reduction in amortization and interest. Maintenance is also greatly reduced, resulting in a total cost lower than the cost of doing the work with the horse equipment.

Women Employees Work for Men in Service.—Fine work is being done by the girls of a number of Massachusetts companies for employees who are in government service. A club has been formed, called the Girls' Electric Social Club, the membership being made up of girls employed in the offices of the following companies: Turners Falls Power & Electric Company, Greenfield Electric Light & Power Company, Easthampton Gas Company, Franklin Electric Light Company, Amherst Gas Company, Agawam Electric Company and Ludlow Electric Light Company. A complete honor roll is kept of those in the service, and letters and boxes of smokes, sweets, etc., are sent to the boys regularly each month. As no boxes can be sent to those who are "over there," an equivalent amount of money is sent to them once in every two months. The funds for this purpose are raised by the employees.

Employing Injured Men in New England.—The Colonial Power & Light Company, Cavendish, Vt., and the Claremont (N. H.) Power Company are doing everything possible to release able men for military service. Wherever possible, crippled men have been given the preference and work has been found to suit them. At the power house in Cavendish one of the load dispatchers is a man with only one arm. It is found that he is able to perform his duties fully as well as though he had both arms. In the power house in Claremont it is found that a lame man makes an efficient operator. Both of these companies have taken the employment of women into consideration. One is acting as load dispatcher in Cavendish and another is employed reading meters in Claremont and Springfield. Both have given complete satisfaction and the companies no longer fear employing them on the grounds of inefficiency.

Government Use of Electric Trucks.—From A. Jackson Marshall, secretary Electric Vehicle Section, N. E. L. A., comes the information that electric vehicles are used extensively in five navy yards, three arsenals and several depots in hauling mail and parcel post matter and at the various departments of the government in Washington; also at Panama and by the Bureau of Insular Affairs in Manila. The electric truck is given preference at the navy yards because of its economy, freedom from fire risk and ease of handling. Gasoline trucks are practically barred from many sections of the yards where there are inflammable stores, ammunition, etc. At the arsenals the same general advantages are found for "electrics" where they are called upon to haul smokeless powder and similar munitions, oils, acids, naphtha, etc., as well as guns of many calibers and machinery. The dependability of the "electric" in mail work is well known. Electric industrial trucks and tractors, in addition to wide application in this country, are being extensively employed in France.

Campaign of South Carolina Utilities.—The leading utility companies of South Carolina are carrying on a joint campaign for the purpose of remedying the difficulties besetting the companies which the war has brought about. The South Carolina Regional Committee, consisting of C. M. Benedict of Charleston, William Elliott of Columbia and F. H. Knox of Spartanburg, are in charge of the campaign. Glenn Marston of New York has been engaged to prepare publicity matter to show that the interests of the public and the companies are identical and that the companies cannot give good or even adequate service without increases in revenue and relief from onerous franchise conditions. All of the street-railway companies expect to show the need for higher fares, and increases in power rates will be asked by some of the companies. It is not expected that there will be any increases in rates for domestic service. President Wilson's recent letter on the need of proper maintenance of utilities will be used extensively. Identical advertisements are to be published simultaneously three times a week in leading papers.

Decision on Cincinnati Rates.—Through decisions rendered by the Ohio Supreme Court the Union Gas & Electric Company, Cincinnati, is denied the right to increase its service rates for both natural gas and electrical energy. It was held that the Public Utilities Commission does not have jurisdiction to determine the appeal of the company from the ordinance passed by the City Council establishing a rate of 30 cents per 1000 cu. ft. for natural gas, and a writ of prohibition was issued to restrain the commission from hearing an appeal for a higher rate for electric service because of a war emergency situation. In the case of the electric light rate, the court ruled that it cannot take into account temporary hardship because of abnormal conditions and that these matters are within the province of the city and the State Legislature to change, if found necessary. The contention of the city was that the company had accepted the ordinance fixing the rate, that it was not clothed with authority to appeal and that it must live up to its contract. The Union Gas & Electric Company was granted a temporary injunction on June 24 by United States District Judge Hollister to prevent the city of Cincinnati from putting into effect the ordinance fixing the natural-gas rate at 30 cents. The company was ordered to furnish a bond of $250,000 to secure refunds to customers in case it is finally decided that this rate must stand.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

F. W. Loomis has been appointed commercial manager of the Dallas (Tex.) Power & Light Company.

J. T. Urquhart has resigned as district manager for the Pacific Power & Light Company at Vancouver, Wash., to go into business on his own account.

J. A. Burnett, electrical engineer Grand Trunk Railway, has been appointed as technical assistant to the British War Mission at Washington, D. C.

G. W. Martin, formerly with the De Pere (Wis.) Electric Light & Power Company, is now superintendent of the Denmark (Wis.) Light & Power Company.

H. C. Mahaffey has been transferred from the post of plant superintendent of the Pacific Power & Light Company at Lewiston to be plant superintendent at Walla Walla, Wash.

John W. Carpenter, for several years manager of the Corsicana (Tex.) Gas & Electric Company, has resigned to become general manager of the Dallas Power & Light Company.

Robert F. Pack, vice-president and general manager of the Minneapolis (Minn.) General Electric Company, has been appointed a member of the Minnesota Board of Arbitration and Conciliation.

Capt. A. S. Smith of the Winthrop Engineer Reserve Corps, formerly superintendent of buildings and power of the Massachusetts Institute of Technology, has been advanced to the rank of major.

Charles Walker, assistant engineer at Station No. 3 of the Milwaukee (Wis.) Light, Heat & Traction Company, has been appointed superintendent of the Hornell (N. Y.) Electric Company.

George Williams has been elected a director of the Cities Service Company, succeeding John C. Mitchell of Denver, whose Federal Reserve Bank duties prevented attendance at many directorate meetings.

W. D. Myers has been transferred by the Pacific Power & Light Company from the position of district manager at Hood River to that of district manager at Vancouver, Wash., succeeding J. T. Urquhart, resigned.

George Wehrle, superintendent of the Denver Gas & Electric Light Company, has been transferred by the Doherty Organization to be manager of the Niagara Light, Heat & Power Company, Tonawanda, N. Y., succeeding C. W. Wallace.

F. S. Dewey, who has been general superintendent of the Muscatine Lighting Company, Muscatine, Iowa, has resigned to accept a position as assistant to the vice-president and general manager of the Kansas City (Mo.) Electric Light & Power Company.

W. B. Montgomery, manager of the water and light departments of the city of Kaukauna, Wis., has resigned to accept a position with the Wisconsin Traction, Light, Heat & Power Company of Appleton. He is to have charge of engineering and new business.

C. W. Wallace, manager of the Niagara Light, Heat & Power Company, Tonawanda, N. Y., has been transferred by the Doherty Organization to be manager of the Atlas Chemical Company, Toledo, Ohio.

L. W. W. Morrow, director of the School of Electrical Engineering, University of Oklahoma, has been granted a leave of absence for the coming school year in order to take an assistant professorship in electrical engineering at Sheffield Scientific School, Yale University.

Howard Murray, vice-president and for several years manager of the Shawinigan Water & Power Company, has been appointed manager of Aldred & Company, Ltd., Montreal, which has just been formed with a capital of $1,000,000 to carry on the business of investment bankers and fiscal agents.

J. O. Posson, superintendent of the city water and light plant at Algoma, Wis., for the past eleven years, has resigned to become manager of the water and electric departments of the city of Kaukauna, Wis. Mr. Posson started his electrical career in 1901 with the Sheboygan (Wis.) Railway & Electric Company.

Stacey B. Lindley, formerly secretary and engineer of the Western Wood Preserving Company, one of the Lindley Brothers Company subsidiary corporations, has been commissioned first lieutenant in the Signal Reserve Corps, Aviation Section, and appointed adjutant of the first training brigade, stationed at Kelly Field, San Antonio, Tex.

J. A. Whitlow has resigned as head of the electric light, water and gas department of the Public Service Commission of Missouri to become engineer for the Corn Products Company of Cedar Rapids, Iowa. Mr. Whitlow was with the commission for five full years, having formerly been chief electrical engineer for the Board of Education of St. Louis, Mo.

Charles A. Coffin, chairman of the board of directors of the General Electric Company, has been made by the French government an officer of the Legion of Honor in recognition of his energetic work as head of the Franco-American War Relief clearing house and of his active efforts to promote the establishment of scholarships in French universities for American students after the war.

Fred M. Lege has resigned as general manager of the Dallas Power & Light Company to become general manager of the Lone Star Gas Company of Fort Worth, Tex. Mr. Lege has been a familiar figure in the gas and electric light business in Texas for many years and in 1912 was elected president of the Southwestern Gas and Electrical Association at the San Antonio convention.

R. Sanford Riley, president of the Sanford Riley Stoker Company, Ltd., Worcester, Mass., and of the Murphy Iron Works, Detroit, Mich., has been requested by the Emergency Fleet Corporation to arrange for supervision of trial trips of all merchant ships now being turned out in this country. He will undertake the organization of this department for the Emergency Fleet Corporation beginning July 1, but has an arrangement by which he will retain supervision of his other interests during his connection with the Emergency Fleet. Before going into the stoker business Mr. Riley had an extensive experience in marine engineering and shipbuilding.

Benjamin F. Eyer, who has recently been appointed manager of the new sales office of the Edison Storage Battery Company of Kansas City, Mo., has been a consulting engineer in Kansas City since 1916, appraising and reporting on Middle West utilities for Eastern syndicates. From 1902 to 1913 he was head of the electrical engineering department of the Kansas State Agricultural College and during these years acted in the capacity of consulting engineer for both municipal and private corporations. In 1908 Mr. Eyer, together with several other men, purchased and developed the Manhattan Ice, Light & Power Company. He is at present interested in the Marshall County Power & Light Company, which was developed in 1914.

I. W. Gross, who has been appointed New York district engineer for the General Devices & Fittings Company, Chicago, was born in 1888 at Frankfort, Me., and was graduated from the Harvard School of Applied Science in 1912 with the degree of M.E. He entered the employ of the Interborough Rapid Transit Company, New York, in June, 1912, as assistant engineer, and when he resigned in April, 1917, he was chief of the electrical research department, having charge of all electrical apparatus in the motive power department of the Interborough system. Mr. Gross is the author of several articles that have appeared in the ELECTRICAL WORLD and other engineering papers and a paper on "Theoretical Investigation of Electric Transmission Systems Under Short-Circuit Conditions," read before the A. I. E. E. in 1915.

Obituary

Dr. James Douglas, chairman of the board of directors of the Phelps-Dodge Corporation, died in New York City on June 25, in the eighty-first year of his age. Dr. Douglas was particularly well known as a copper expert. He was the first to separate on a commercial scale the precious metals from copper by the electrolytic method of refining now in general use.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

MANUFACTURERS OF SWITCHES AND SOCKETS ARE RUSHED

Government Orders Take Larger Part of Output—Deliveries Running from One to Three Weeks

Makers of switches and sockets are unusually busy at present trying to fill orders placed just before the recent price advances took effect. Stocks of equipment suitable for the domestic market are low, and factories are running full time. Comparatively little night work is being done now, a factor in this being the extensive employment of women, which militates against protracted overtime and night production.

The manufacturers are doing a very large government business, as might be expected. One representative maker informed the ELECTRICAL WORLD last week that more than 50 per cent of the wiring device sales which he is making to the jobbers goes into direct or nearly direct war applications; and besides this, probably three-fourths of his other production, if not more, goes direct to Uncle Sam. The activities of the shipyards have stimulated the demand for marine wiring equipment, and a good deal of work is also being done at the various army camps and coastal stations.

It appears that the country is still a long way from attaining its maximum production of war supplies, although in particular districts the individual plants are being worked to the limit set by the present labor supply. The competition of munitions plants is causing the switch and socket makers a good deal of trouble, and while there is no doubt that there is a tendency among some former employees to exaggerate the wages being received in the munitions plants, the difference is enough to make it difficult in many instances to hold the old-time organization together.

Most of the switch and socket manufacturers have anticipated the adverse delivery conditions on raw material which have for so long hampered production. The reduction of embargoes has lately been helpful in getting through shipments of porcelain, and in some districts local producers of refractory materials have been called upon to great advantage to supply temporary shortages, notably in central Connecticut. Copper is in fairly plentiful supply at present.

Deliveries on wiring material are now running about two or three weeks from receipt of order, one month also being a common quotation where no particular stress for quick shipment is emphasized. Railroad conditions, while much better than earlier in the year, are still unsatisfactory in many cases. A Connecticut manufacturer informed the ELECTRICAL WORLD that it was impossible last week to ship even a government order to Virginia over the New Haven system until the priority number of the shipment could be obtained from Washington.

Attachment plugs are at present in fairly large stock, one producer stating that he could take care of an order for several hundred thousand for immediate shipment. Fuse plugs are also fairly plentiful at this time. Development work is not being pushed much at present except for special government purposes. Expert staffs are being retained and utilized so far as possible in meeting the problems which the war is bringing to the factories.

Until the effect of the recent advances in freight rates is determined little can be said as to the prospect of further price advances toward the end of the summer. In fact, predictions as to trade conditions are far from easy, in view of the close supervision now effected by the government over the prices and supply of raw materials, and the actual business of the wiring device manufacturers themselves is carried on with government regulations and requirements constantly in mind.

The lack of shipping facilities is holding back foreign trade development at this time, but as the tonnage increases it is hoped that more active efforts can be made to develop the South American and other foreign markets. A good beginning has been made in the establishment of a separate foreign trade department in one of the largest New England factories making wiring devices, and other producers are watching the development of shipping facilities and foreign credit conditions with no little interest. South America is at present using much wiring material of cheap and inferior design supplied from Germany before the war, and one of the problems before the American manufacturer is to develop a market in Latin America for better grades of material. About the only competition in wiring devices at present met in South America is that of Spanish manufacturers, and the lack of ships cuts this down materially.

Broadly speaking, business at the present time is in very good condition among the switch and socket makers. Some are heavily stocked on material suitable for foreign trade but not adapted to American markets, but on the whole the industry is in a strong position and the outlook is optimistic.

OPPOSITION TO MOVEMENT FOR NATIONAL TRADEMARK

Held that It Would Not Be Possible Under Such a Law to Safeguard Goods Against Unscrupulous Exploitation

The movement for a national trademark to be used in foreign commerce is meeting with criticism. There is a bill in the House of Representatives authorizing the "adoption, registration and protection of a national trademark to distinguish merchandise manufactured or produced in the United States and used in commerce with foreign nations or among the several states."

After a full discussion of the bill the Merchants' Association of New York has disapproved the idea and filed its disapproval with Congress. The association holds that if such a trademark were widely used it would be harmful since "it would be practically impossible to control and maintain the standards of all of the articles eventually licensed to bear it."

The attachment of the trademark to inferior and cheap merchandise and to goods not possessing the merits which their sellers claim for them, the association says, could not but bring into disrepute all goods bearing the mark. If the utilization of the trademark should become widespread and cover good, bad and medium merchandise, it would not be possible to safeguard it against unscrupulous users who would exploit their merchandise under it. In fact, it would be the maker and seller of merchandise of unestablished value and merit who would adopt and flaunt the national mark rather than firms handling goods whose name, mark and value are established abroad.

This of course refers to merchandise generally. On electrical goods an opportunity is open to use some of the names already well known as American electrical names. Inasmuch as general trade names are in use in this country without the misuse indicated above, it should not be impossible to do something of this nature for foreign commerce. Already English manufacturers are busily giving publicity to the Beama (British Electrical and Allied Manufacturers' Association) mark in foreign markets.

THE WEEK
IN TRADE

AGAIN the Eastern trade has been notified of not a few price advances on staple lines. This is caused by the sharp curtailment and difficulty of retaining suitable labor at the manufacturing plants, as well as by a threatened shortage of material and increase in the price of essential metals. In the Pacific Northwest a steady buying of heavy equipment for the changing of industrial plants to electrical operation is noted. There is a steady depletion of raw material and some finished articles in the Southeast. On the Pacific Coast and in New England, as well as other sections, business is of a progressive nature and the volume of sales satisfactory.

The sale of domestic appliances, particularly of sewing and washing machines, is well sustained Washing machines, with their labor-saving qualifications, are reported to be in such demand that they may be officially declared an essential product. The demand for copper wire and conduit, flashlights and weatherproof and rubber-covered wire is heavy. The shortage in several of these articles is becoming more acute, while with others stocks are in fair shape.

Deliveries in nearly all parts of the country are deferred on long time and are continuing to fall behind. Where motor-truck service can be utilized it is giving great satisfaction. Charges are not much, if any, lower than railroad rates, but the quick dispatch and certain delivery are appreciated by shippers.

Collections are of a healthy quality, and in not a few places they are excellent. A factor of increasing importance in wholesale transactions is the shortening of credit terms. This policy, which is having a wholesome effect. will be gradually extended to retail circles.

NEW YORK

With the continued trouble incident to transportation difficulties is coupled the uneasiness over the growing scarcity of skilled labor. Military duties have called away a vast number of the best equipped men on the executive staffs of jobbers and distributors, as well as on the factory-operating forces of the important manufacturing companies of the industry. Their places are not easily filled for the reason that men of equal caliber are not to be had readily. In fact, the vacancies created will probably remain open during the war activities. The United States Employment Service notes the shortage of skilled workers in the eastern section of the country. The governmental efforts are so far largely confined to increasing the supply of unskilled workers, and preparatory steps have been officially taken toward the standardization of wages.

This is the outstanding situation of the trade, but notwithstanding this fact business in general may be said to be very good. It is estimated that about 90 per cent of current orders are on government account. Locally the demand for electrical staples from this source is very active. Jobbers having stocks to meet the calls promptly are having their hands full, but prices are not being raised as the bids are carefully scrutinized by alert officials. Deliveries are taken charge of by the buyers, and therefore the transactions are very satisfactory. It appears that jobbers are not greatly concerned over their stock for the fall and are not ordering beyond their normal requirements.

Collections are on a firm basis in this territory. The government bills are slow in coming through, and therefore commercial accounts are held down to meet this deficiency. On the same score credits are tightened all along the line.

CABLES.—On account of the advancing price of lead prices will be marked up from 5 to 10 per cent according to size. The new quotations go into effect immediately. Lead has been steady at 7¼ cents a pound for several months, but jumped to 8 cents last week. Cable manufacturers believe the price is fictititous, holding that the market is in the hands of professional manipulators.

HOUSEHOLD APPLIANCES.—Electric washers have had $7.50 added on each machine, owing largely to scarcity of galvanized sheets and difficulty in obtaining motors. The delivery on the latter is running further behind every week and is now reported as back four to five months.

LOCUST PINS.—The movement is very active with stocks in a fair condition. Oak pins are also having a strong sale with very satisfactory stocks to draw upon.

PORCELAIN.—Sockets, receptacles and rosettes are easier and stocks are in a better condition. The advance which has been in the air for a couple of months has not yet materialized. Selling agents of the factories are advising jobbing houses to get their orders in early on this score. The buying, however, is not unusual.

COLLECTIONS AND CREDITS.—Collections are closely followed as so much money is locked up in government orders, which are back in settlement fully six months in not a few instances. Consequently commercial credits are tightened up to thirty days, instead of the sixty and ninety days customary in the last two months.

WIRE.—Weatherproof is available in fair quantities, with the government a heavy buyer, the consumption going into the new cantonments, naval and medical bases and training camps, which are being wired. Prices are steady, depending largely on the pressure for goods. This holds true on every kind of wire. An inquiry last week for a lot of No. 516 double-cotton magnet wire, listed at 39 cents a pound, was answered by a manufacturer this week with a quotation of 45.30 cents a pound, an advance of about 15 cents a pound over list.

ANNUNCIATOR WIRE.—On June 25 annunciator wire base was advanced 3¼ cents a pound and office wire 7¼ cents a pound on account of the increased cost of the cotton yarn used in double-winding and braiding the copper core.

CROSS-ARMS.—An advance of about 3 per cent was made on June 25, when the new price list became effective. Yellow pine stock is coming into the hands of distributors, with shipments now en route. A good stock of Rainier fir from the State of Washington is in warehouse. There is a brisk demand for all this material.

CONDUIT.—The government is taking all sizes of conduit, with some of the regular trade saying it cannot obtain any. On the other hand, reports are to the effect that certain jobbers are carrying big stocks. One concern has stated that it has 500,000 ft., with five cars additional arriving a couple of weeks ago. On ½-in. and ¾-in., which has been listed at $94 per 1000 ft., as much as $135, $145 and $150 is now being realized by some jobbers. A readjustment of prices to absorb the 25 per cent advance in freights effective June 25 is expected to be forthcomng this week.

VACUUM CLEANERS.—Prices were advanced on June 24. One concern making a well-known cleaner added $5 on its line, another $3 and a third manufacturer $1 50 on each machine. Several producers, while not making an increase, stated that one was coming along on account of the higher manufacturing cost. Aluminum is getting scarce, the government absorbing all available stocks of the metal.

RUBBER-COVERED WIRE.—About a 5 per cent advance was made on June 22 on sizes from No. 14 up to No. 0000, owing to the higher cost of cotton and the 25 per cent advance in freights. Tinned wire is up from ⅛ cent to 10 cents a pound, according to size, because of the increased cost of tin. On the heavier wires tinning is being omitted altogether, only the finer wires now going through the process. Tin is also being discontinued in lead cables, and antimony is being substituted for it on telephone cables, a practice followed for some time back by the big telephone companies. Shortage of labor at the wire plants is causing delays in deliveries, some concerns running behind three months on important orders, smaller requirements being shipped out of stock. Quotations are for immediate acceptance, excepting where a great deal of detail is involved in the specifications.

CHICAGO

Advanced prices incident to higher freight rates and the further tightening up of the steel situation are the two things which most intimately concern the electrical trade in the Middle West at this time. Both jobbers and manufacturers are now engaged in figuring new prices for all such heavy material as wire, pole-line hardware, glass insulators and conduit. It is possible that the increase in price on commodities of this class will be slightly more than 25 per cent of the former freight. While the freight advance amounts to only 25 per cent, it will be necessary to make the increased charges slightly more than the freight advance in order to maintain a satisfactory proportion of profit. The "work or fight" order, which has given jobbers difficulty in some quarters, has not yet affected the Chicago district, and some jobbers do not believe that their business will be seriously affected since they are now only serving industries engaged in war work.

Inquiries from railroad sources have increased within the last few weeks, and it is thought highly possible that the former hand-to-mouth buying, which has been the railroad practice, will shortly give way to purchases of more substantial character. Industrial business continues very good. The jobbers' business, as a whole throughout the territory, will usually be found as good as last year, and in some cases it has increased as much as 15 per cent over that period.

CONDUIT.—It is now necessary for a jobber to have a priority order to show that conduit which he purchases from the conduit manufacturer is going directly into industries engaged in war work.

LINE HARDWARE.—It has been announced that this product will go up, but the exact amount is not known.

CONTROL APPARATUS.—Practically all manufacturers of control apparatus in the Central Western territory are quoting sixty-day deliveries, nor are better conditions in sight.

OIL-FILTERING SYSTEMS.—Owing to the large numbers of oil-filtering systems required for the ships now under construction, and for other uses incident to government work, about which very little is being said, factories are practically 120 days behind.

LAMPS.—Incandescent lamps in sizes up to 100 watts are now plentiful in jobbers' stocks. Moreover, jobbers are continuing to load up on this class of goods.

FANS.—The three or four consecutive hot days needed to produce a real fan business have not yet arrived.

BOSTON

Trade continues very active, with war service plants dominating the buying market. Prices hold firm, with little change from a week ago. An advance of $2 in Western Electric sewing machine units was scheduled for July 1. Deliveries are still seriously handicapped by embargoes on the railroads. The demand for appliances continues good, and a vigorous washing-machine campaign in Boston bids fair to yield excellent results. The labor market manifests some unrest, but a strike in the munitions plants at Bridgeport, Conn., has been declared off pending settlement by governmental arbitration, and the strike of electrical workers in the Boston district has so far proved a flat failure.

Stocks are still well maintained, but at the cost of a decided increase in capital investment on the part of jobbers. It is fair to say that the larger houses are ordering material at least six months ahead which formerly could have been had in two months. The government is doing a good deal of direct buying from the jobbers. Outside of war plant work contractors are doing little except rehabilitation jobs.

FANS.—A change in the weather for warmer days at the end of last week gave promise of better retail sales in July than May exhibited. Stocks are large and well advertised.

LAMPS.—Manufacturers are taking advantage of the present recession in domestic demand to stock up in anticipation of the fall business. Sales of lamps for war uses continue in good volume, and the rapid development of the shipbuilding industry is absorbing many units. The opening of new territory in the Cape Cod district of Massachusetts between Buzzard's Bay and Chatham by the Carpenter central-station interests will provide a significant addition to the present lamp market in these times of public utility war service.

MOTORS.—The market is still excellent for larger-sized units, and an excellent demand is noted for very small motors used in driving conveniences of the labor-saving type. Stocks of intermediate sizes are rather spotty.

WASHING MACHINES.—It has been learned that the government is prepared to declare the washing machine an essential product, first, on account of its labor-saving qualifications, leading to the giving of more time to the housewife for Red Cross and other war service, and, second, because of the lessened wear it creates on clothing compared with the rubbing board and "elbow-grease" method. Washer sales are very satisfactory, and the increasing acuteness of the domestic labor problem under munition-plant competition is helping both jobber and retailer.

CREDITS AND COLLECTIONS.—Not much change takes place from week to week in collections. There is a movement among the contractors to secure better recognition from the government, with resulting increase in war work. Improved credit will bring a larger participation by contractors in this important field of service.

ATLANTA

The decision of the War Industry Board, the United States Fuel Administration and the Railroad Administration regarding limiting the manufacture of war supplies in the East is of great interest to this section, as large additional extensions to war plants are contemplated in the South and Southeast. Industrial activities this week include a two-million-dollar sawmill, a flour mill and miscellaneous lumber plants in Louisiana, the development of graphite in Alabama and the construction of military barracks in Florida, Georgia and South Carolina.

Jobbers report that manufacturers are tightening up on the credit reins. This condition will no doubt be reflected to the retailer and ultimate consumer.

What compels wider attention is the steady depletion of raw materials and semi-finished articles, resulting either from the commandeering process or through curtailment of civilian outputs and ordinary requirements.

FLOODLIGHTING.—Indications at present are that the demand for this equipment is slumping. Orders for material are not quite so urgent, and existing plants appear to be anticipating their requirements much better, longer daylight and a temporary lull in construction being instrumental.

FANS.—All sizes are moving freely, and those jobbers who are fortunate enough to have a good stock are handling some substantial transactions. A carload of fans consigned to a Southeastern jobber has been taken over by the government en route.

FARM LIGHTING OUTFITS.—The volume of sales for direct-connected units is holding up very well. Belted units are in good demand accompanied with corresponding better promises of shipment. Manufacturers of this equipment anticipate a healthy business this fall.

FLASHLIGHTS.—While the demand for these is comparatively steady, the volume of sales recorded shows a slight decrease over the earlier spring months. This condition is especially true regarding all types of dry cells. Carload lot deliveries, while spotty, are ample for present demand.

SCHEDULE MATERIAL.—Some large transactions have been handled this week, and there is no evidence that the demand is decreasing. In fact, jobbers contemplate a much greater volume of business as the year progresses. This demand will come mainly from military establishments, shipyards and associated essential lines.

LIGHTNING ARRESTERS.—The peak buying of this class of equipment is not in evidence this year. Orders are well distributed and the demand is comparatively steady. Shipments are good. The promise of shipment on the aluminum-cell type has been reduced from ten to five months.

SEATTLE

The volume of trade the past week was well sustained, although no particularly heavy sales, such as have been lately reported to shipyards and industrial plants, were made. Particularly noticeable, however, were the sales of electrical equipment to the lumber mills which are changing over from steam to electrical operation or are making extensive additions to the present electrical equipment. The plant of the Clear Lake (Wash.) Lumber Company, destroyed by fire, when rebuilt will be the largest in the Northwest completely equipped with electricity. The Snoqualmie Falls Lumber Company of Seattle is adding electrical equipment, including generators and heavy motors. The port of Portland is calling for bids until July 11 for an electric generating set and fittings.

Projected industrial construction has attracted considerable attention. The Astoria Marine Iron Works of Astoria, Ore., will build a marine railway capable of hauling out vessels of 6000 tons net, the expenditure being financed by the Emergency Fleet Corporation. The Interocean Barge & Transportation Company of Seattle plans the immediate construction of a concrete shipbuilding plant to build concrete freighters and barges. The Pacific Coast Steel Company of Portland plans to start immediately the construction of a proposed one-million-dollar steel plant.

Northwest building activity in the past month was exceedingly brisk. This applies particularly to the larger cities in the Puget Sound district and in the Portland territory. Residence building is in the lead, although several large building projects account for huge totals. Officials in charge of the government's housing program at the Puget Sound Navy Yard have selected sites for several hundred residences to be built immediately.

MOTORS.—The demand continues substantial, particularly from shipyards, allied industrial plants and government machine shops at the navy yard. Sales are keeping pace with shipments. Lumber mills are buying more heavily than usual.

POLE-LINE MATERIAL.—The slight movement of recent date has subsided. No new construction is in sight. The supply of poles, cross-arms and pole-line material is ample for present needs,

COLLECTIONS AND AUDITING.—Both jobbers and dealers report excellent collections. Some new extensions of credit were made.

FANS.—The movement is a shade heavier, owing to the humidity of the past ten days.

COPPER WIRE AND CONDUIT.—The demand is increasing, and shortages along these two lines especially are becoming more acute. Government buying was lighter than for weeks past.

WIRING DEVICES, ETC.—Dealers report the sales of housewiring devices, fixtures, lamps, etc., still on the upward trend.

SAN FRANCISCO

Business has picked up considerably during the past week, although stocks are again in a rather disorganized state due to recent heavy demands that have not yet been replaced by Eastern shipments. Business from the country districts is excellent, industrial business is good and business from the shipping plants is fine with a great deal more in sight as vessels under construction approach the stage when they will require their electrical equipment. Only in dealers' counter business is there any condition that is below normal.

There is no change in the status of credit nor in the quality of collections. Both may be said to be in a healthy state. A lock-out by one of the telegraph companies in a coast city and the refusal of certain employees of the Pacific Gas & Electric Company to accept the company's proposed new schedule of wages for its linemen and cable splicers are Pacific Coast contributions to recent labor unrest. Manufacturers of non-essentials have voluntarily agreed to accept a prorated cut in their fuel supply, thus probably anticipating government action. Comparatively little new building has been reported during the past week.

FLASHLIGHTS.—An unusually heavy demand, even beyond recent standards, is reported, probably because of the usual summer vacation demand on top of the already heavy increase in standard demand because of soldiers' orders. Stocks and deliveries are good owing to the presence of one of the largest manufacturers on the Pacific Coast.

WEATHERPROOF WIRE.—Stocks are fair for some sizes and poor for others, with double-braid wire apparently having the best of it. The demand for this class of wire, however, is slow.

RUBBER-COVERED WIRE.—There is still a wonderful demand, with stocks in good shape.

KNIFE SWITCHES.—There is no such demand as there was last year, for two reasons—first, the sale for patent safety knife switches is far in excess of last year's demands, and second, there are no such range campaigns as were in progress at this time last year.

RANGES.—The character of the business for 1918 is very different from that of 1917, it being scattered over a wide area and through many dealers instead of concentrated in a few areas where the central stations themselves were doing the purchasing and making active campaigns. There are no such campaigns this year, although one or two are rumored Rather, there has been an attempt to follow up national advertising, as regards conservation of fuel by electric ranges, with public demonstrations coupled with vigorous follow-ups by sectional dealers. An increase of orders from export sources, particularly from the Hawaiian Islands, is noted, and further results are predicted.

METAL MARKET SITUATION

Efforts to Raise Price of Copper—Advance in Lead Suspicious—Sharp Demand for Aluminum

Reports from several reliable sources convey the information that producers and refiners of copper are again agitating for an increase in price on the expiration of the present limitation, Aug. 15. The official rate of 23.50 cents a pound in car lots and above is said to be satisfactory. The Federal Trade Commission, which recently investigated a number of industries in which profiteering is charged, says very large earnings have been made in the copper industry on the whole. In 1917 twenty-one companies made profits running to 107 per cent on their investments, the average being 24.4 per cent. Another meeting with the War Industries Board will be held in Washington, D. C., Aug. 7, when the matter of a revision of price will be again discussed. It is generally believed that the feeling that there will be an increase is fast disappearing. The metal is in fair supply for commercial orders.

An advance in lead is regarded with strong suspicion, it being held by large consumers that it is fictitious. A sudden increase in price from 7¼ cents a pound, where it has stood for several months, to 8 cents is not considered legitimate. Platinum is in sharp demand for war material, and further restriction of its use for commercial purposes is mentioned. In old metals lead and zinc scrap are advancing in price.

NEW YORK METAL MARKET PRICES

	June 24	July 1
Copper:	£ s d	£ s d
London, standard spot	110 0 0	110 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	26.25	28.25
Lead, trust price	7.82½	8.00
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	Govt. price 15.00	Govt. price 15.00
Spelter, spot	8.57½	8.80 to 8.90
Tin, Chinese*	90	90
Aluminum, 98 to 99 per cent	Govt. price †33.00	Govt. price †33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	21.50 to 22.00	21.50 to 22.00
Brass, heavy	13.50 to 13.75	13.50 to 13.75
Brass, light	10.50 to 11.50	10.50 to 11.50
Lead, heavy	7.00 to 7.25	7.12½ to 7.37½
Zinc, old scrap	6.25 to 6.50	6.50 to 6.75

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*No Straits offering. †In 50-ton lots or more; carload, 33.10 cents per lb.; 1-ton to 14-ton lots, 33.20 cents per lb.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List Per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List to + 15%
Coil to 1000 ft	10% to 57.25

	No. 12 Solid
Less than coil	List to + 15%
Coil to 1000 ft	10% to 66.75

Twin-Conductor

	No. 14 Solid
Less than coil	List to $120.00
Coil to 1000 ft	10% to $100.00

	No. 12 Solid
Less than coil	List to + 15%
Coil to 1000 ft	10% to 126.80

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	List to + 20%
Coil to 1000 ft	List to 20%

	No. 12 Solid
Less than coil	List to + 20%
Coil to 1000 ft	List to 20%

Twin-Conductor

	No. 14 Solid
Less than coil	List to + 20%
Coil to 1000 ft	List to 20%

	No. 12 Solid
Less than coil	List to + 20%
Coil to 1000 ft	List to 20%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+10% to 12%
1/5 to std. pkg	5% to 20%
Std. pkg.	23% to 44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	10% to + 20%
1/5 to std. pkg	List to 20%
Std. pkg.	28% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35 to .36	.35 to .36
50 to barrel	.31 to .32	.32 to .33
Barrel lots	.28 to .289	.29 to .299

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.3190-.3293	.3290-.33
Barrel lots	.2890-.2995	.2990-.30

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, per 100 Ft.
5/16	250	$5.00
⅜	250	7.50
½	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 100 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
⅜-in. s. stp.	List to $82.50	63.75 to 69.75
⅜-in. d. stp.	List to 84.00	69.00 to 75.00
½-in. s. stp.	List to 110.00	85 00 to 93.00
½-in. d. stp.	+List to 112.00	92.00 to 100.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
½-in. single strip	List	$63.75
⅜-in. double strip	78.50-78.75	71.25-85.00
⅜-in. single strip	List	85.00
½-in. double strip	105.00	94.50-95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In	List per Foot
7/32	$0.05½	1	$0.25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2¼	.65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$25.00-$55.00	$24.00-$41.25	$21.50-$33.00
¼-in.—	$30.00- 60.00	27.00- 45.00	23.50- 36.00

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$55.00-$60.00	$25.00-$30.00	$22.50-$26.50
¼-in.—	$60.00-$65.00	$27.00-$32.50	$25.00-$29.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 39

Size, In.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58¼
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in
Less than 2500 lb.	12% to 20%	14% to 20%
2500 to 5000 lb.	15% to 20%	17% to 20%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ in. to ½ in.	¾ to 3 in.
Less than 2500 lb.	6.8% to 8.9%	9.8% to 10.3%
2500-5000 lb.	7.3% to 9.3%	11.8% to 12.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5.00 to $6.00
Discount	25% to 30%

CHICAGO

List price	$5.00 to $6.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10% to 30%
1/5 to std. pkg	20% to 50%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$5.00 to $7.00
1/5 to std. pkg	4.50 to 5.95

Standard packages, 500. List, each $0.07

CHICAGO

	Per to 100 Net
Less than 1/5 to std. pkg	$7.00
1/5 to std. pkg	5.75

Standard packages, 500. List, each $0.07

LAMPS, MAZDA

105 *to* 125 *Volts*

	Std. Pkg.	List, Each
Regular, clear:		
t0 to 40-watt—B	100	$0.30
60-watt—B	100	.35
100-watt—B	24	.70
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round bulbs, 3⅛-in., frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round bulbs, 3¾-in., frosted:		
60-watt—G 30	24	.77
Round bulbs, 4⅜-in., frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	List
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	List
Std. pkg.	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$29.13 to $34.90
Coil to 1000 ft.	26.22 to 28.73

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft)	$29.00 to $30.00
Coil to 1000 ft.	21.50 to 25.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100 .... $24.00

CHICAGO

Net per 100 .... $21 75 to $30.00

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½ 4 S	30.00
103—C.A., 9, 4R, B 1½	25.00
t06—F.A., 7, C.S., 1½, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25% to 33%	20% to 27%
$10.00 to $50.00 list	35% to 42%	25% to 37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	5% to 10%
1/5 to std. pkg.	15% to 20%
Std. pkg.	25% to 30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80 to $38.00
1/5 to std. pkg.	14.80 to 19.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80
1/5 to std. pkg.	14.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.—Solid	Std. Pkg. 4000 Nail-It—N.C.
Less than 1/5 std. pkg.	$11.85 to $20.00	$30.70 to $30.75
1/5 to std. pkg.	11.10 to 15.60	21.20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.—Solid	Std. Pkg. 4000 Nail-It—N.C.
Less than 1/5 std. pkg.	$11.85 to $12.00	$20.75 to $30.75
1/5 to std. pkg.	11.10	24.20 to 40.80

SOCKETS AND RECEPTACLES

	Std.Pkg.	List
⅛-in. cap key and push sockets	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+ 10%
1/5 to std. pkg.	5% to 8%

NET PER 100—CHICAGO

Less than 1/5 std. pkg.	10% to 29.70 cts.
1/5 std. pkg.	20% to 26.40 cts.

SWITCHES, KNIFE

250-*Volt, Front Connections, No Fuse*

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+ 10% to + 5%
$10 to $25 list	List to 15%
$25 to $50 list	10% to 20%
	Low Grade
Less than $10 list	List to 10%
$10 to $25 list	10% to 25%
$15 to $50 list	15% to 28%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 5%
$10 to $25 list	11% to + 10%
$25 to $50 list	14% to + 14%
	Low Grade
Less than $10 list	5% to + 5%
$10 to $25 list	8% to 16%
$25 to $50 list	16% to 24%

SWITCHES, SNAP AND FLUSH

5-*Amp. and* 10-*Amp.*, 125-*Volt Snap Switches*

	Std. Pkg.	List
5-amp. single pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-*Amp.*, 250-*Volt Push-Button Switches*

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Cont'd

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+ 10%
1/5 to std. pkg.	5% to 8%
Std. pkg.	23% to 25%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List to + 20%
1/5 to std. pkg.	List to 20%
Std. pkg.	List to 28%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List, Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	List to 40%	List to 30%
$2.00 to $10.00 list	10% to 50%	5% to 40%
$10.00 to $50.00 list	20% to 64%	10% to 52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25% to 50%	20% to 40%
$2.00 to $10.00 list	25% to 64%	20% to 52%
$10.00 to $50.00 list	25%	20%

TOASTERS, UPRIGHT

NEW YORK

List price	$5.00 to $6.00
Discount	25% to 30%

CHICAGO

List price	$5.00 to $6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0 42¼-$0 50
No. 18, full spools	0.36¼- 0.45

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0 57½-$0 65
No. 18, full spools	0.50½- 0.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14..	$15.00-$18 00	$12 00-$14.00	$9.85-$12.25
12..	21 78- 26.25	19 97- 21.80	25 95- 16.33
10..	33.18- 36.47	27 67- 30 20	21.50- 22 40
8..	38.61- 51.24	35.10- 42.10	30.01- 31.47
6..	55.60- 81.06	50.04- 66.75	47.54- 50.79

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14..	$18.00-$19.00	$13.00-$14.00	$11.50-$12.50
12..	25.33- 27.53	21.78- 25.33	14.97- 22.02
10..	33.02- 35.21	30.03- 30.48	27.66- 28.23
8..	46.09- 49.14	41.98- 42.54	35.10- 39.42
6..	54.14- 67.28	61.76- 72.12	52.78- 60.10

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 *to* 3 *Inc.*

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$33.25 to $37.85
25 to 50 lb.	33.25 to 37.85
50 to 100 lb.	30.40 to 37.10

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$37 00 to $37.43
25 to 50 lb.	36.00 to 36.43
50 to 100 lb.	35.00 to 35.42

NEW APPARATUS & APPLIANCES

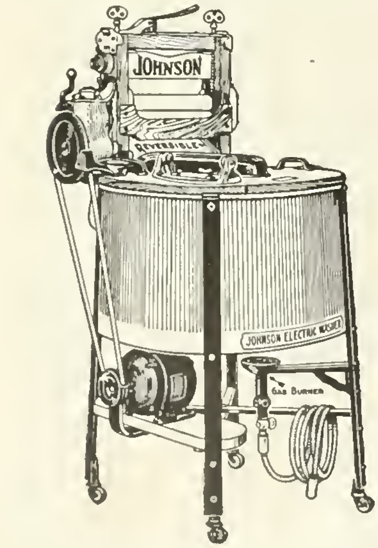
A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Lighting Plants That Serve Other Purposes

Four sizes of farm lighting plants are now being manufactured by the Winters Farm Light Company of Davenport, Iowa. A 4-hp. engine direct-connected to a 1.5-kw., 32-volt generator with a switchboard mounted over the generator is used in all sizes. The storage battery is furnished in 60 amp.-hr., 80 amp.-hr., 100 amp.-hr. and 120 amp.-hr. sizes. The engine is equipped with a pulley from which 2 hp. to 4 hp. may be taken for power purposes, depending upon whether the battery is being charged or all power is being used on the belt. The plants are self-starting, and electric irons or other electrical devices may be used when the generator is not running with the two largest sizes of batteries.

Copper Washing Machine

Clothes can be washed, boiled and wrung out at the same time by means of a washing machine that has been placed upon the market by the Johnson Electric Washer Company, 2074 Market Street, San Francisco. The tub is made of solid copper, which is very durable, and the manufacturers claim that it will never warp, leak or rust. The machine is compact and simple and has only one operating lever. It is run by a 1/6-hp. Westinghouse waterproof motor, and the power transmission gears are completely inclosed. It is pointed out that after the clothes are washed they can be wrung through the wringer to a tub of rinsing water, the washer refilled with clothes to be washed, the wringer reversed, and the clothes sent through the wringer traveling over a special board set on the top of the washing machine and falling into the basket by its side.

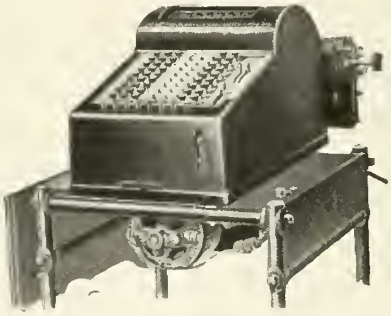


ADJUSTABLE LEGS ALLOW WASHER TO BE USED WITH STATIONARY TUB

The machine has strong adjustable extension legs so that it can be lowered or raised to conform with the height of the adjacent tub. The water outlet drains from the center of the tub and thus allows all water to drain out freely. Six feet (1.8 m.) of hose is furnished to convey water into the washer, and this hose can also be connected to the drain faucet for emptying the tub, thus eliminating the heavy lifting of water.

Easily Operated Electrically Driven Adding Machine

Direct addition and subtraction without preliminary mental calculations or complicated and indirect mechanical operations can be accomplished with the adding machine manufactured by the Teetor Adding Machine Company of Des Moines, Iowa. This makes it possible to list debit and credit items as they occur and to obtain the net result at the completion of the operation. All operating levers are on the right of the machine, which leaves the left hand free to turn pages, etc.

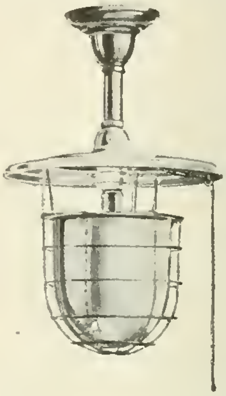


ALL LEVERS AT LEFT OF MACHINE FACILITATE OPERATION

A complete line of electric statement machines, bookkeeping machines and special machines for various classes of business is to be offered to the trade at a later date.

Industrial Lighting Unit

What is, it is claimed, an inexpensive unit to install and maintain in manufacturing plants, garages, warehouses and similar places has been placed upon the market by H. A. Bauer, Inc., Lansdowne, Pa. This unit is known as the "Safe-T-Lite" and is suspended on a flexible attachment concealed in a covering tube. This makes the electric lamp secure against vibration of machinery and jar on the floor above. The wire guard protects the opal-glass diffusing globe, making it practicable to use the lamp in manufacturing plants.



DIFFUSING GLOBE ELIMINATES GLARE

This diffusing globe is desirable also when high-efficiency lamps are used because by its use glare is avoided. The wire guard is securely attached to the white enamel metal reflector by springing the clamps into corresponding openings in the reflector. The chain is connected with the electric lamp socket, giving individual control for each unit within convenient reach if desired.

Regulator for Tungsten Lamps

The accompanying illustration shows an alternating-current regulator manufactured by the Argus Lamp & Appliance Company, 322 Euclid Avenue, Cleveland, Ohio, for maintaining the voltage and current supply to tungsten lamps for motion-picture projection at constant values. It consists of a vari-

ALTERNATING-CURRENT REGULATOR FOR MOTION-PICTURE PROJECTION able reactance placed in the primary circuit to reduce the line voltage and an ammeter in the secondary to facilitate maintaining the current at a constant value.

The direct-current regulator manufactured by the same company is shown on page 1010 of the May 11 issue of the ELECTRICAL WORLD and consists of two units—one to be mounted outside the booth and the other installed in the booth near the operator.

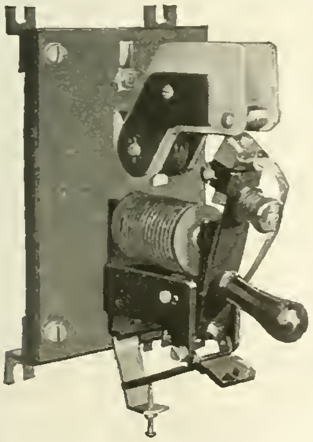
Variable Carbon Resistance Unit

Non-corrosive and infusible variable carbon resistance units have been placed upon the market by the France Manufacturing Company of Cleveland, Ohio. This device makes possible a long low-rate reforming charge to a battery and is especially adaptable for small batteries for motorcycles, mine lanterns, time clocks, etc., which require low ampere charging rates because of their low ampere-hour capacity.

In the laboratory, where there are a great variety of uses for a variable current in experimental and research work, this device is especially adaptable. The manufacturers claim that it cannot melt, disintegrate or break from overload or continuous service. Shipping weight is about 5 lb. (2.3 kg.).

Underload and Overload Circuit Breakers

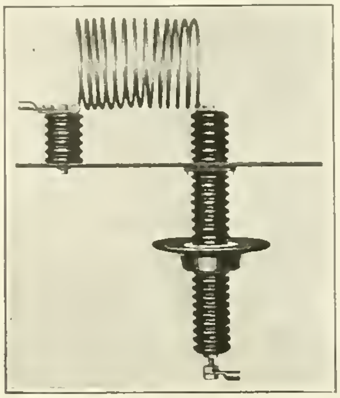
Circuit breakers made in single-pole and in two-pole combinations, one of which provides both overload and low-current protection, while the other provides only low-current protection, are being manufactured for battery-charging service by the Allen Bradley Company, 495 Clinton Street, Milwaukee, Wis. The combined overload and low-current breaker is used on battery-charging switchboards to protect the battery, generator and circuit from excessive current due to short circuits or careless handling to disconnect the battery from the line when the charging current drops down to a very low value, and to protect the battery from discharging into the line when the generator stops or for any other reason the current supply fails. The underload pressure is used only to disconnect the battery and to prevent its discharging into the line. The combined overload and low-voltage breakers will carry, the manufacturer claims, their rated capacity continuously, can be set to trip at 50 per cent above or below rated capacity, and will open at a low current of 20 per cent rated capacity. The low-current pressure will carry its rated capacity continuously and will open at a low-current value of 5 per cent. This apparatus is applicable for charging installations serving electric vehicles and electric industrial trucks and tractors.



COMBINED OVERLOAD AND UNDERLOAD SINGLE-POLE CIRCUIT BREAKER

Combination Entrance Tube and Choke Coil

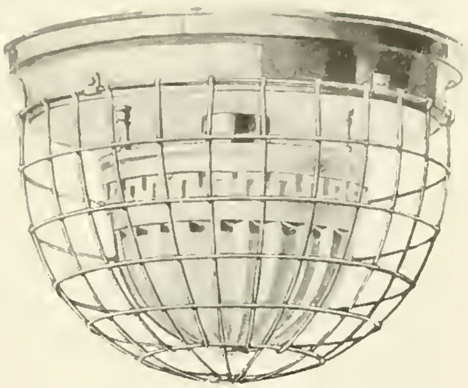
One of the important requirements of high-tension transmission is that a safe method be provided for bringing high-tension conductors into the station. For this purpose the Delta-Star Electric Company of Chicago has developed and placed upon the market a unit-type entrance tube and choke coil as shown in the accompanying illustration. The lightning arrester can be connected to the outside end of the tube or to the upper support of the choke coil, thus securing a convenient and efficient arrangement for reflecting surges to the arrester gaps.



ARRESTER CONNECTED TO END OF TUBE OR TO UPPER SUPPORT OF CHOKE COIL

Interchangeable Protective Guard for Lighting Unit

Liability to breakage of the incandescent lamps and glassware is eliminated by means of a wire protective guard that has been developed for lighting units by the Luminous Unit Company of St. Louis, Mo. This device, known as type BDX, may be installed in combination with any of a number of "Brascolites" of different designs and can also be used to protect any other lighting unit which can be contained within it. Glassware and lamps installed in gymnasiums, squash courts, over swimming pools and in certain shipping rooms and warehouses are subject to excessive breakage unless adequate mechanical protection is provided.



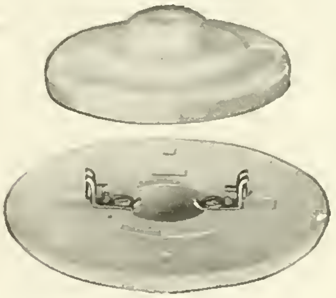
WIRE GUARDS THAT CAN BE USED ON ANY BRASCOLITE LIGHTING FIXTURE

As shown in the accompanying illustration, the wire guard is supported by an angle-iron ring which is drilled with four holes to provide for fastening in the ceiling. The ring is entirely independent mechanically of the lighting unit which is to be protected. Therefore, when strains are imposed on the guard they are not transmitted to the lighting unit. The hemispherical wire cage is held to the ring with four knurled-head set screws. These permit easy removal and replacement of the guard to provide for cleaning and lamp renewal.

The guards are manufactured regularly in four different sizes of the following outside diameters: 13 in., 18 in., 21 in. and 25 in. (33 cm., 45.7 cm., 53 cm. and 63 cm.). They can be used with bowls of outside diameters ranging from 10.25 in. to 23 in. (26 cm. to 57.6 cm.).

Fuseless Rosette for Outlet Boxes

The Bryant Electric Company of Bridgeport, Conn., has recently placed upon the market a line of fuseless rosettes for 3¼-in. (8.3-cm.) and 4-in. (10.1-cm.) outlet boxes which have complied with the National Electrical Code standard. These rosettes are made in two types, with and without terminals, the latter for use when the line wires lead directly to the lamp socket. The design of these rosettes is very symmetrical and attractive.



FUSELESS ROSETTES WHICH ARE CODE STANDARD

Trade Notes

THE MOYERS-BENNETT COMPANY is the successor to the Moyers-Francy Company, electrical engineers of Wheeling, W. Va.

McMEEN & MILLER, consulting engineers of Chicago, have dissolved partnership. The business will be continued by K. B. Miller, the junior member.

R. J. KIRCHNER, dealer in used equipment, Detroit, Mich., has taken in a partner and the concern is now known as the Kirchner-Purcell Company at the same address.

THE EDISON STORAGE BATTERY COMPANY of Orange, N. J., has established a new sales office in Kansas City, Mo., appointing Benjamin F. Eyer resident manager.

THE FERRANTI ELECTRICAL COMPANY of Canada, Ltd., announces a change in address of the Montreal office from 704 Unity Building to 101 Southam Building, 128 Bleury Street.

THE BEEDLE EQUIPMENT COMPANY of Cincinnati has been appointed district representative for the Electrical Engineers' Equipment Company of Chicago in Cincinnati and surrounding territory.

R. P. DRYER, assistant sales manager of the Canadian Allis-Chalmers Company, Ltd., Toronto, Can., has resigned to take a position in the Pittsburgh (Pa.) office of the Allis-Chalmers Manufacturing Company of Milwaukee.

W. A. THOMPSON has resigned as general agent for the Federal Sign System (Electric) at San Francisco and Oakland, Cal., to become Northwestern district manager for the Novelty Electric Sign Company, with headquarters at Boise, Idaho.

J. VAN BUSKIRK, formerly sales manager of the Minerallac Electric Company of Chicago, has taken the position of Chicago district manager for the Moloney Electric Company of St. Louis. Mr. Van Buskirk is well known in the central-station field.

THE ELECTRICAL SUPPLY & REPAIR COMPANY of Hazard, Ky., was recently incorporated. The company will carry a stock of electrical apparatus and house-wiring supplies. It is erecting a modern machine shop equipped to take care of repairs.

H. J. PRITCHARD, treasurer and director of the National Conduit and Cable Company, Inc., New York City, has been elected first vice-president of the company and placed in charge of operations. He is now virtually acting president, succeeding the late George F. Jackson.

THE PITTSBURGH CRANE & EQUIPMENT COMPANY of Pittsburgh, Pa., has placed the selling agency of its electric overhead traveling cranes, wall-type jib and hand-power cranes for the metropolitan district with John H. Barker, 95 Liberty Street, New York City.

T. D. SCARFF, for several years Cleveland city salesman of the Buckeye division of the National Lamp Works, was recently appointed manager of the Pittsburgh office, succeeding to the position of H. T. Gates, who is now distributor for Delco lighting plants in the Pittsburgh territory.

ERNST W. ROTH, formerly sergeant in the ordnance department in the National Army at Camp Dodge and prior to that time Minneapolis manager for the Lindsley Brothers Company, has been transferred to the Bureau of Standards at Washington, D. C., to engage in research in the chemical department.

THE DAVIS SLATE & MANUFACTURING COMPANY of Chicago and Muskegon, Mich., is doubling the capacity of its Muskegon factory. An additional factory has been erected and new machinery installed. The Davis company recently placed on the market a fine grade of electrical marble for switchboard panels.

THE FRED THOMSON COMPANY, Ltd., of Montreal, Can., manufacturing and contracting electrical engineers, has removed from 326-330 West Craig Street, to its new building at 7-13 St. Genevieve Street. The new building, which is of fireproof mill construction and consists of three floors and a basement, has a total floor space of over 30,000 sq. ft.

JOHN McC. PRICE, who has recently taken a position with the Mechanical Appliance Company of Milwaukee, Wis., has been the Pittsburgh sales agent for the company for a number of years, handling its line in conjunction with that of the Century Electric Company, with which company he was associated for over ten years. Mr. Price attended Pennsylvania State College and Westminster College, after which he engaged in the electrical contracting business.

WILLIAM A. STACEY, whose appointment as Western manager is announced by the Bryant Electric Company, has been in the Chicago electrical jobbing and supply field since 1898. His connection with the Bryant company dates from September, 1908, first as salesman, then as Pacific Coast manager, later as field representative in the Central West, and recently as special representative from the factory at Bridgeport. Mr. Stacey will make his headquarters at the Chicago office of the Bryant company, 323 West Jackson Boulevard.

DR. CHARLES W. BURROWS, formerly of the Bureau of Standards, Washington, D. C., has established a laboratory at Grasmere, borough of Richmond, New York City, for the experimental study of problems relating to the magnetic characteristics of material and apparatus. The initial laboratory equipment provides for all lines of magnetic research and has modest facilities for such chemical and metallurgical investigations as may be required. While the work will be confined to investigations along magnetic lines, it will cover several phases. Attention will be paid to the design, procurement and installation of magnetic testing apparatus suited to the particular requirements of the individual manufacturer. This will include the instruction of the testing operator as well as the maintenance of a continuous inspection and advisory service so as to reduce to a minimum the difficulties inherent in commercial testing and research and to aid in the solution of new problems as they arise. The magnetic analysis of steel and steel products with a view to the determination of homogeneity and uniformity of output as determined by mechanical and thermal treatment will form one of the important activities. A third phase of the work includes the investigation of apparatus and materials. Finally the design and development of new apparatus to meet specified requirements will be undertaken. This phase of the work will include the development of apparatus which has not previously received careful scientific consideration.

Trade Publications

MOTOR-GENERATOR SETS. — Generator sets for battery charging are described in a circular that is being distributed by Hobart Brothers, Troy, Ohio.

FLEXIBLE CONDUCTORS. — The Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York, has issued a circular describing the Sprague type SS flexible-steel conductors.

DRILL PRESS.—Bench-type and floor-type motor-driven multiple drill and tapper devices are described in a bulletin distributed by the Landau Machine & Drill Press Company, Inc., 19 West Forty-fourth Street, New York City.

FUSE TESTER.—The Electric Service Auto Company, 391 Oak Street, Portland, Ore., is distributing a circular describing and illustrating its universal fuse and circuit tester for testing circuits from 110 volts to 600 volts potential.

CONDUIT FITTINGS.—M. B. Austin & Company of Chicago describe and illustrate their line of conduit fittings in a circular just issued. Conduit union, squeeze box connectors, conduit adapter, floor boxes, etc., are described in the circular.

INDUSTRIAL LIGHTING. — The National X-Ray Reflector Company of Chicago has issued a booklet, entitled "X-Ray Industrial Lighting," in which it gives illustrations of successful factory lighting and figures on the increased production, accident prevention and similar topics.

MEASURING INSTRUMENTS.—The Reliance Instrument Company, 1135 Van Buren Street, Chicago, has issued a ninety-two-page catalog on its alternating-current and direct-current instruments for power-station, automobile, electro-therapeutic, high-frequency and electroplating uses. It is designated as catalog No. 25.

PUMPING SYSTEMS.—F. E. Myers & Brothers, Ashland, Ohio, have issued a booklet describing their self-oiling "bulldozer" power and electric house pumps for open or pressure tank systems. These pumps are modern in every respect, according to the bulletin, and are very useful for the home farm, factory or wherever water conveniences are desired. A price list and illustrations are included.

DISPLAY CARDS.—An attractive display card for promoting the sale of bell-ringing transformers is being issued by the Dongan Electric Manufacturing Company, 741 Franklin Street, Detroit, Mich. The sign is made of aluminum, lithographed in black and red. It contains a diagram showing a midget bell-ringing transformer installed for operation, illustrating the simplicity with which a transformer can be connected to the circuit.

New Incorporations

THE MARVEL (ARK.) LIGHT & ICE COMPANY has been incorporated with a capital stock of $20,000 by H. B. Mayo, L. S. Cooke, Norman McKinley and others.

THE WAYNE PUBLIC SERVICE CORPORATION of Collinwood, Tenn., has been chartered with a capital stock of $5,000 by Thomas S. Bailie, John H. DeWitt, E. H. Steinman and others.

THE W. J. PALMER MANUFACTURING COMPANY of Roaring River, N. C., has been incorporated by S. R. James and others. The company is capitalized at $125,000 and proposes to develop electric power.

THE BRIGGS ELECTRICAL COMPANY of Charlottesville, Va., has been incorporated with a capital stock of $50,000 to do an electrical contracting business. Samuel Briggs is president and D. C. Solbohm secretary.

THE OKLAHOMA BATTERY SERVICE of Muskogee, Okla., has been incorporated by J. H. Schmidt, W. H. Stuere and H. K Herbst. The company is capitalized at $25,000 and proposes to establish a battery service.

THE SUBURBAN LIGHTING CORPORATION of Norfolk, Va., has been incorporated with a capital stock of $10,000 to deal in lighting fixtures. R. T. Trant is president and E. H. Danforth is secretary and treasurer.

THE AMERICAN ELECTRIC TOOL COMPANY of Petersburg, Va., has been organized with a capital stock of $100,000. The company has acquired a plant which it proposes to enlarge to manufacture electric calking tools and appliances.

THE WILBUR B. DRIVER COMPANY of Belleville, N. J., has been chartered by Irving Eisenberg, Evelyn T. Adam and Arthur T. Vanderbilt of Newark. The company is capitalized at $500,000 and proposes to manufacture and deal in wire rope, cables, etc.

THE ELECTRICAL SALES COMPANY of Sioux City, Iowa, has been incorporated for the purpose of dealing in electrical devices and promoting electrical enterprises. The officers are: I. J. Kelman, president; C. B. Cryslee, vice-president and secretary, and H. E. Trowbridge, treasurer.

THE L. S. BRACH SUPPLY COMPANY, 127 Sussex Avenue, Newark, N. J., has been incorporated with a capital stock of $200,000 to manufacture and sell electrical devices, railway signals and insulating specialties. The incorporators are Leon S. Brach, Alexander G. Brach and R. Tuchman.

THE ELECTRIC WELDING & SHIPBUILDING COMPANY OF CANADA, Montreal, Que., has been incorporated with a capital stock of $50,000 to manufacture machinery, engines, etc., and to build boats. The incorporators are: John J. Meagher, Henry N. Chauvin, James E. Coulin and others.

THE MAINE WATER POWER COMPANY of Portland, Me., has been incorporated by Frederick R. Lewis, Arthur I. Douglass and W. Mayo Payson of Portland. The company is capitalized at $500,000 and proposes to develop and operate water powers and to do a general textile, lumber and manufacturing business.

THE NORWALK LIGHT & POWER COMPANY of Des Moines, Iowa, has been incorporated with a capital stock of $25 000 to furnish electricity for lamps and motors. The principal office of the company will be in Des Moines. The officers are: Fred Keithley, president; C. A. Willett, vice-president; J. H. De Mar, secretary, and W. R. Thomas, treasurer.

THE CANADIAN DRIVER-HARRIS COMPANY of Walkerville, Ont., has been incorporated by Leon O. Hart, LeRoy Edwards of Jersey City, N. J.; John H. Coburn of Walkerville and others. The company is capitalized at $150,000 and proposes to manufacture wire, machinery, etc. The company is contemplating the construction of a plant in Windsor, Ont., for the manufacture of alloys.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way.

New England States

AUGUSTA, ME.—The Central Maine Power Company has petitioned the Public Utilities Commission for permission to issue bonds to an amount not to exceed $200,000.

FALL RIVER, MASS.—Several changes and installation of new lamps have been approved by the Aldermanic committee on street lamps. The Fall River Electric Light Company has the contract for street lighting.

GARDNER, MASS. — Work has been started by the Gardner Electric Light Company on the installation of two banks of transformers at its station on Lake Street. In connection with the installation of the new transformers a new power line will be laid connecting the power station with the second main trunk line of the New England Power Company at the transmission tower near the Wilder farm.

WORCESTER, MASS.—Plans are being considered by the New England Power Company to link up the large power plants in the state to provide for emergency service. The proposed project includes the erection of a transmission line from Dedham to Sudbury, which will enable the Edison Electric Illuminating Company of Boston to interchange with the New England company, and another from Millbury to the Connecticut line at Webster, enabling the New England company and the Narragansett company to make connections.

NEW LONDON, CONN.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 15 (specification 3089), for construction of emergency hospital buildings at New London, Conn., including a laundry building, one 1-story ward, one 2-story ward, garage and a power house, including lighting, plumbing and sewerage system. For further information address the chief of bureau.

Middle Atlantic States

BROOKLYN, N. Y.—The Nitrates Agencies Company of New York City has leased the five-story building, power house and sheds on Metropolitan Avenue, near Flushing Avenue.

BROOKLYN, N. Y.—Plans are being prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the installation of an electric-lighting system at base No. 6, Brooklyn Navy Yard. Specification 2917.

NEW YORK, N. Y.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is preparing specifications for the installation of additional freight elevators at the general storehouse. Specification 3019.

NEW YORK, N. Y.—Plans are being prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the installation of an electric-lighting power system at shipbuilding slip No 2 (specification 3136), to cost about $20,000.

NEW YORK, N. Y.—Plans are being prepared by J. Petit, architect, 103 Park Avenue, for the construction of a garage and service station, 200 ft. by 350 ft., five stories, on Second Avenue, between Forty-seventh and Forty-eighth Streets, to cost about $1,000,000.

NIAGARA FALLS, N. Y.—Contract has been awarded by the Hydraulic Power Company for substructure, 100 ft. by 300 ft., one story, for the proposed hydroelectric plant to be erected on Canal Basin, to the Dock Contracting Company, 95 River Street, Hoboken, N. J. The cost of the entire plant is estimated at $1,000,000.

ONEONTA, N. Y.—Bids will be received by Dr. Thomas E. Finegan, Deputy Commissioner of Education, Education Building, Albany, N. Y., until July 17 for three new boilers for the Oneonta State Normal School. Drawings and specifications and blank forms may be obtained at the Department of Architecture, Capitol, Albany, and may be consulted at the Oneonta State Normal School and at the New York office of the Department of Architecture, room 1224, Woolworth Building. Lewis F. Pilcher is State Architect.

POUGHKEEPSIE, N. Y.—The boiler plant at the works of the Price Fire & Water Proofing Company was recently destroyed by fire.

CAMDEN, N. J.—The Board of Public Utility Commissioners has given its approval of the application of the Eastern Telegraph & Telephone Company for permission to lease duct space in Camden for the installation and maintenance of electric conduits, cables, etc.

GLOUCESTER, N. J.—Contract has been awarded by Pusey & Jones of Gloucester for the erection of a new power plant for the Lewis & Roth Company, Broad and Chestnut Streets, Philadelphia. The proposed plant will cost about $596,780 and will supply power to operate its two shipbuilding plants.

HARRISON, N. J.—Contract has been awarded by the General Electric Company to Edward M. Waldron, Inc., 665 Broad Street, Newark, for the construction of a large boiler plant on Cross Street. The cost of the building is estimated at about $37,600.

JERSEY CITY, N. J.—The Board of Freeholders of Hudson County has engaged William W. Law of New York as consulting engineer to supervise the construction of the proposed central power plant to supply electricity for lighting the county roads and lighting and heating the county institutions.

ALTOONA, PA.—The Penn Central Power & Transmission Company has filed notice with the Public Service Commission of an issue of $31,000 in bonds, the proceeds to be used for extensions, improvements, etc.

BRADFORD, PA.—Plans have been filed by the Corless Carbon Company for the erection of a new electric oven plant, 45 ft. by 75 ft., one story, to cost about $10,000. E. N Unruh of Bradford is contractor.

CHESTER, PA.—The contract for the construction of a second track on the Chester Pike from Darby to Eddystone (Southern Pennsylvania Traction Company), awarded to MacArthur Brothers, New York, N. Y., by the Emergency Fleet Corporation, includes the construction of a new power house.

McKEESPORT, PA.—Contract has been awarded by the McKeesport Tin Plate Company, Frick Building, Pittsburgh, for the construction of a new boiler plant, 80 ft. by 200 ft., one story high, at its local works. S. Diescher & Sons, Farmers' Bank Building, Pittsburgh, are engineers.

MIDLAND, PA.—The Crucible Steel Company, Oliver Building, Pittsburgh, is contemplating additions to its local plant, to cost about $1,000,000.

PHILADELPHIA, PA.—Plans have been completed by the United States government for the erection of a new transformer station at the aircraft plant on League Island.

PHILADELPHIA, PA.—Notice has been filed with the Public Service Commission by the Penn Central Light & Power Company of an issue in bonds to the amount of $576,000, the proceeds to be used for extensions, improvements, etc.

PHILADELPHIA, PA.—Contract has been awarded by the R. H. Fonderer Company to the George Kessler Construction Company, Drexel Building, for improvements and alterations in its boiler plant at Wheat Sheaf Lane and Coral Street.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D C., until July 15 for installing coal and ash-handling equipment for boiler plant at the aircraft factory at Philadelphia, to cost about $40,000.

PHILADELPHIA, PA.—Plans have been filed and contract awarded by the Ludwig-Fritz Commercial Products Company for the construction of a power plant, 30 ft. by 60 ft., at its plant at State Road and Robbins Street. Anton Ahlers, 3425 Howell Street, Philadelphia, is contractor.

PITTSBURGH, PA — The Central District Telephone Company, 416 Seventh Avenue, has awarded contract to Toupet, Beil & Conley, Oliver Building, for alterations and improvements in its telephone exchange building on Butler Street.

PITTSBURGH, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 12 for changes in the conduit and lighting system in the post office and court house at Pittsburgh. Specifications and drawings may be obtained at the above office or at the office of the custodian of building at Pittsburgh.

READING, PA.—Notice has been filed with the Public Service Commission by the Metropolitan Electric Company of an issue of $61,500 of bonds, the proceeds to be used for extensions and improvements.

WILMINGTON, DEL.—Miller Brothers, it is reported, are contemplating the installation of an electric elevator, electric lighting system and other improvements in the building at Tenth and Wilson Streets, which they have recently acquired.

BEL AIR, MD.—Plans have been approved by the Public Service Commission for the construction of an electric light, heating and power plant in the Fourth District in Hartford County. Power will be furnished by the dam to be erected on Deer Creek near Stansbury Mill.

CUMBERLAND, MD.—The War Department, Washington, is planning to erect a plant to manufacture cellulose for war purposes, to cost about $10,000,000. The project will include factory buildings, machinery, industrial city, etc., to be located on the Potomac River, about 3 miles from Cumberland.

CHARLESTON, W. VA.—The Leroy Swinburn Company, 606 Virginia Street, would like to receive prices on equipment for electric drive for a feed mill.

CLENDENIN, W. VA.—The Elk Gas Coal Company is considering the purchase of an electrically operated exhaust, fan, pump and hoisting machinery.

HAMPTON ROADS, VA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is preparing plans for the erection of an electric school at Hampton Roads (specification No. 3064), to cost about $75,000.

HOPEWELL, VA.—The capital stock of the Prince George Electric Light & Power Company has been increased from $100,000 to $150,000.

LYNCHBURG, VA.—Contract has been awarded by the Lynchburg Cotton Mill Company for the erection of additions, 115 ft. by 102 ft. and 50 ft. by 40 ft., to its plant, to cost about $60,000, to Lockwood, Greene & Company, Boston, Mass. A steam power plant, to cost about $30,000, will be installed. The equipment will include 10,400 spindles, 600 looms, equipped for electric motor drive.

WYTHEVILLE, VA.—R. P. Johnson of Wytheville, it is reported, is in the market for the purchase of a 250-kw. electric generating unit, with boilers, switchboard, etc., and also a 150-hp. engine directly connected to a 150-kw. generator, second-hand.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., has awarded contract to the Sumner-Sollitt Company, Pullman Building, Chicago, Ill., for construction of mine laboratory at navy yard, at $73,000.

WASHINGTON, D. C.—Irwin & Leighton, 126 North Twelfth Street, Philadelphia, Pa., general contractors to erect the annex to the United States Treasury Building, have awarded contract for electrical work to the Carroll Electric Company of Washington, and for elevators to the Otis Elevator Company of New York, N. Y. The cost of the building is placed at $1,250,000.

North Central States

BATTLE CREEK, MICH. — Plans are being prepared by the MacDonald Engineering Company, 53 West Jackson Boulevard, Chicago, architects, for the construction of a grain elevator for the Postum Cereal Company, to cost about $300,000.

DETROIT, MICH.—Steps have been taken by the city of Detroit to condemn river front property at the foot of Randolph Street for expansion of the municipal electric-light plant. Frank R. Mistersky is superintendent of the lighting plant.

HOWARD CITY, MICH.—The Western Hydro Electric Power Company, recently organized, has taken over the Universal Power Company. William F. Turner is president. James E. Tobin is secretary and Albert Masters is treasurer of the new company.

KALKASKA, MICH.—The Elk Rapids Electric Company has purchased the plant and holdings of the Kalkaska Light & Power Company, which serves Alden, and Rapid City and the resorts along Torch Lake. The system includes 19 miles of high-tension lines and franchises for three villages and several townships and the pumping service of Kalkaska.

PORTLAND, MICH.—Bonds have been authorized by the voters to provide funds for improvements to the dam on Grand River which furnishes power to operate the municipal electric-light plant.

AMHERST, OHIO.—Contract has been awarded by the United States Automatic Company of Amherst to the Austin Company of Cleveland for the construction of a new factory building, 120 ft. by 160 ft., with an ell, 40 ft by 120 ft., to be used for a power house

LOUISVILLE, KY.—The National Process Company, Speed Building, is contemplating the purchase of vacuum pumps, condensers, evaporating machinery, etc.

LOUISVILLE, KY.—Contracts, it is reported, will soon be awarded by the Board of Water Commissioners for installation of a new pumping engine of from 30,000,000 to 40,000,000 gal. daily capacity, at the Crescent Hill pumping station. D. R. Syman is city engineer.

PRINCETON, KY.—The Illinois Central Railroad Company contemplates the installation of automatic block signals between Princeton and Ilsley, a distance of 18 miles. The cost is estimated at about $51,000. A. S. Baldwin of Chicago, Ill., is chief engineer.

EATON, IND.—The Council is considering the purchase of additional equipment for the municipal electric-lighting plant.

CARLINVILLE, ILL. — The Standard Oil Company has begun work on the construction of a large power plant at mines Nos. 2 and 3, northeast of the city. The plant will be located on the banks of Macoupin Creek.

CHICAGO, ILL.—Plans are being prepared by the Consumers Packing Company for the erection of a large brick factory, consisting of four units and power house at Forty-sixth and Loomis Streets, to cost about $450,000. The Packers' Architecture & Engineering Company is engineer.

FAIRMOUNT, ILL.—The Homer Electric Light Company is erecting a high-tension transmission line from Homer to Fairmount, a distance of 7 miles, to furnish electrical service in Fairmount. It is expected to complete the line about Aug. 1.

MOUNT CARROLL, ILL.—A company has been organized to construct an electric interurban railway between Mount Carroll and Freeport. The road may possibly be extended from here to Rock Island.

EAU CLAIRE, WIS.—The United States Switch Company has acquired a tract adjoining its plant on which it proposes to erect an electric steel foundry, 100 ft. by 100 ft., and a new machine shop, 100 ft. by 200 ft., contingent upon the award of contracts by the Railroad Administration. The company manufactures automatic switches and signals. J. W. Hubbard is president and general manager.

JANESVILLE, WIS.—The General Motors Corporation is reported to have purchased the plant of the Janesville Machine Company and will enlarge the plant for the purpose of turning out farm implements, including tractors.

MILWAUKEE, WIS.—The Hercules Steel Casting Company, 500 Free Press Building, Milwaukee, recently organized, has acquired the plant of the Crown Metal Company, 871-889 Robinson Avenue. The present buildings will be removed and a steel and concrete foundry, 90 ft. by 350 ft., will be erected, to be equipped with a 5-ton electric furnace, for which contracts have already been placed. Joseph Evens is president.

STEVENS POINT, WIS.—The Automatic Cradle Company is contemplating the construction of a new steam generating plant to utilize wood waste and refuse of the woodworking plant erected a year ago. The power house will be 43 ft. by 63 ft., equipped with one 250-kw. generating unit and a 150-hp. boiler. The cost is estimated at about $150,000. J. J. Bukolt is president and general manager.

SUPERIOR, WIS.—The Great Northern Power Company has been granted a right of way for the erection of a 22,000-volt transmission line.

FOLEY, MINN.—Plans are being prepared for the installation of a water-works system to include a deep-well, 60,000-gal. steel tank pump, driven by a motor.

MAHNOMEN, MINN.—Plans are being considered by H. S. Richer, owner of the local electric-light plant, for enlarging the plant next year.

MUSCATINE, IOWA.—Permission has been granted to the Muscatine Lighting Company to erect an electric transmission line to supply energy to the Farmers' Electric Light Company.

TRAER, IOWA.—Preparations are being made for the erection of a new high-tension transmission line from Traer to Depart.

KANSAS CITY, MO.—H. L. Tomlin, Sharp Building, is reported to be considering the equipment of an electrical service building.

KANSAS CITY, MO.—Plans are being considered by the Joplin & Pittsburg Railroad Company, First National Bank Building, Kansas City, for the construction of an electric railway at Pittsburg, Columbus and Miami, Okla., to cost about $400,000. The proposed project will include power plants, car barns, etc., and also the erection of 45 miles of transmission lines (wooden poles), trackage, etc. E. E. Maxwell of Pittsburg, Kan., is chief engineer.

ST. JOSEPH, MO.—Work has begun on the construction of a new substation by the St. Joseph Railway, Light, Heat & Power Company to be erected on Felix Street, between Second and Main Streets, to cost about $4,000. J. H. Van Brunt is general manager.

HURON, S. D.—Bids will be received by the Packers' Architecture & Engineering Company, Manhattan Building, Chicago, Ill., until July 15 for construction of a packing plant, 90 ft. by 235 ft., and boiler house, 65 ft. by 90 ft., for the Farmers' Co-operative Packing Company, to cost about $500,000.

BEATRICE, NEB.—A petition has been presented to the City Council asking that an election be called to submit the proposal to issue $100,000 in bonds for improvements to the municipal electric light and power plant to the voters.

HOMER, NEB.—An election will soon be called to submit the proposal to issue $7,500 in lighting bonds and $3,400 in bonds for waterworks extensions.

NORFOLK, NEB.—Bids will be received by the Board of Commissioners of State Institutions, care of Leo Matthews, secretary, Lincoln, until July 15 for construction of power house, equipped with three units, at the State Hospital for Insane at Norfolk, to cost about $40,000. J. C. Stitt is architect.

NORFOLK, NEB.—Bids will be received by the Board of Commissioners of State Institutions, Lincoln, until July 15 for construction of a ward building, 50 ft. by 100 ft., three stories, including steam heating, electric wiring, plumbing, etc. The cost of the building is estimated at $70,000. J. C. Stitt is architect.

SIDNEY, NEB.—The Union Pacific Railway Company has awarded general contract for the construction of a coaling station and cinder pit at Sidney to J. E. Nelson & Son of Chicago, Ill. Steam heating and electric wiring, etc., will be done by the railway company.

ELLIS, KAN.—Bonds to the amount of $30,000 have been voted for improvements to the municipal electric-lighting plant. Black & Veatch, Interstate Building, Kansas City, Mo., are engineers.

GARNETT, KAN.—Bids will soon be asked for equipment for electric-light plant and water-works system, for which $65,000 in bonds have been voted. Black & Veatch, Interstate Building, Kansas City, Mo., are engineers.

JUNCTION CITY, KAN. — The Union Pacific Railway Company contemplates the construction of machine shops, roundhouse and power house, etc., to cost about $1,000,000. R. L. Huntley, Fifteenth and Dodge Streets, Omaha, Neb., is chief engineer.

SALINA, KAN.—The capital stock of the Salina Light, Power & Gas Company has been increased from $500,000 to $750,000.

Southern States

GREENSBORO, GA.—Plans are being considered for improvements to the light and water systems in Greensboro.

DAYTONA, FLA.—The Daytona Crate Company, recently organized, is planning to build a plant for manufacturing crates, which will include two factory buildings, 130 ft. by 60 ft., and a power plant. T. F. Williams is president.

MOORE HAVEN, FLA.—Contract has been awarded by the Florida Ice & Power Company of Lake Wales for the installation of an ice plant and cold-storage room to the Henry Vogt Machine Company of Louisville, Ky.

COLLINWOOD, TENN.—The Wayne Public Service Corporation, recently incorporated, contemplates the construction of an electric-light plant. The company is capitalized at $5,000. John DeWitt and others are interested in the company.

SHEFFIELD, ALA.—The Southern Bell Telephone Company contemplates the erection of a telephone exchange building on Nashville Avenue, to cost about $60,000.

GRENADA, MISS.—The installation of a telephone circuit in the Grenada district of the Mississippi Division, between division and general offices and principal station, to cost about $30,000, is under consideration by the Illinois Central Railroad Company. A. S. Baldwin of Chicago, Ill., is chief engineer.

DE WITT, ARK.—The Arkansas Light & Power Company of Arkadelphia, it is reported, contemplates the installation of an electric-lighting system in De Witt.

LITTLE ROCK, ARK.—Justin Matthews, Urquhart Building, Little Rock, is asking for bids for electrically driven pumps for District No. 1, North Little Rock.

ROGERS, ARK.—The Link Pat Mining Company of Joplin, Mo., is contemplating the construction of a concentrating plant and stamp mill in Rogers, to cost about $100,000. P. C. Quinn, 530 Main Street, Joplin, Mo., is superintendent.

STUTTGART, ARK.—The Arkansas Public Service Corporation of Pine Bluff contemplates the erection of a transmission system from Pine Bluff to Stuttgart.

NEW ORLEANS, LA.—The Benevolent and Protective Order of Elks is planning to erect a two-story annex and install a refrigerating plant and cooling system for main building and annex, and also a laundry.

MIAMI, OKLA.—The contract for electrical work on the hospital building for the State Baptist Hospital Association has been awarded to the M. O. K. Electric Company, Kansas City, Mo. The cost of the building is estimated at $100,000.

POTEAU, OKLA.—The Poteau Glass Company, recently organized, is planning to build a plant, to cost about $100,000. The plans provide for the installation of an electric power plant.

BLOCKER, TEX.—Plans are being considered by the Waterman Lumber Company to rebuild its sawmill, recently burned down. A double-band resaw and gang, dimension plant and electrical planing mill will be installed.

MERCEDES, TEX.—The construction of a large precooling and ice plant is under consideration by Wetegrove & Company of Mercedes. Considerable machinery, including a 100-hp. engine, will be required.

Pacific and Mountain States

SEATTLE, WASH.—The City Council has engaged M. J. O'Shaughnessy, engineer of San Francisco City and County, to make a survey of available hydroelectric power and the present needs of the city of Seattle. He will also inspect the Skagit River power site and the city's Cedar River dam.

BISHOP, CAL.—Fred L. Somers of Pomona has been awarded a contract to erect an electric transmission line, 55 miles long, and a telephone line 11 miles long, in Inyo County, for the Nevada-California Power Company, at $70,000. Both lines will be of wooden pole construction.

GOLDEN, COL.—The Jefferson County Power & Light Company has completed the erection of 5 miles of 6600-volt transmission line from the top of Lookout Mountain to Genesee Park, part of the Denver Mountain Parks systems. This line will furnish service to the pavilion erected in Genesee Park by the city and county of Denver for lighting and cooking purposes, and will also furnish service for the illumination of the free camping grounds in Genesee Park. The company has also erected a 11,000-volt line (5 miles) to furnish electricity to the Consumers' United Coal Mines Company, located about 6 miles from Golden. E. A. Phinney is president.

LOVELAND, COL.—Bonds to the amount of $79,000 have been voted for the installation of an electric-light plant.

PUEBLO, COL.—Contract has been placed by the South Side Water Works of Pueblo for an additional pump of 7,500,000 gal. capacity every 24 hours, which will be operated by a 350-hp. motor to be served by the Arkansas Valley Railway, Light & Power Company. This is the second unit installed within the past few months by the Pueblo Water Works.

LAS VEGAS, N. M.—Extensive improvements are contemplated to plant of the Las Vegas Light & Power Company during the coming year, involving an expenditure of from $50,000 to $100,000.

Canada

VANCOUVER, B. C.—The Department of Mines, Dominion government, Ottawa, is contemplating the erection of an ore testing plant in Vancouver, to cost about $100,000.

WINNIPEG, MAN.—A report submitted by City Electrician Cambridge recommends preparing plans for placing all wires in the city underground.

KENTVILLE, N. S.—Preparations are being made for the construction of a municipal electric-light plant in Kentville, to cost about $50,000. Booker & McKeohnee, Davidson Building, Halifax, N. S., are engineers.

OTTAWA, ONT.—The City Council is considering the question of acquiring the property of the Ottawa Light, Heat & Power Company and the Ottawa Gas Company, to be owned and operated by the municipality. A committee has been appointed to look into the matter and report to the Council.

PETERBORO, ONT.—Plans are being prepared by the Canadian General Electric Company for enlarging its local plant, at a cost of about $250,000.

TORONTO, ONT.—The city of Toronto, it is stated, is considering giving notice to the Toronto Electric Light Company of its intention to purchase the property and holdings of the company in 1919. The original agreement between the company and the city made on July 31, 1889, provides that the city may take over the property provided notice is given one year in advance.

Miscellaneous

PEARL HARBOR, H. T.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 12 (specification 3938) for construction of power plant extension and improvements at naval station at Pearl Harbor, to cost about $150,000.

SAN GERMAN, PORTO RICO.—I. B. Montaloo of San German would like to communicate with manufacturers of and dealers in electric lighting apparatus and fixtures, pumps for irrigation and domestic use, belting and other equipment for transmission of power and accessories for automobiles.

PORT AU PRINCE, HAITI.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 22 for the construction of a two-story barracks building, one-story operating building and a power house at the naval radio station at Port au Prince, Haiti. Drawings and specifications No. 3069 may be obtained at the above bureau or of the commandant of the naval station named.

Directory of Electrical Associations

Printed in the First Issue of Each Month

Alabama Light and Traction Association. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

American Association of Engineers. Secretary, A. H. Krom, 29 South La Salle St., Chicago.

American Electric Railway Association. Secretary, E. B. Burritt, 8 West Fortieth St., New York. Annual meeting, Atlantic City, Oct. 8 and 9.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

American Institute of Consulting Engineers, Inc. Secretary, F. A. Molitor, 35 Nassau St., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

American Physical Society. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

American Society for Testing Materials. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

Arkansas Public Utilities Association. Secretary-treasurer, W. J. Thorp, Little Rock, Ark.

Associated Manufacturers of Electrical Supplies. General secretary, C. E. Dustin, 30 East 42d St., New York.

Association of Edison Illuminating Companies. Secretary, George C. Holberton, San Francisco, Cal.

Association of Iron and Steel Electrical Engineers. Secretary, John F. Kelly, McKeesport, Pa. Annual convention, September, 1918.

Association of Railway Electrical Engineers. Secretary-treasurer, Joseph A. Andreucetti, Chicago & North Western Railway, Chicago.

Association of Railway Telegraph Superintendents. Secretary, W. L. Connelly, Gibson, Ind.

British Columbia Association of Electrical Contractors and Dealers. Secretary, R. B. W. Pirie, 406 Yorkshire Building, Vancouver, B. C. Annual meeting, September, 1918.

California Association of Contractors and Dealers. Secretary, A. H. Halloran, San Francisco, Cal.

Canadian Electrical Association, affiliated with N. E. L. A. Secretary-treasurer, W. Volkman, Toronto Electric Light Co.

Colorado Electric Light, Power and Railway Association. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

Commercial Section, N. E. L. A. Secretary, Henry Harris, Pittsburgh.

Connecticut Electrical Contractors and Dealers' Association. Secretary, George M. Chapman, Waterbury, Conn.

Eastern New York Section, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

Electrical Manufacturers' Club. Secretary, Shiras Morris, Hart & Hegeman, Hartford, Conn.

Electrical Supply Jobbers' Association. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Meeting, Cleveland, November.

Electrical Trades Association of Canada. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

Electrical Credit Association of the Pacific Coast. Secretary, Albert E. Elliott, 502 Flatiron Building, San Francisco.

Electric Power Club. Secretary, C. H. Roth, 1410 West Adams St., Chicago.

Electric Vehicle Section of the N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York.

Empire State Gas and Electric Association. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

Florida Engineering Society. Secretary, J. R. Benton, Gainesville, Fla.

Georgia Electrical Contractors' Association. Secretary, Dan Carey, Atlanta Builders' Exchange, Atlanta, Ga.

Illinois Electrical Contractors' Association. Secretary, L. B. Van Nuys, Central Electric Co., Peoria, Ill.

Illinois State Electric Association. Secretary, R. H. Abbott, Petersburg, Ill.

Illuminating Engineering Society. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual meeting Oct. 10.

Indiana Electric Light Association. Secretary, Thomas Donahue, Lafayette, Ind.

Indiana State Electrical Contractors' Association. Secretary, George Skillman, Indianapolis, Ind.

Industrial Electric Heating Association. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

Institute of Radio Engineers. Secretary, David Sarnoff, City College of New York.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex. Annual convention, Atlanta, Ga., Sept. 24-27.

Oklahoma Gas, Electric and Street Railway Association. Secretary, L. W. W. Morrow, Norman, Okla.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

Iowa Electrical Contractors' Association. Secretary, M. T. Humphrey, Waterloo, Iowa.

Iowa Section, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines.

Jovian Order. Jupiter (president), Henry J. F. Strickland, Dallas, Tex.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

Kansas Electrical Contractors' Association. Secretary, R. M. Sutton, Wichita.

Kansas Public Service Association. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan. Annual meeting, Kansas City, Kan., Oct. 17-19, 1918.

Kentucky Association of Electrical Contractors. Secretary, F. F. Valinoti.

Louisiana Electrical Contractors' Association. Secretary, I. G. Marks, 323 Chartres St., New Orleans, La.

Maine Electric Association. Secretary-treasurer, Walter S. Wyman, Augusta, Me.

Massachusetts Electrical Contractors and Dealers' Association. Secretary, J. E Wilson, 263 Summer St., Boston, Mass.

Michigan Section, N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Monroe, Mich.

Minnesota Electrical Association. Secretary, H. E. Young, Minneapolis General Electric Company, Minneapolis, Minn.

Minnesota Electrical Contractors' Association. Secretary, G. M. Jones, 112 South Seventh St., Minneapolis, Minn.

Mississippi Electric Association. Affiliated with the N. E. L. A. Secretary-treasurer, L. O. Gordon, Jackson Light & Traction Co., Jackson, Mich.

Missouri Association of Public Utilities. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

Missouri Electrical Contractors and Dealers' Association. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

National Arm, Pin and Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National Association of Electrical Contractors and Dealers. Secretary, H. C. Brown, 110 West 40th St., New York. Annual convention, Cleveland, July 15-20.

National Association of Electrical Inspectors. Secretary-treasurer, William L. Smith, Concord, Mass.

National Electric Light Association. Executive secretary, T. C. Martin, 33 West 39th St., New York.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

National Fire Protection Association. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

Nebraska Section, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

New England Electrical Credit Association. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

New England Section, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual meeting, Hotel Kimball, Springfield, Mass., Sept. 27 and 28.

New Mexico Electrical Association. Secretary-treasurer, E. A. Thiele, Roswell.

New York Electrical Credit Association. Secretary, Franz Neilson, 120 Broadway, New York.

New York Electrical Society. Secretary, George H. Guy, 29 West 39th St., New York.

Northwest Electric Light and Power Association. Affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore. Annual meeting, Sept. 11, 1918.

Northern White Cedar Association. Secretary, N. E. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio. Convention, Cedar Point, Ohio, July 10, 11, 12.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

Oregon Association of Electrical Contractors and Dealers. Secretary-treasurer, J. W. Oberender, 302 Dekun Building, Portland, Ore. Annual meeting, September, 1918.

Pacific Coast Section, N. E. L. A. Secretary, A. H. Halloran, Crossley Building, San Francisco, Cal.

Pennsylvania Electric Association. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

Pennsylvania Electrical Contractors and Dealers' Association. Secretary, M G. Sellers, 1518 Sansom St., Philadelphia.

Public Service Association of Virginia. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

Public Utilities Association of West Virginia. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

Radio Club of America. Secretary, T. J. Styles, 152 Beach St., Yonkers, N. Y.

Rocky Mountain Association of Municipal Electricians. President, Lawrence Stone, Denver, Col.

Society for Electrical Development, Inc. General manager, J. M. Wakeman, 29 West 39th St., New York.

Society for the Promotion of Engineering Education. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

South Dakota Electrical Power Association. Secretary-treasurer, O. J. Gronsdahl, Hartford, S. D.

Southeastern Section, N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus, Ga.

Southern California Electrical Contractors and Dealers' Association. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

Southwestern Electrical and Gas Association. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

Southwestern Society of Engineers. Secretary, C. E. Barglebaugh, 703 First National Bank Building, El Paso, Tex.

Texas State Association of Electrical Contractors. Secretary, H. S. Ashley, Fort Worth, Tex.

Toronto Electrical Contractors' Association. Secretary, J. E. Myers, 3 Gould St., Toronto, Ont.

Tri-State Water and Light Association. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

Vermont Electrical Association. Secretary-treasurer, C. H. West, Rutland, Va.

Virginia State Electrical Conractors' Association. Secretary, E. M. Andrews, Richmond.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 175 W. Jackson Blvd., Chicago.

Western Society of Engineers, Electrical Section. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago.

Wisconsin Electrical Association. Secretary, J. P. Pulliam, Green Bay, Wis.

Wisconsin Electrical Contractors and Dealers' Association. Secretary, J. C. Staff, 578 Jackson St., Milwaukee, Wis.

Record of Electrical Patents

Notes on Recent United States Patents

1,268,200. Electromagnet; Alfred A. Ziegler, Boston, Mass. App. filed Sept. 14, 1908. An electromagnet especially adapted for use in relays employed for railway signaling purposes.

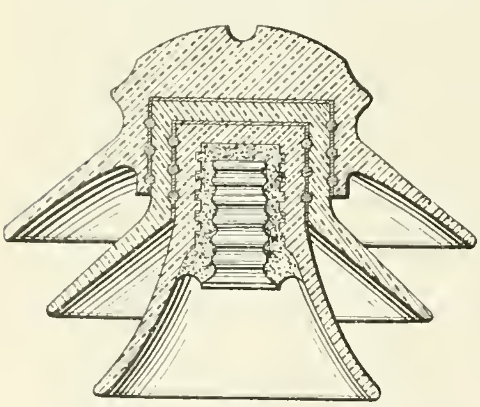
1,268,221. Automatic Telephone - Exchange System; Bert G. Dunham, Chicago, Ill. App. filed Oct. 5, 1904. Automatic telephone exchange systems wherein the connection between any two lines is made by automatic switches at the central office.

1,268,265. Reciprocating Motor; Howard J. Murray, Brooklyn, N. Y. App. filed Sept. 15, 1914. An electromagnetic reciprocating motor in the form of a multiple-armature magnet.

1,268,288. Signal for Street Intersections; James W. See, Hamilton, Ohio. App. filed July 8, 1914. Device that gives audible signals or readable signals or light signals, alone and together.

1,268,293. Brush Holder, Robert W. Stanley, Cleveland, Ohio. App. filed Oct. 18, 1915. Holders for brushes adapted to cooperate with collector rings.

1,268,315. Insulator Thimble; Raymond A. Becker and Thomas E. Maddex, Hillsboro, Ill. App. filed June 6, 1917. A type of insulator adapted to be supported upon pins or studs.



1,268,315—Insulator Thimble

1,268,328. Rail Bond; Lawrence P. Crecelius, Cleveland, Ohio. App. filed July 24, 1916. A rail bond wherein the end or terminal of the bond is surrounded by a sleeve or terminal.

1,268,330. Dynamo; Alfred H. Darker, London, Eng. App. filed Oct. 10, 1917. Relates to brush and terminal contact mechanism of dynamo-electric machines.

1,268,348. Means for Controlling Electric Current; Varian M. Harris, Chicago, Ill. App. filed Oct. 12, 1918. Means for controlling an electro-thermic device.

1,268,369. Electrolytic Process of Making Alkali Perborates; Otto Liebknecht, Frankfort-on-the-Main, Germany. App. filed Oct. 23, 1915. A process for the production of sodium perborate by an electrolytic process.

1,268,374. Resistance Coil; Israel Marcus, Winthrop, Mass. App. filed Sept. 17, 1917. Resistance coils used as regulators in lighting systems of automobiles.

1,268,381. Railroad-Crossing Signal; Will C. Neahr, Denver, Col. App. filed June 13, 1916. Visual signals of the movable type.

1,268,422. Automatic Alarm; George E. Beach, Glenrock, Wyo. App. filed March 26, 1917. Automatic alarm for brooders and incubators.

1,268,425. Casing for Electrical Appliances; Carl H. Bissell, Syracuse, N. Y. App. filed Jan. 13, 1913. Casing for electrical appliances to be used in connection with conduit outlet boxes.

1,268,426. Automatic Switch; Carl H. Bissell, Syracuse, N. Y. App. filed Dec. 3, 1913. An automatic switch comprising a moving switch member and two solenoids.

1,268,438. Electrical System of Distribution; Gorham Crosby, Glen Ridge, N. J. App. filed Sept. 1, 1915. Electrical systems in which a storage battery is charged from a generator.

1,268,457. Ground Clamp; Howard H. Haynes, Bridgeport, Conn., and Tonjes A. Both, Stratford, Conn. App. filed July 16, 1917. Ground clamp for use with electrical conductors.

1,268,465. Process and Apparatus for Electrodeposition; Nathaniel Huggins, New York, N. Y. App. filed April 18, 1916. Immersing a mold in an electrolytic bath and by electrodeposition forming the article in such mold.

1,268,468. Induction Coil; Edward B. Jacobson, Pittsfield, Mass. App. filed Dec. 3, 1913. Sparking coils for an ignition system for combustion engines.

1,268,469. Electrical System of Distribution; John W. Jepson, Buffalo, N. Y. App. filed Aug. 24, 1915. Systems employing a generator feeding a storage battery.

1,268,473. Distributer Cap for Ignition Apparatus; William O. Kennington, Detroit, Mich. App. filed April 19, 1916. Distributer cap for a combined distributer and circuit breaker, adapted to an engine of many cylinders.

1,268,483. Electrode for Use in Electric Furnaces and for Other Purposes; Hans Nathusius, Friedenshutte, Kreis Beuthen, Germany. App. filed July 19, 1916. Electrodes made of dolomite and metals.

1,268,485. Duplex Switch; Herman G. Pape, New York, N. Y. App. filed July 3, 1917. A plurality of narrow switches inserted in an ordinary outlet box.

1,268,491. Electrically Operated Typewriter; Paul C. Rawls, Kansas City, Mo. App. filed Jan. 8, 1914. An electrically operated typewriter by means of a combination of keys, type bars and selective magnets.

1,268,545. Sinusoidal - Wave Generator; Ralph W. Chapman, Oldtown, Me. App. filed March 19, 1917. Therapeutic apparatus adapted to produce sinusoidal current.

1,268,548. Arc-Lamp Regulation for Headlights; Ray P. Deardorff, Buffalo, N. Y. App. filed Dec. 2, 1913. Arc lamp for use on locomotives.

1,268,618. Embossing Attachment for Printing Presses; Frederick W. Reed, South Bend, Ind. App. filed Oct. 1, 1914. An embossing die-heating plate heated by an electric current.

1,268,662. Electrical System of Power Transmission; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed April 22, 1916. Electrical systems of regenerative braking.

1,268,666. All-Water Rheostat; William A. Archibald and Harold W. Thom, Tyler, Pa. App. filed Sept. 11, 1917. A liquid rheostat employed in the starting of electric motors.

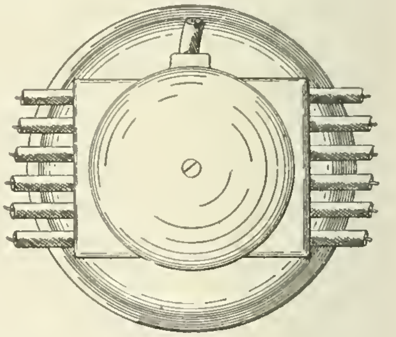
1,268,673. Directory Signal; Jesse Boyer, Massillon, Ohio. App. filed June 1, 1917. Provides a foot-operated signal designed for use with automobiles.

1,268,685. Electric Resistance Furnace; William D. Coolidge, Schenectady, N. Y. App. filed Dec. 16, 1916. Resistance furnace having a heater tube of refractory material.

1,268,689. Magneto - Electric Machine; William W. Dean, Stamford, Conn. App. filed Aug. 24, 1916. Magnetos used for ignition and lighting.

1,268,695. Signal; Halley C. Dolan, Detroit, Mich. App. filed March 31, 1917. Signals for automobiles.

1,268,712. Mechanism for Controlling Movement; Frederic A. H. Harle, Paris, France. App. filed July 21, 1914. Electric control apparatus actuated by the balance current of an electric arrangement.



1,268,473—Distributer Cap for Ignition Apparatus

1,268,716. Current Distributer and Timer; Clarence E. Holliday, Duncan, Neb. App. filed Jan. 4, 1916. Electrical appliance in the form of a timer for engine cylinders.

1,268,719. Vacuum-Energized Make-and-Break Spark Plug; Herbert G. Irwin, Spur, Tex. App. filed July 26, 1917. Ignition apparatus for internal-combustion engines of a vacuum-operated make-and-break.

1,268,733. Lightning Arrester; Garrett W. Kotts, Hope, N. D. App. filed Nov. 30, 1917. A lightning arrester adapted for use with telephone and telegraph lines.

1,268,743. Lock; Philip Madson, Lemmon, S. D. App. filed Feb. 20, 1917. Combination locks for use on automobiles.

1,268,749. Vehicle Signal; John Meile, East St. Louis, Ill. App. filed Nov. 27, 1916. A vehicle signal controlled co-ordinately with the speed of the vehicle.

1,268,776. Engine Starter; George M. Willis, Chicago, Ill. App. filed Jan. 14, 1914. Provides means for controlling the supply of energy to the storage battery by a voltage coil.

1,268,804. Push - Button Switch; Alexander K. Sutherland, Plainville, Conn. App. filed April 21, 1915. Provides a switch having a detent and a releasing device therefor.

1,268,807. Fuse Cartridge; Frederick A. Feldkamp, Newark, N. J. App. filed March 31, 1917. Improved construction of multiple fuse cartridge.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

Volume 72 New York, Saturday, July 13, 1918 *Number* 2

Service for the Electrical Engineer

BOTH President Rice and President-elect Adams in their addresses at the recent convention of the American Institute of Electrical Engineers touched on the present and future work of the electrical engineer. The thought expressed was that in these abnormal times and in the period to follow the function of the engineer is primarily an economic one. So far as efficiency of conversion is concerned, much electrical apparatus has already attained practical perfection. The immediate task, therefore, does not contemplate any increase in the efficiency of electrical apparatus so much as it does the application of that apparatus to the conservation of material and labor and to the winning of the war. There has been during the last year rapid advancement in that direction due to the imperative demands for economy in coal, saving of money and increased efficiency of production. Happily, the electric generating systems of the country had been developed and planned so wisely that when the nation found it necessary to create or enormously expand industries for the production of ships, armament, munitions, etc., the power to operate these was not wanting. The same foresight and skill displayed in the creation of our power stations and vast transmission networks will still be needed, however, and to a much larger degree, after the war; for what we have acquired through a process of evolution may have to be applied so broadly and so hastily as to suggest revolution.

Electrical engineers, as Professor Adams has well said, have tied the four corners of the earth together before their inhabitants have learned how to live together. Time and space have been eliminated, but human beings with their passions, race prejudices, systems and institutions remain. The present war, we firmly believe, will serve to check these passions, and by effacing tyranny will see a regenerated and better world when peace is declared. For that day the electrical engineer should now prepare. Needless to say, his opportunities will be exceedingly great, for the world, exhausted and impoverished, will turn to the engineer for help. He who can render industry more productive and more efficient, who can apply practical science to world use, will increase his personal value by every kilowatt which he controls. But to do this requires expanded vision and broader sympathy in human affairs. The engineer is indeed the hope of the nation both now and hereafter, as President Rice has said. It is up to him to a very considerable degree to help by scientific methods to solve the problems which will confront us. We are therefore heartily in accord with the suggestion of Professor Adams that the scope of the work of the American Institute of Electrical Engineers should be restricted in one direction and expanded in another to give the service most needed at this time by the nation and the world.

More About High Pressures

ESKIL BERG'S paper on this topic gives concrete evidence of the drift of opinion and practice regarding high steam pressures and superheat. We have been preaching this doctrine for years, but improvements come slowly, particularly where the trend of industrial conditions has been in the direction of standardization rather than bold experiment, and it is only within a very few years that material progress has been made. The spur of costly fuel under war conditions is now leading to important results. Mr. Berg points out that in turbine design conditions have reached a plane of efficiency where the only hope of material gain is in increasing the temperature range. This implies higher steam pressures, higher superheat or both. In theory the gain by going from 200 lb. to 500 lb. boiler pressure (14.1 kg. to 35.15 kg. per sq.in.) supplies a saving in fuel of between 14 and 15 per cent, amounting in cash in a plant burning five-dollar coal at the rate of 900 tons a day to no less than $200,000 a year—a figure not to be sniffed at even in these days of large reckonings. Superheat in itself makes a smaller direct thermodynamic gain, but is much more easily applied and also reacts favorably on the efficiency of the turbine itself. This is due chiefly to the removal of the moisture in the steam, cutting down the friction and windage loss in the turbine, which is far bigger than all the other losses there combined.

To obtain the best results high steam pressure and superheat together should be utilized. The present over-all efficiency, including the generator losses, in a high-grade turbine with boilers worked at top efficiency is a shade better than 20 per cent. Mr. Berg indicates that an over-all efficiency of more than 30 per cent is obtainable without particular difficulty if one goes to high pressure and superheat, and also emphasizes this result by suggesting that the cost of high-pressure equipment may turn out under such circumstances to be even less than that of the standard equipment now used.

The chief objection to a radical movement upward in pressure and temperature lies in the fact that boilers, piping and auxiliaries to meet the new conditions are not standard, precisely the same line of reasoning by which the old atmospheric pressures were defended three generations ago. From a practical standpoint the real difficulty is that at the present time under war conditions it is pretty nearly impossible to procure the manufacture of anything out of the ordinary line, save as the excursions may be in the direction of things immediately necessary for war purposes. This objection will remain valid only while we are in the fight, and is no excuse for the abandonment of judicious experiments, making ready for work on a large scale when the present stress is removed.

Supply Raw Materials for Electrical Manufacturers

IN THE production of highly essential materials sorely needed in the vigorous prosecution of the war the electrical manufacturing industry has a large and patriotic work to do. We believe that still more will be required of the industry in the future. Like some other great branches of trade, the electrical manufacturing industry serves the nation not alone by producing munitions but also in a very important way by continuing to make the necessary quantities of regular apparatus and supplies. Without the steady production of such regular lines of products in enormous volume the entire national manufacturing program, whether directly or indirectly connected with the war, would be irretrievably delayed. Therefore it is in the direct and vital interest of the whole country that electrical manufacturers shall not be allowed to slow down their normal activities in essential lines.

The standpoint of the manufacturers on the subject of their war-time needs has been expressed in recommendations to the War Industries Board, as published in the ELECTRICAL WORLD of July 6, page 23. These touch the timely questions of preference listings for the supply of indispensable steel products, priority certificates to assure steel supply, and the co-ordination of whatever arrangement is made for steel with that for other raw materials. They are the heart of the immediate problem. From the handling of this matter can come either an orderly, dependable arrangement for making the supply of steel adequate to the war demands upon electrical manufacturers for their products or grave confusion and the dislocation of manufacturing and labor conditions. Without doubt the War Industries Board must make its decisions inflexibly on the basis that strict war calls come first, although there is abundant indication that the authorities will be prudent in trying to convert industries to war uses rather than let public distress or unrest grow from abrupt curtailment of industrial activity. Its conclusions, however, will probably have to be tempered by the well-recognized fact that supply of steel is bound to be seriously short, that the amount called for by the purely munitions program is stupendous, and that other industries are clamoring that their requirements, whether deserving of consideration or not, shall have recognition.

The conditions developed in the electrical industry by time, competition and the economic testing of methods are comprehended in two points which the manufacturers have taken to the War Industries Board for discussion. One is the desirability of securing steel so that the manufacturers may not only follow their regular policy of producing in quantities for stock but may furthermore be protected by an advance supply now in order to lessen transportation troubles next winter. Barring the possibility of a grave war crisis or other exigency bearing on the energetic prosecution of the war, we feel that the electrical manufacturers are entitled to this aid in pushing their manufacturing programs. In the nature of their business they cannot produce most lines merely on the basis of definite orders received. They have to produce ahead to some extent, forecasting requirements in order to be ready to comply promptly with the needs of industry. This is true of both apparatus (excepting large units) and supplies.

There is a direct relation between the question of manufacturing for stock and the question of distributing through jobbers. The War Industries Board rightly recognizes the function of the jobber as economic. You cannot both have the invaluable distributive service of the jobber and at the same time refuse to supply him with the stock which alone enables him to give immediate delivery. It is not possible to withhold steel from the electrical manufacturers and at the same time to find badly needed electrical supplies in the jobbers' warehouses throughout this extensive country. The jobber provides an economical, useful means of distribution which is of large advantage to the government in saving time and waste in the tremendous engineering and construction outlay incident to the war. Faith in the government gives us confidence that the problems, which directly involve the maintenance of the electrical manufacturing industry as a powerful industrial force, will be met as equitably by the authorities as the war necessities permit; but in the process of meeting them time, which is the essence of victory, should not be whiled away.

Industrial Motor Control

THE evolution of motor-control apparatus and practice is an interesting phase of electrical development. It has gone through many stages, and its present status is excellently set forth by Prof. C. E. Clewell in an article in our current issue. In certain respects motor-controlling devices have been simplified greatly since the early days of the art. In the beginning the electric motor was a peculiarly tender piece of apparatus both electrically and mechanically. The control of sparking was very imperfect, the insulation was none of the best, the slotted armature was unknown, and above all the motors in small sizes were commonly installed on lighting circuits of meager capacity so that their effect was unpleasantly conspicuous. Under such circumstances motors had to be installed where the brushes could receive constant attention, a precaution doubly necessary if any attempt were made to introduce variable speed. The starting rheostat had to be provided with many steps, and it behaved rather badly at that. Remote control, current-limiting devices other than open fuses, sometimes replaced by wire nails, and low-voltage automatic stops were quite unknown.

Professor Clewell's article is a study of an important

A. I. E. E. paper dealing particularly with control of small motors, especially direct-current motors. It is apparent from the facts brought out that great changes in the way of simplifications have been made. The complicated starting rheostat can now be brought to a most elementary form, even down to a single step of resistance variation, and it is indeed not very unusual to omit the external starting resistance entirely. It is well to look a bit into the cause of this now justifiable change in practice. In the first place, direct-current motors are much better designed with respect to sparking than they were in the old times. A first-class modern motor will stand all kinds of speed changes and changes of load with never a blink at the brushes, so that rheostatic control to avert commutator trouble at starting or in changing speeds is rather unnecessary. Second, the individual small motor here discussed is so trivial an element on the average electric system that it can be switched on or suddenly loaded without any perceptible effect on the system. A 10-hp. motor across the outside of a three-wire system is no longer a cause of worry to the station operator or to its own operation. This is one of the beneficial results of sheer magnitude in the scale of operations—that it takes 100 hp. or so to bear the same relation to the system operation as 5 hp. or 10 hp. a quarter century ago. Again, those who buy and use motors are much less fussy about some of their characteristics than in the early days.

Electro-Thermal Lightning Arresters

THE ordinary spark-gap lightning arrester in its simplest form is a device that has been used for the protection of signaling circuits over a period of at least sixty years. When connected between line and ground it forms an electric relief valve of a very simple but effective nature. Unless the lightning discharge passing over the gap is so powerful as to injure or deflagrate the metallic spark points, the device may continue to be serviceable for an indefinite period of time.

When the simple spark gap was first applied to active electric lighting and power circuits it was soon found to be defective. The moment that the lightning spark discharge occurred at the gap the conducting stream of ionized vapor formed by the discharge permitted the working voltage of the system to follow up with a vicious arc. This arc in most cases speedily wrecked the device and often short-circuited the system. It became necessary to add to the device some element which, while not interfering with the lightning discharge or jump spark, would suppress the dynamo arc very speedily. The Thomson magnetic blow-out has been a widely used accessory of this kind, especially for working pressures below, say, 1 kv. For use with higher pressures electrolytic protectors have been developed. These interpose an electrolytic counter-emf. approximately equal to that of the working voltage in the system and so prevent the formation of a dynamo arc at the spark gap.

The article by E. O. Schweitzer, beginning on page 52, deals with certain defects that may occur in an electrolytic lightning arrester and with devices intended to obviate them. If the electrolytic arrester fails for any reason to suppress the dynamo arc very promptly, it becomes heated and thereby weakened, so that it may even break down and become destroyed. To guard against this contingency an electrolytic cylinder is inserted in series between the electrolytic arrester and the spark gap. The cylinder is of bakelite, with metallic ends, through which pass metallic rods terminating inside on carbon electrodes of special forms. The cylinder is partly filled with electrolyte and is provided with an escape pipe into a reservoir of electrolyte and also with a needle valve relieving into the air. If the flow of dynamo current through the arrester, cylinder and spark gap is excessive, the heat within the cylinder, generated electrically, will force out the electrolyte into the reservoir until the upper electrode is denuded and the discharge circuit thereby opened.

The development of the electrolytic cylinder, as an adjunct to the electrolytic arrester, appears to have been so successful that it is now contemplated to develop it to the point where the electrolytic arrester can be eliminated altogether if possible, and to depend entirely on the electrolytic cylinder as the arrester, in conjunction with the spark gap. This is equivalent to promoting the cylinder from a subordinate position to one of complete responsibility for arresting the arc. It will be interesting to see how far this plan can be carried successfully.

It will be remembered that in some European power stations using three-phase pressures which in this country would be called moderate each of the three busbars in the central station is sometimes steadily connected to ground through a narrow column of slowly escaping tap water. Each column is contained in an insulating cylinder, and the steady flow of water through this cylinder is relied upon to keep the temperature low and the electric leak insignificant. In these cases the spark gaps are sometimes eliminated entirely, thus providing a liquid path to ground from each conductor for all accidental surge or lightning discharges. This is in one sense the antithesis of the Schweitzer method, because the latter depends upon suddenly developed heat for the operation of the device to clear the circuit.

The Coming Issues

HOW present conditions have affected cost of line construction, the advisability of overhauling water turbines during low-water season to secure the maximum economy later, and a method of calculating the hot-spot temperature in transformer windings will be among the subjects which will be discussed in coming issues of the ELECTRICAL WORLD. Other articles will dwell on methods of storing fuel to tide over the coming winter, increased necessity of basing rates on maximum demand and how to determine it, and characteristics of solid and stranded steel wire. The next industrial-control article will refer to the application of relays to motor circuts.

New Principle for Lightning Arresters

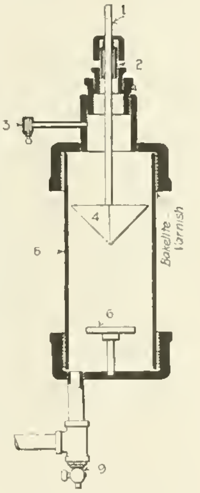
Preliminary Tests of an Electro-Thermal Valve Indicate Important Development in Lightning-Arrester Design—Performance of the Valve at Different Voltages Is Shown Diagrammatically

BY E. O. SCHWEITZER
Chief Testing Engineer Commonwealth Edison Company

THE electrolytic lightning arrester is designed to protect electrical machines, transmission lines and other equipment from the evil effects of high-voltage, high and low frequency discharges and surges, whether these originate from lightning or from some source in the electrical system itself. As a rule, the arrester is remarkably effective for this purpose, but, under sustained conditions, supplementary protection may be employed to advantage. A long sustained high-voltage surge, or a series of frequently repeated surges, may raise the temperature of the arrester to such an extent that the hot electrolyte will dissolve the active film from the arrester cones, thus reducing their resistance. For the protection of the arrester under these conditions the writer has conducted preliminary experiments on a device of his own invention, which is designed to open and close or vary the resistance of the arrester circuit automatically at any time when it is in danger. The possible use of the electro-thermal valve, as this device is termed, as a complete lightning arrester, entirely obviating the use of an arrester of the ordinary type, is indicated by the experimental data. A series spark gap is here required as for other arresters. The electro-thermal valve is shown in Figs. 1 and 2.

FIG. 1
CROSS-SECTION OF ELECTRO-THERMAL VALVE

It consists of a vertical cylindrical chamber made of a bakelite tube (5) closed at the ends by cast-iron caps. The upper adjustable electrode (4) is of artificial graphite in the shape of an inverted four-sided pyramid supported by a steel rod (1), through which it makes electrical connection with the high-potential circuit to be protected. This rod passes through the stuffing-box (2) in the upper cap, in which it can be moved, when desired, to vary the distance between the electrodes. The lower electrode (6) is a flat plate of artificial graphite, permanently attached to the lower cap, which is grounded. So far ordinary city water has been used as the electrolyte. The chamber is provided with a small relief valve (3) and is also connected by a pipe to a reservoir by means of which a certain desired pressure is maintained in it.



The heat generated by the flow of current following a discharge through the electrolyte produces a pressure in the electrolytic chamber. This pressure is only partly relieved by the small valve, and in the meanwhile the resistance of the electrolyte decreases as its temperature rises, so that the current increases rapidly. Then the area of contact between the electrode and the electrolyte becomes less and less as the electrolyte level goes down, since the electrode tapers to a point. The decreasing area of contact results in an increasing contact resistance and the current drops rapidly, although smoothly. Despite the decrease in current, heat is now being generated at a high rate at the contact surface, and the electrolyte is forced rapidly downward until contact is broken at the point of the electrode and the current becomes zero.

The needle valve now relieves the pressure, and if the impressed voltage has been removed the electrolyte will return rapidly to its original level. If, on the other hand, the impressed voltage has been maintained at its full value, the electrolyte rises only to a point where it makes contact with the tip of the electrode. This contact is so small and of such high resistance that the production of heat is exceedingly rapid, the pressure quickly rises, the electrolyte is immediately forced down out of contact with the electrode, and the flow of current is but momentary. This last cycle is repeated over and over again so long as the impressed voltage is maintained, resulting in a momentary flow of current at brief intervals.

The higher the impressed voltage, the more rapid the operation of the valve, since a high voltage results in a large flow of current and a rapid generation of heat. If the impressed voltage is sufficiently low, a small flow of current may continue indefinitely without causing the valve to function. Other conditions remaining constant, the distance between electrodes governs the electrical resistance of the valve, and thus the magnitude of current flow. If the distance is short, the current flow will be large and the operation of the valve rapid. As the distance is increased the time required to open the circuit becomes greater.

If the distance between electrodes is very short and the impressed voltage high, an arc might form and maintain itself from the electrode after the electrolyte had been forced out of the way. This can happen only in case the normal voltage of the power line is sufficiently high to form an arc across the gap, since the duration of a disruptive discharge is too brief to cause such a result. The limiting electrode distances for different voltages have not yet been determined, and no such arc has ever formed during the course of our experiments.

The current-carrying capacity of the device may also be greatly increased by reducing its resistance. Increasing the cross-section of the electrolytic chamber and at the same time increasing the size of the electrodes will also increase the valve's current-carrying capacity.

Adjusting the needle valve to have a greater orifice decreases the speed of operation since the needle valve then prevents the pressure from building up so rapidly as before, and when the circuit has once been opened the electrolyte will re-establish contact with the upper electrode in a shorter time than before, since the needle valve will release the accumulated pressure more rapidly. The needle valve must be set at the point which will give the desired balance between speed of initial operation and speed of return to initial position, and then be locked in place.

PERFORMANCE OF VALVES AT DIFFERENT VOLTAGES

An approximate idea of the speed at which the electro-thermal valve operates at different voltages and the current which it carries can be obtained from the curves shown in Fig. 3. These show the experimental results obtained at 220 volts, 600 volts, 1050 volts and 2200 volts, these voltages in each case being impressed directly across the electrodes without the use of limiting resistance of any kind. At the beginning of each run the valve was at room temperature and the impressed voltage was maintained at its full value for ten minutes. The electrode distance was 3 in. (7.62 cm.) in each case.

At 600 volts the current climbed from an initial value of 0.55 amp. to 1.80 amp. in four minutes and thirty seconds. From the maximum the current dropped abruptly to zero in about two seconds. After remaining at zero for a few seconds the current began to rise again, at first rapidly, then more slowly, finally reaching a maximum at about the same value as before, whence it again dropped abruptly to zero. This cycle was repeated over and over again up to the end of the run, but each cycle was of briefer duration than the one before it.

It will be noted also that after the third cycle the current remained approximately constant at its maximum for several seconds. By this time the electrolyte was very hot and its resistance low, resulting in a tendency for the current to reach a higher maximum than before. This tendency was opposed by the fact that the pressure above the electrolyte also increased more rapidly than before. At the maximum value of the current these opposing tendencies exactly balanced each other for an appreciable time, thus holding the current constant.

The operation at 1050 volts was quite different. Starting at an initial value of 1.25 amp., the current increased more rapidly than before to a maximum of 2.80 amp., which was reached in one minute and thirty seconds. The point of inflection in the curve is still noticeable but less distinct than before, because the action is now more rapid. As before, the current dropped abruptly from its maximum to zero. After a brief interval it rose again—not to the former maximum this time, but to about 1.75 amp., dropping immediately to zero. Thereafter the current did not at any time exceed 0.25 amp., a value which it reached intermittently until the end of the ten-minute test, at periods varying from about five seconds at the beginning to about two or three seconds at the end.

At 2100 volts the current rose very rapidly from an initial value of 2.2 amp. to a maximum of 5 amp., which it reached in twenty-five seconds. It then dropped abruptly to zero as before. This time the action was so rapid that no point of inflection can be observed in the ascending curve. After the circuit was first opened, at the end of twenty-five seconds, the current never again exceeded a value of about 0.5 amp. Up to the end of the ten-minute run the electrolyte made contact with the electrode tip at intervals of three to four seconds. At each contact there was a momentary flow of current, about 0.5 amp. in value, which dropped to zero again almost instantly. For the sake of simplicity, the curve sheet does not show these rapid alternations of current from zero to 0.5 amp. after the first minute, but they continued substantially as shown during the remaining nine minutes of the test.

It is interesting to note that the flash of the arc each time contact was made and instantly broken could be distinctly seen through the ⅛-in. (3.17-mm.) bakelite-fiber wall of the electrolytic chamber.

The variation of electrical resistance during the four runs described is worth noting. Calculated from the observed values of voltage and current, it was as follows:

Impressed Voltage	Initial Resistance, Ohms	Resistance of Maximum Current, Ohms
220	. . . .	880
600	1,080	333
1,050	840	375
2,100	955	420

The resistance of the electrolyte itself decreases uniformly as the temperature increases, but the contact resistance between the electrolyte and the electrodes, always a considerable percentage of the total and sometimes the governing factor, varies according to the impressed voltage and other conditions in a manner which is rather obscure and does not lend itself to accurate prediction.

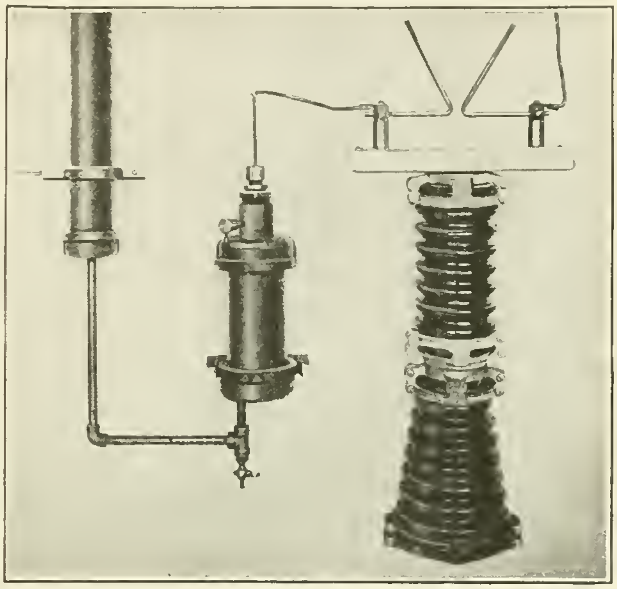


FIG. 2—APPARATUS ASSEMBLED AS COMPLETE ARRESTER

The electro-thermal valve is shown between spark gap and reservoir, both of which are essential parts of the arrester unit.

Other tests, made at various voltages, served merely to corroborate the results obtained in these four tests. No sustained test has yet been made at a voltage higher than 2100, as the laboratory equipment has been found to be inadequate above that point. Tests at higher voltages should be made at some location where a greater power capacity is available, so that the current drawn by the valve will not pull down the voltage of the line.

After some twenty or more separate runs had been made, the interior of the electrolytic chamber was inspected and found to be in perfect condition, despite the constant and rapid succession of high-voltage arcs which had been formed and broken during the tests. The upper electrode, which had acted as one terminal for these arcs, was as smooth and unpitted as it had been originally. The bakelite tube, the lower electrode and the cast-iron caps all appeared to be in perfect condition.

No test has yet been made to determine how adequately the electro-thermal valve will take care of a disruptive discharge such as that caused by lightning. All tests so far made merely indicate how the valve will operate from the moment the power current begins to follow the disruptive discharge. Special tests should be made to determine the effect of such high-voltage, high-frequency discharges as result from lightning and system surges.

The experiments outlined for immediate execution include tests to determine the characteristics of the valve at voltages up to 6000 or possibly higher. Various electrode distances will be tried at different voltages, and readings will be taken of time, initial current and maximum current. Other determinations will be made to establish the relative influence of the different factors such as needle-valve orifice, dimensions of chamber and electrodes, distance between electrodes, composition of electrolyte, etc.

WHAT THE TESTS INDICATE

These tests will show the relationship, one to another, of the various factors which must be considered in the design of the electro-thermal valve. The device at present under test was not designed; it was built by guess because the information necessary for design was not available. Such information will be available when the tests at present under way are completed, and a larger unit, with higher current-carrying capacity and suitable for use at higher voltages, can then be designed and constructed with some degree of precision.

Two points in the development of the device up to date deserve mention. It was foreseen that the electrolytic action between the electrodes would result in the decomposition of water into hydrogen and oxygen, and that these gases would form an explosive mixture above the surface of the electrolyte. This expectation was later confirmed by draining off some of the gas into a test tube and igniting it. To prevent the possibility of an explosion in the electrolytic chamber, which might occur when an arc forms at the moment the circuit is broken, the electrolyte was covered with a layer of transil oil. No explosion has occurred, but it is doubtful whether the presence of the oil is really necessary. The quantity of gas formed during the brief flow of current must be rather small, and, furthermore, it is greatly diluted by a larger quantity of water vapor, which would tend to prevent an explosion of any violence. An attempt will be made to operate without the oil which has so far been used.

Although the electro-thermal valve was originally proposed for use in series with an aluminum arrester, for the purpose of protecting the latter from destruction, it soon became apparent that if the electro-thermal valve could be made suitable for this purpose it would be equally suitable for use as a self-contained lightning arrester, without any assistance from the aluminum arrester. Such inherent limitations as it may possess are equally serious whether we connect it in series with an aluminum arrester or install it as a lightning arrester.

From the preliminary experiments so far completed it is evident that the electro-thermal valve possesses peculiar qualities which are advantageous in a lightning arrester. Connected from ground, through a horn gap, to a power line, it will promptly extinguish the power arc at the gap, following a disruptive discharge. It will at the same time afford complete protection to itself from any possible ill effects resulting from the flow of power current. It is probable that the device can be so designed for a power line of any given voltage as to interrupt the flow of power current within five seconds after an arc forms at the gap. This much may be said with a fair degree of confidence. It remains to be determined whether this device will provide a sufficiently easy path to ground for high-voltage disruptive discharges, and whether it can dispose of such discharges without injury to itself.

That the electro-thermal valve can be so constructed as to carry current from a high potential to ground over a very wide range of voltage conditions is evident from the curve sheet already discussed. It is theoretically possible to design the device in such a way that any one of the four operating curves there illustrated can be duplicated at any predicted voltage, no matter how high. To duplicate, at 100,000 volts, the curve marked 220 volts on the sheet would merely require a device of huge dimensions. This, of course, is an extreme which is neither practicable nor desirable, but it serves to illustrate the remarkable flexibility of the device in this respect, a flexibility which can be utilized to advantage within more reasonable limits.

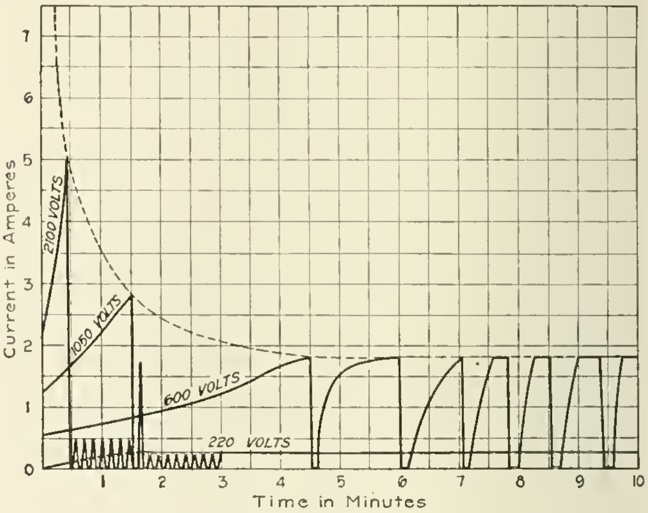


FIG. 3—TIME CHARACTERISTICS OF ELECTRO-THERMAL VALVE

Tests made with device of given dimensions showing action at various voltages. Shows only the action in interrupting dynamic currents.

If, after further test, the electro-thermal valve is found to possess in sufficient degree the other qualities required of a good lightning arrester, its possible field of usefulness should be very wide. It would be very much cheaper in first cost than the ordinary arrester and would not require any charging, frequent inspection, skillful attendance or delicate handling. By virtue of these advantages it might be expected to replace existing types of arresters to a considerable extent, depending upon how nearly it equals the quality of performance of these types of arrester. It might also replace the many types of cheaper arresters under conditions where a highly effective arrester is desirable.

Work of the Engineering Council

Many of Its Activities Are Directly or Indirectly Connected with the War and Helpers Are Wanted Who Can Give Time to Assist the Committees—Consideration of the Licensing of Engineers

THE Engineering Council, as was designed, is engaging in many activities for the engineering profession of America, many of these being directly or indirectly connected with the war. The council is a body of representatives from member societies conducting most of its work through committees. For effectiveness these committees have usually a small number of members, although committee membership is not limited to the representatives on the Engineering Council.

As the work of some committees develops, however, there are occasions when helpers are needed who can devote time to details, to special investigations, to getting local information in some community or state, to compiling and analyzing of information already accumulated, or to scouting for men needed for some particular service. When need arises for such assistance it is often difficult to think of or to find the right man available at that moment. In order to meet this difficulty, to give a larger number of engineers a share in the activities, to broaden the council's contact and gain greater breadth for its views and statements, as well as to make its work more widely known, the Engineering Council is requesting engineers who can help to write to the council's office registering their names and addresses and in a general way stating the extent and nature of service each is willing to render. This is an opportunity for some of the younger members of the profession to take a hand in society activities, but the request is not limited to the men of few years.

The public affairs committee reports on matters of public policy and those relating to national, state or local government, other than technical questions.

The American Engineering Service has the duty of compiling as complete a classified catalog of the engineers of America as it may be practicable to get together. Much information has been assembled, but a great deal remains to be collected. During war time lists collected by this committee and the engineering societies co-operating with it are being used to supply thousands of names in response to calls from government departments for specialists for combatant and other forces of the army and navy and for the war industries. This committee frequently could use volunteers not only in New York but in distant communities also in scouting for men to meet special and urgent calls from the government, as well as in other ways.

The war committee of technical societies is engaged upon the examination of new inventions offered to the War and Navy departments and to stimulation of the development of useful new appliances for warfare. In reviewing ideas received, preparing bulletins and writing reports and records, this committee could make use of a number of helpers from time to time.

The water conservation committee is organizing to deal with questions of policy in various parts of the country concerning the utilization and control of water for such purposes as power development, navigation, irrigation and municipal supply. This committee will need correspondents to aid it in keeping informed or in asking special investigations about local laws and policies.

Engineers who are able and willing to take some part in this service for the profession should communicate with Alfred D. Flinn, secretary of the Engineering Council, 29 West Thirty-ninth Street, New York.

DISCUSSION ON LICENSING ENGINEERS

At the regular meeting of the Engineering Council on June 20 a special report by the public affairs committee on the licensing of engineers was debated at length. It was decided to create a small special committee to study this important question thoroughly with a country-wide view. It is intended that through the work of this committee the Engineering Council shall in due time be prepared to advise engineering organizations in any of the states upon this much discussed matter. Engineers who have knowledge of proposed legislation are requested to communicate with the secretary of the Engineering Council. Information or rumor has already been received of possible action by the Legislatures of Iowa, Ohio, Indiana and Michigan. A few states have passed laws.

The fuel conservation committee has been working with the Fuel Administration and the Bureau of Mines, particularly in consultation on questions of policy.

A committee on Americanization activities was authorized for the purpose of co-operating with the National Americanization Committee and the Bureau of Education of the Department of the Interior. The council was requested by Miss Frances A. Kellor, special adviser to the Bureau of Education, to appoint such a committee to co-operate in the war-work extension in an advisory capacity, especially in educational propaganda among mechanics and laborers with whom engineers come in contact.

Upon receiving a telegram from Boston engineers that the Legislature of Massachusetts was expected to pass a bill abolishing the Public Service and the Gas and Electric Commissions and substituting a Public Utilities Board, the Engineering Council passed resolutions, in part as follows, which were sent to Governor McCall:

> Whereas experience has shown that engineering training, combined with special knowledge of organization and experience therein, is of great advantage to the public and should be associated with business capacity and tact for the efficient discharge of the duties of a public utilities board, be it therefore
>
> Resolved, that the Engineering Council suggests the advisability of the appointment to membership on your board of at least one engineer who is qualified by training and experience for such duties as may be required of the members of such a board.

The recent meeting completes the first year of the council's activities.

Possibilities with Higher Steam Pressures

With Steam at 800 Lb. Pressure and 800 Deg. Fahr., 1 Kw.-hr. Can Be Produced on 11,750 B.t.u.—Sufficient Superheat to Reduce the Condensation in the Turbine to a Practicable Minimum Is Found Advisable

BY ESKIL BERG
Engineer Turbine Department General Electric Company

IN DEVELOPING the steam turbine the designer has constantly had higher efficiency in view and in this respect has succeeded to the extent that to-day turbines are in operation having a thermodynamic efficiency of almost 90 per cent. While this already high efficiency may be improved by a small percentage in the future, it will be necessary to look to other parts of the power plant for substantial gains in fuel economy. Such gains can be made by increasing the temperature range of the steam, but as the lower range is fixed by the temperature of the cooling water, the gain must be made by going to a higher initial temperature. This can be accomplished by the use of higher steam pressure, by the application of superheat or by a combination of both.

The theoretical gain obtainable by the use of higher steam pressures is illustrated in Table II, in which case 1 lb. of dry steam at 200 lb. pressure (14.1 kg. per sq. cm.) expanded to 28½ in. (72.39 cm.) of vacuum is considered unity. It will be seen that by raising the boiler pressure to 500 lb. (35.15 kg.) there is a saving in fuel of 14.43 per cent. In money this saving would amount to about $200,000 a year in a plant burning about 900 tons a day with coal at $5 a ton.

Table III shows the theoretical gain by superheat. The table is calculated on the basis of an initial pressure of 250 lb. (17.6 kg.) gage expanded to a 29-in. (73.66 cm.) vacuum. It will be seen that the theoretical gain is small, being only 2.9 per cent when superheating up to 300 deg. To this, however, must be added the practical benefit of using superheat. This is often expressed by saying that the water rate is reduced 1 per cent for a certain number of degrees of superheat. The amount of this decrease varies with turbines of different design, but a figure frequently used is 1 per cent gain in water rate for every 12.5 deg. increase of superheat. Column 5, Table III, is based upon this assumption. The actual net gain of fuel in per cent is therefore shown by column 8, which is the difference between column 7 and column 4. The practical gain by superheat is about two and one-half times as great as the theoretical, the reason being that in a well-designed turbine of, say, the impulse type the magnitude of the total losses is about the following proportions when dry initial steam is used:

	Per Cent
Loss due to friction in nozzles and blades and windage loss of disks and blades	20
Leakage loss . . .	3
Rejected energy (due to residual steam velocity)	3
Bearings, packing, etc	1
Total losses . . .	27
Efficiency of turbine . .	73

From the preceding table it may be seen that the first item is by far the most important, and it is this one that is reduced by the use of superheat. The use of 200 deg. superheat will reduce the friction and windage loss about one-quarter, or to 15 per cent, and the total loss would then be 22 per cent, making the turbine efficiency 78 per cent. This reduction is effected by the superheat reducing the moisture in all the stages. The reduction is best shown by entropy-temperature dia-

TABLE I—THEORETICAL WATER RATES PER KW.-HOUR
(Heat Values from Marks & Davis' Steam Tables)

Supht. Deg. F.	26 in.	27 in.	27.5 in.	28 in.	28.5 in.	29 in.	26 in.	27 in.	27.5 in.	28 in.	28.5 in.	29 in.
	150 lb. gauge						160 lb. gauge					
0	11.80	11.23	10.92	10.55	10.12	9.59	11.68	11.10	10.79	10.43	10.01	9.50
25	11.61	11.05	10.74	10.38	9.96	9.44	11.45	10.91	10.61	10.28	9.85	9.34
50	11.42	10.87	10.58	10.22	9.81	9.30	11.28	10.75	10.45	10.11	9.70	9 21
75	11.24	10.71	10.41	10.07	9.66	9.17	11.10	10.58	10.29	9.95	9.56	9.07
100	11.07	10.55	10.26	9.92	9.52	9.03	10.92	10.41	10.13	9.80	9.42	8.94
125	10.90	10.38	10.10	9.77	9.38	8.90	10.75	10.25	9.98	9.66	9.27	8 81
150	10.75	10.23	9.96	9.63	9.25	8.78	10.60	10.10	9.84	9.52	9.15	8.69
	165 lb. gauge						170 lb. gauge					
0	11.57	11.03	10.73	10.37	9.96	9.45	11.50	10.98	10.66	10.32	9.91	9.40
25.	11.39	10.84	10.55	10.20	9.80	9.30	11.31	10.78	10.49	10.15	9.75	9.25
50	11.20	10.68	10 39	10.05	9.65	9.16	11.13	10.61	10.33	9.99	9.60	9.11
75	11.02	10.50	10 22	9.89	9.50	9.02	10.95	10.45	10.17	9 84	9.45	8.98
100	10.85	10.35	10 08	9.75	9.37	8.89	10.79	10.29	10.02	9.70	9.32	8.85
125	10 68	10.18	9.92	9 60	9.23	8.76	10.62	10.13	9.88	9.55	9.18	8.73
150	10.52	10.04	9.77	9.46	9.10	8.64	10.47	9.99	9.73	9.42	9.05	8.60
	175 lb. gauge						180 lb. gauge					
0	11.44	10.91	10.81	10.27	9.87	9.36	11.37	10.85	10.58	10.22	9.82	9.31
25	11.25	10.72	10.44	10.10	9.70	9.21	11.18	10.87	10.38	10.05	9.66	9.17
50	11.07	10.55	10 27	9.94	9.55	9.07	11.01	10.60	10.22	9.89	9.61	9.03
75	10 89	10.39	10.11	9.79	9.41	8.94	10.83	10.34	10.06	9.74	9.37	8.90
100	10.72	10.23	9.96	9.64	9.27	8.81	10.66	10.17	9.90	9.60	9 22	8 77
125	10.55	10.07	9.81	9.50	9.13	8.68	10.49	10.02	9.76	9.46	9.09	8.65
150	10.40	9.92	9.67	9.37	9.00	8.56	10.34	9.87	9.81	9.32	8.96	8.52
	185 lb. gauge						190 lb. gauge					
0	11.31	10.79	10.51	10.17	9.77	9.28	11.25	10.74	10.46	10.12	9.73	9.25
25	11.12	10.61	10.33	10.00	9.61	9.13	11.06	10.56	10.28	9.96	9 58	9.10
50	10.94	10.44	10.17	9.84	9.46	8.99	10.88	10.39	10 12	9.80	9.42	8.96
75	10.77	10.28	10.02	9 69	9.32	8.86	10.71	10.23	9.97	9.65	9.28	8 82
100	10.60	10.12	9.86	9.55	9.19.	8.73	10.55	10.08	9 82	9.51	9.15	8.70
125	10.43	9.97	9.72	9.41	9.05	8.61	10.39	9.92	9.67	9.37	9 01	8 58
150	10 28	9.82	9.57	9.27	8.92	8.49	10.23	9.77	9.53	9 24	8.88	8 46
	195 lb. gauge						200 lb. gauge					
0	11.20	10.69	10.41	10.08	9.69	9.22	11.15	10.64	10 37	10.04	9 66	9 18
25	11.01	10.51	10.24	9.92	9.53	9.07	10.95	10.46	10.19	9.87	9 49	9 03
50	10.83	10.35	10.08	9.76	9.38	8.92	10.77	10.29	10.03	9.71	9.34	8 88
75	10 66	10.18	9.92	9.81	9.24	8.79	10.61	10.13	9.87	9.57	9.20	8 75
100	10.50	10.03	9.77	9.47	9.11	8.66	10.44	9.97	9.72	9.42	9.06	8 62
125	10.33	9.87	9.62	9.32	8.97	8.54	10.28	9.83	9.58	9 28	8.93	8 50
150	10.18	9.72	9.48	9.18	8.84	8.42	10.13	9.68	9.44	9.15	8 81	8.38
200	9.86	9.43	9.19	8.92	8.59	8.18	9.81	9.39	9.15	8 88	8.55	8 15
	205 lb. gauge						210 lb. gauge					
0	11.09	10.60	10.32	9.99	9.62	9.15	11.04	10.55	10.28	9.97	9.59	9.12
25	10.90	10.41	10.14	9.82	9.45	8.09	10.85	10.37	10 10	9.79	9.42	8 96
50	10.72	10.24	9.98	9.67	9.30	8.85	10.68	10.20	9.94	9.63	9 27	8.82
75	10.55	10.09	9.83	9.52	9.17	8.72	10.50	10.04	9.78	9.48	9 13	8 69
100	10.39	9.93	9.68	9.38	9.03	8.59	10.34	9.89	9.63	9.34	9.00	8.56
126	10.23	9.78	9.54	9.24	8.90	8.47	10.19	9.75	9.49	9.21	8.87	8 44
150	10.08	9.64	9.39	9.11	8.77	8.35	10.03	9.60	9.35	9.07	8 74	8.32
200	9.77	9.35	9.11	8.84	8.52	8.12	9.73	9.31	9.08	8.81	8 49	8 10
	215 lb. gauge						220 lb. gauge					
0	11.00	10.51	10.24	9.93	9.55	9.09	10.95	10.47	10.20	9.89	9.52	9.06
25	10 79	10.32	10.05	9.75	9.38	8.93	10.75	10.28	10.02	9.71	9.35	8.90
50	10.62	10.16	9.89	9.59	9.24	8.79	10.58	10.11	9.85	9.55	9.20	8 76
75	10.46	10.00	9.74	9.44	9.09	8 66	10.41	9.95	9.70	9.40	9 06	8 63
100	10 30	9 85	9.60	9.30	8.98	8.53	10.24	9.80	9.55	9.28	8.93	8 50
125	10.14	9.70	9.46	9.16	8.83	8.41	10.09	9.66	9.42	9.13	8.80	8.38
150	9 98	9.55	9.31	9.03	8.71	8.29	9.94	9 52	9.28	9 00	8.67	8.27
200	9.68	9.27	9.04	8.77	8.48	8.06	9.64	9 23.	9.00	8.74	8.42	8 03
	225 lb. gauge						230 lb. gauge					
0	10.90	10.42	10.16	9.85	9.48	9.03	10.88	10.39	10.12	9.82	9.45	9.00
25	10.71	10.24	9.98	9.67	9.32	8.87	10.66	10.20	9.94	9.64	9.28	8.84
50	10.53	10.07	9.81	9.52	9.17	8.73	10.48	10.03	9.78	9.48	9.13	8 70
75	10.38	9.91	9.68	9.37	9.03	8.60	10.32	9 87	9.63	9.34	8 99	8.57
100	10.20	9.76	9.52	9.23	8.90	8.47	10.16	9.72	9.48	9.70	8.86	8.45
125	10.05	9 62	9.38	9.10	8 77	8.35	10.91	9.58	9.34	9.06	8.74	8.33
150	9 90	9.47	9.24	8.96	8.64	8.23	9.85	9 44	9.20	8.93	8 61	8 21
200	9.60	9.20	8.97	8.71	8.40	8.01	9.56	9.16	8.93	8.67	8.37	7.98
	235 lb. gauge						240 lb. gauge					
0	10.81	10.35	10.09	9.78	9.42	8.98	10.76	10.31	10.05	9.75	9.39	8 94
25	10.61	10.15	9.90	9.60	9.25	8.91	10.57	10.12	9.86	9.57	9.22	8 78
50	10.44	9.99	9.75	9.45	9.10	8.67	10.38	9.95	9.70	9.41	9.07	8 64
75	10.27	9.83	9 59	9.30	8.96	8.54	10 23	9.70	9.55	9.26	8.93	8.51
100	10.12	9.68	9.45	9.17	8.83	8.42	10.08	9.65	9.41	9.13	8 80	8.39
125	9.96	9.54	9.30	9.03	8.70	8.29	9.92	9.50	9.27	9.00	8.67	8.27
150	9.81	9.40	9 16	8.90	8.58	8.18	9.97	9.36	9.13	8.88	8.55	8.15
200	9.52	9.12	8.90	8.64	8.33	7.95	9.48	9.09	8.87	8.61	8.31	7.93
	245 lb. gauge						250 lb. gauge					
0	10.73	10.27	10.01	9.71	9.35	8.91	10.69	10.23	9.98	9.68	9.33	8.89
25	10 53	10.08	9.83	9.53	9.18	8.75	10.49	10.04	9.79	9.49	9.15	8.72
50	10.35	9.91	9 67	9.38	9.04	8.61	10.31	9.87	9.63	9.34	9.01	8.59
75	10.19	9.76	9.52	9.23	8.90	8.48	10.15	9.72	9.48	9.20	8.87	8.46
100	10.03	9.61	9.37	9.09	8.77	8.36	9.99	9.57	9.34	9.07	8.74	8.34
125	9.88	9.47	9.23	8.96	8.64	8.24	9.84	9.43	9.29	8.93	8.61	8.22
150	9.73	9.33	9.10	8.83	8.52	8.12	9.69	9.29	9.06	8.80	8 49	8.10
200	9.43	9.04	8.82	8.57	8.27	7.90	9.41	9.02	8.80	8.55	8.25	7.88

grams. From such a diagram it may be seen that starting with dry steam at 265 lb. (18.6 kg.) absolute pressure and expanding it adiabatically to 29 in. vacuum through a turbine of 100 per cent efficiency would result in steam of about 26.5 per cent moisture, whereas if the steam had been superheated to say 250 deg. this moisture would be reduced to about 19 per cent, a reduction of almost 30 per cent. In an actual turbine this percentage of moisture is a great deal lower, the amount depending upon the efficiency.

TABLE II.—THEORETICAL GAIN IN FUEL BY INCREASING STEAM PRESSURE

Absolute Pressure, Lb.	Corresponding Temperature, Deg. Fahr.	Total Heat	Increase in Total Heat, Per Cent.	Available Energy in Ft.-Lb. Expanding to 28.5 in Vacuum	Increase of Available Energy, Per Cent.	Net Gain in Fuel, Per Cent
200	381.9	1198.5		272,000		
300	417.5	1201.9	0.28	293,000	7.72	7.44
400	444.8	1202.5	0.33	304,500	11.95	11.62
500	467.2	1201.7	0.27	312,000	14.7	14.43
600	486.5	1199.8	0.11	319,000	17.2	17.09
700	503.4	1197.4	0.902	323,000	18.7	18.79
800	518.5	1194.4	—0.342	327,000	20.2	20.54
900	532.3	1191.1	—0.617	329,000	20.9	21.51
1000	545.0	1187.6	—0.909	331,000	21.7	22.6

Table IV gives a comparison of the condition of the steam in each stage of a ten-stage turbine using dry steam and using steam superheated to 250 deg. temperature. It is assumed that the turbine has 80 per cent efficiency, is supplied with steam at 250 lb. (17.6 kg.) pressure, and is exhausting into a 29-in. vacuum.

For determining the effect of moisture on friction a great many formulas and curves are given by various authors based upon experimental and theoretical data, and they all have a constant which varies according to the conditions of the steam. Professor Moyer, for example, in his book on steam turbines, gives a formula for rotation losses of buckets and wheel disks in which the constant is as follows:

	Constant
100 deg. superheat	0.875
50 deg. superheat	0.93
0 deg. superheat	1.00
5 per cent moisture	1.08
10 per cent moisture	1.25
20 per cent moisture	2.00

In other words, the friction loss is twice as great with 20 per cent moisture as it is with dry steam.

Throttling of dry steam always produces superheat, and it has often been said for this reason that there is practically no loss due to throttling, which is true as far as heat is concerned. There is, however, a considerable loss of available energy. The amount of superheat obtained by throttling is easily calculated because the total heat before and after throttling is the same. Assume that steam at 200 lb. (14.1 kg.) absolute pressure is throttled down to 100 lb. (7 kg.) absolute pressure. The total heat in dry steam at 200 lb. abs. = 1198.1 and that at 100 lb. abs. = 1186.3. If the specific heat of steam is taken as 0.5, then $1198.1 = 1186.3 + (0.5 \times t)$ in which t, the superheat, = 23.6 deg. The available energy, however, assuming that the steam in both cases is expanded to 28.5 in. vacuum, is, with 200 lb. pressure and dry steam, 270,800 ft.-lb. and, with 100-lb. pressure and 23.6 deg. superheat, 240,200 ft.-lb., or a loss in available energy of about 11 per cent.

High steam pressure with no superheat has the disadvantage, as may be seen from an entropy diagram, of producing more moisture through the turbine. It is therefore advisable to combine high pressure with superheat so as to produce a more efficient turbine.

With steam pressure of 200 lb. gage, 150 deg. superheat (temperature of 538 deg.) and a vacuum of 28.5 in., the present practice of turbine plants in this country, the ratio of maximum available heat for work to the total heat is only about 31.25 per cent. In Europe, however, steam temperatures as high as 700 deg. Fahr. are now used (corresponding to a steam pressure of 500 lb. and 233 deg. superheat), so the ratio of available heat is about 36.3 per cent there. This permits a fuel saving of 16 per cent compared with conditions in this country.

Turbine-generator sets are now built having an overall efficiency of more than 80 per cent, including generator losses, which with a boiler efficiency of 80 per cent would give an efficiency from fuel amounting to $36.3 \times 0.80 \times 0.80 = 23.26$ per cent. Since 1 kw.hr. = 3412 B.t.u., the B.t.u. required to produce 1 kw.-hr. at the switchboard $= 3412 \div 0.2325 = 14{,}675$. On the other hand, if 800 lb. pressure and 800 deg. temperature are used, the efficiency will be 38.75 per cent; so that with a turbine efficiency of 85 per cent and a boiler efficiency of 88 per cent (obtainable with liquid fuel, forced draft and preheated combustion air) a kilowatt-hour could be obtained on $38.75 \times 0.88 \times 0.85 = 29$ per cent, or $3412 \div 0.29 = 11{,}750$ B.t.u. This is equivalent to $11{,}750 \div 19{,}000 = 0.62$ lb. of fuel oil per kilowatt-hour.

Diesel-engine advocates now claim about 0.55 lb. of fuel oil per kilowatt-hour, but this is obtained only with a fuel about 50 per cent higher in price than that which can be satisfactorily burned under a boiler. It may thus be seen that when full advantage has been taken of the various processes that are used in transforming the energy of the fuel into mechanical energy through the medium of steam the steam process compares quite favorably with results obtained at the present time with internal-combustion engines.

TABLE III.—EFFECT OF SUPERHEATING STEAM WHEN WORKING BETWEEN 250 LB. GAGE AND 29 IN. OF VACUUM

Degree Superheat	Temperature, Deg. Fahr.	Total Available Energy per Lb. of Steam	Total B.t.u. per Lb.	Per Cent. Increase in Coal to Produce Superheat	Per Cent. Increase Available Energy Due to Superheat	Net Theoretical Gain, Per Cent.	Actual Gain, Per Cent.	Actual Net Gain, Per Cent.
(1)		(2)	(3)	(4)	(5)	(6) = (5—4)	(7)	(8) = (7—4)
0	406	298,000	1202.3	..	.	..	..	
50	456	308,500	1237.0	2.89	3.53	0.64	4.00	1.11
100	506	318,000	1264.6	5.18	6.72	1.54	8.00	2.82
150	556	327,500	1290.5	7.33	9.90	2.57	12.00	4.67
200	606	336,000	1315.6	9.45	12.75	3.30	16.00	6.55
250	656	341,500	1340.5	11.50	14.60	3.10	20.00	8.50
300	706	347,000	1365.3	13.55	16.45	2.90	24.00	10.45

In a discussion of this subject which took place at a joint meeting of the Western Society of Engineers and the Chicago sections of the American Society of Mechanical Engineers and American Institute of Electrical

Engineers lately questions arose as to the practicability of obtaining piping and equipment that will withstand higher pressures and superheats, whether the increased cost of the equipment will keep pace with the gain in economy, the probability of higher radiation losses, the possibility of superheat high enough to give dry steam at the turbine exhaust, the possible advantages of resuperheating the steam for the lower stages with the waste heat from the boilers, and the interference of economizers in obtaining the theoretical advantages from higher pressures and superheat.

To show that the design of equipment for the higher pressures mentioned is not impracticable the author referred to the case of De Laval, in 1817, supplying all the electrical energy for lighting the Exposition of Arts and Industries in Stockholm with turbo-generating sets operated from boilers of his own design using over 1500 lb. pressure. Of course the units were small, four being rated at 100 hp. and two at 50 hp. each.

TABLE IV.—QUALITY OF STEAM IN TEN STAGES OF A TURBINE, STARTING WITH DRY STEAM SUPERHEATED 250 DEG.

	Stages									
Quality of Steam	1	2	3	4	5	6	7	8	9	10
Dry initial, per cent. moisture	4.4	6.8	8.15	9.8	11.5	13	14.5	16.0	17.3	18.7
250 Deg. Superheat:										
Deg. superheat	160.0	120.0	75.0	30.0						
Per cent. moisture					0.6	2	4.0	6.5	8.0	10.5

To get dry steam at the exhaust in the average turbine would require excessive superheat. Enough superheat to reduce the moisture to 5 or 6 per cent at the turbine exhaust is about the practical limit.

The author holds that the cost of high-pressure equipment will be less than that of present equipment. This applies particularly to the boiler. Smaller tubes can be used, say of 1-in. (2.54-cm.) diameter, and the boiler can be smaller, lighter and cheaper than boilers carrying the lower pressures of to-day. All auxiliaries would have to be redesigned, and it would probably be best to eliminate joints and weld the piping system solid.

There would be a little more moisture from condensation at the casing. The use of the flue gases for resuperheating the steam for the lower stages would necessitate splitting the turbine into two elements, so that the residual velocity would be lost, causing a drop of 5 or 6 per cent in efficiency. It would also introduce undesirable complications. However, there might be a gain in using an oil-fired superheater for the purpose, allowing the gases to pass into the boiler.

Electricity for Rural Districts in Sweden

United States Consul Wallace J. Young, stationed at Gothenburg, Sweden, reports that owing to the scarcity of fuel and illuminating oils the possibility of further utilizing Sweden's hydroelectric power is receiving serious attention. In many rural districts electric power and lighting are already in use, and this use is constantly increasing despite the difficulty of obtaining copper for the transmission lines. Recently there was a meeting of representatives of several associations for the distribution of electrical energy and delegates from farmers' credit funds, at which it was resolved to invite all the Swedish rural societies of this character to organize a central association.

COMING APPROPRIATIONS FOR THE PANAMA CANAL

Estimates for the Next Fiscal Year Call for a Total Expenditure of $1,731,129.54 on Electrical Equipment and Labor

Estimates of appropriations for expenditures on electrical labor and electrical supplies and equipment for the maintenance and operation of the Panama Canal and for use in the Panama Canal Zone for the fiscal year ending June 30, 1919, amount to $1,731,129.54, which is divided as follows:

PANAMA CANAL MAINTENANCE AND OPERATION		
Wages and salaries, electrical division		$590,000
Maintenance of equipment:		
Generating equipment		241,000
Electric lighting equipment		136,500
Electrician supplies (not otherwise stated)		55,900
Wire and cable		103,265
Wire covered and coated		108,925
NEW PROJECTS, ELECTRICAL DIVISION		
One 4500-kw. generator for hydroelectric station at Gatun		125,000
Two 66,000-volt transmission feeders, with equipment (hydroelectric station to Gatun substation)		50,000
One 8400-kva. transformer (Gatun substation)		40,000
One 5000-kva. synchronous condenser (Balboa substation)		60,000
Four 2200-volt distribution feeders, substation equipment		12,000
Auxiliary hook for hydroelectric crane		2,000
Miscellaneous additions and alterations to plant not chargeable to the cost of power		25,907
30-ton traveling chain hoist (Gatun substation)		5,000
Belt-driven governors for hydroelectric units Nos. 1, 2 and 3		3,500
Underground cables and extensions to duct system:		
Mindi cable	$12,000	
Extension to New Cristobal	20,000	
Cable to Corozal	4,000	
Cristobal (rearrangement)	13,000	
Cable to New Culebra	15,000	
Feeder to Ancor Hospital	20,000	
Total		84,000
Changes from overhead to underground distribution:		
Ancon-Balboa	$15,000	
Pedro Miguel	3,000	
Gatun	2,000	
Cristobal	8,000	
Total		28,000
Extensions to street-lighting systems:		
Corozal	$3,850	
Colon Beach and hospital	11,000	
Paraiso	7,500	
Red Tank	5,000	
Total		27,350
CANAL ZONE SANITATION		
Electric power, repairs and installations, electric division		6,000
CANAL AND CANAL ZONE CIVIL GOVERNMENT		
Electric energy and repairs, electric division		75.00
Postal service		900,00
Electric signaling and lighting equipment for police launches		125.00
Electric fire-alarm system		4,000.00
PANAMA CANAL FORTIFICATIONS		
Manufacture and test of ammunition, heating, lighting and electric materials		3,705.44
Artillery, electric supplies		785.15
Submarine mines, electric supplies		2,691.95
Fire control, submarine cable and reels		2,500.00
Aerial and underground cable		1,500.00
Power equipment (including generators, storage batteries, switchboard, etc.)		500.00
Construction and other material, including wire, poles, dry cells, etc		5,000.00
District signal stations, including all radio and visual signaling equipment		5,000.00
Grand total		$1,731,129.54

In addition is the electrical work on some army cantonments, one (contract let) to cost $1,663,628 and the other to cost $290,932.

The Engineering Profession in Warfare

How American Engineers Have Responded to the Call of the Nation—Military Needs That Have Been Met—Engineering Plays an Important Part from the Front of the Army to the Rear

BY GEN. WILLIAM M. BLACK
Chief of Engineers United States Army

Following is part of the address made by General Black before the Atlantic City convention of the American Institute of Electrical Engineers on June 27. While recognizing the great services of engineers in the war, General Black also made some constructive criticisms in advocacy of the broadest possible education of men preparing to enter the engineering professions.

ENGINEERING in warfare has always been essential, and it is even doubtful whether the science of engineering does not owe its birth to the works of war. An engineer myself, I would be the last to belittle the work of our profession. It is a matter of pride that the men of our profession, because of the nature of their employment in time of peace, are, of all the civil professions, most prepared to serve the country in war; but to serve the country adequately in war the engineer must add to his peace equipment for professional work. There would be a great amount of effort saved if our people recognized more clearly the existence of the technicalities of the profession of arms. The government in Washington is simply deluged with suggestions and so-called inventions for the winning of the war. The records show that about ninety-eight per cent of all these are without military value and that time and labor have been thrown away by men eager to help but entirely ignorant of the history and conditions of warfare.

THE PART THAT ENGINEERS ARE TAKING

The part which engineers are now playing in the war is a very great one. The records of the American Institute of Electrical Engineers show that out of a total membership of 9370 there are 850 in the service, or 9.1 per cent of its roster. The American Society of Civil Engineers, with 8573 active members, has 14½ per cent in the service. The American Institute of Mining Engineers has 10.4 per cent, and the American Society of Mechanical Engineers 10.1 per cent. But these records are not complete. At the outbreak of the present war there were in the Engineer Corps of the regular army about 300 officers and approximately 3500 enlisted men. At the present time there are about 8000 commissioned officers and 200,000 enlisted men, made up of men formerly engaged in works of an engineering character. It is probable that this does not represent much more than one-half of the number of the profession now serving in the army.

Let us consider the nature of the work of the engineer, passing from front to rear of the army. First in importance is the work of the sappers. They go before and remove obstacles, clearing away obstructions, building bridges and roads, making the trench systems complete, mining, providing light, water, lines for supply (light railways or roads) and military mapping. In this category enter practically all of the branches of the profession. Further to the rear are found the construction and operation of railways; road and bridge construction; the construction of veritable towns for supply depots, with all their accessories, drainage, sewerage, lighting and water supply; construction of quarters and of hospitals; and furthest to the rear; the construction of the ports of debarkation with their wharves, storehouses, railway lines, yards and shops, all with their sanitary systems. Separate from these activities, but necessary for their supply, are the forestry troops who turn the growing timber into lumber of the dimensions required for the various services. Locomotive and car-shop also are performing essential services. Topographic corps, sound-ranging corps and camouflage corps are also among the varied activities of the engineers.

What preparation is required for the fulfillment of these varied duties? For the actual technical work of construction or installation the civil training of the engineer should prove sufficient where the plans which embody the military features have been prepared or when the military technique has been learned and assimilated. A fundamental of this military technique is that the time element is to be considered rather than money cost and that the work must be done with whatever materials are available.

What have the engineers done? War was declared April 4, 1917. By the middle of July nine regiments of railroad engineers had been raised and organized and two had actually started for France. In each regiment were two officers of the Corps of Engineers of the regular army, the colonel and the regimental adjutant. The remaining officers were all from the Engineer Reserve Corps, some receiving their commissions only when on the point of sailing. Of course, few of the officers had had any previous military training and the tasks of organization were most difficult. Since then there have been organized five corps regiments, consisting of sapper, searchlight and sound-ranging troops; forty-three regiments and trains; two mounted battalions and trains; five pontoon trains; four inland-waterway companies; forty railway regiments and battalions, including all classes of standard gage and light railway troops necessary for the construction, operation and maintenance of railways; one railway transportation corps; one highway regiment; one gas and flame regiment; one gas training service; five forestry and auxiliary forestry regiments; one surveying and printing battalion; one military mapping service; two supply and shop regiments; one water-supply regiment; one quarry regiment; one mining regiment; one electrical and mechanical regiment; two crane-operating companies; one camouflage battalion; eighteen truck and auto companies, and forty-four depot detachments. The greater part of these organizations are now overseas. Some are serving with the British army, some with the French, but the majority are with our own troops, in service both at the front and in the rear.

Features of Industrial Motor Control

Important Functions of Controllers in Modern Plant Equipment—Apparatus for Use With Small Motors Should Fulfill Requirements Without the Necessity of Much Attention

BY C. E. CLEWELL
Assistant Professor of Electrical Engineering, University of Pennsylvania

ALTHOUGH the control equipment for industrial motors is commonly looked upon as a means for starting and stopping machinery or adjusting its speed, a more general view indicates that it often has to care for many other operating functions. For example, the controller may have to insure safety to machine-tool operators, afford a convenient method of remotely controlling the driving mechanism, permit automatic disconnection of the motor in case the supply voltage fails, or limit the amount of load which can be thrown onto a motor.

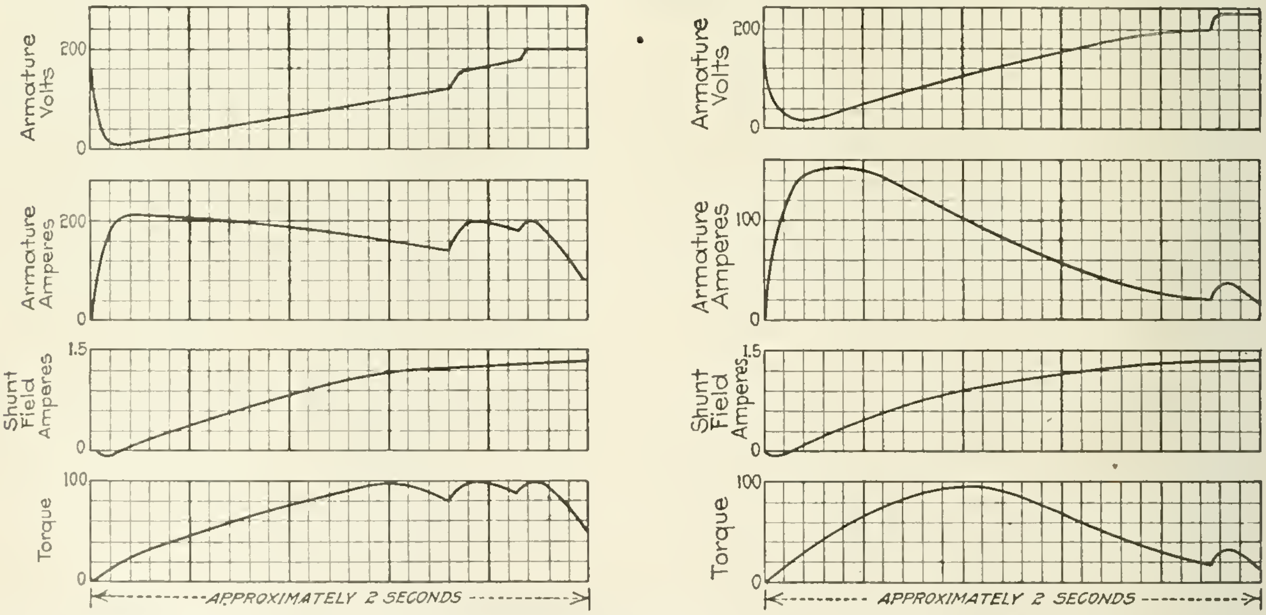
Starting Characteristics

In general, the selection of the control for small motors does not receive the same degree of attention nor is it likely to receive so much care in every-day operation as would be expected in connection with larger motors and control apparatus. However, the starting characteristics of small motors deserve a sufficiently close study so that they and their starting equipment shall not be overlooked in favor of the larger units.

One of the most interesting studies in connection with the starting of motors up to 15 hp. and 20 hp. was reported recently by H. D. James.[1] Certain references are made here to that report. Mr. James points to the fact that in the earlier days of the direct-current motor much care was necessarily taken in starting motors and also in changing their speed in order to prevent bad sparking or flashing. For the purpose, therefore, of keeping the current change small per step of the controller, a fairly large number of steps were employed for the starting rheostat. The adoption of the common face-plate starter followed, which, from the mechanical standpoint, can readily be arranged for a large number of starting steps. Many starting steps are required because of the tendency of such starters to arc and burn at the contact points if the current change per step is unduly large.

Changed Conditions Due to Improvements

Marked improvements both in motors and in controllers have changed some of the older limitations. As Mr. James points out in his report, the permissible starting currents for modern motors are not so likely to be limited by the effect they have on supply voltages as formerly, since small and even medium-sized motors can be started with twice full-load current or more without disturbing the supply voltage to any extent. However, there are applications where the starting current must be more carefully considered, as in the operation of elevator motors, certain power devices in public buildings, and especially printing presses and paper-making machines, where a relatively slow start is required and consequently a more unusual controller.



FIGS. 1 AND 2—OSCILLOGRAPH CURVES FOR A 20-HP., 230-VOLT SHUNT-WOUND DIRECT-CURRENT MOTOR WITH A "TWO-STEP" STARTING RESISTANCE, AND SIMILAR CURVES FOR THE SAME MOTOR BUT WITH A "ONE-STEP" STARTING RESISTANCE (JAMES)

The report mentioned before refers to the present successful operation of direct-current series and compound motors up to 20 hp. without the use of any external resistance for starting, and of shunt motors up to 15 hp. connected through drum controllers arranged to short-circuit the starting resistance in one step. Numerous oscillograph curves are given, among which those shown in Figs. 1 and 2 give the torque, field and armature current and armature volts of a 20-hp. shunt direct-current motor under starting conditions with a two-step and with a one-step controller respectively.

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[1] *Transactions A. I. E. E.*, Vol. 36, p. 253.

A comparison of Fig. 1 with Fig. 2 shows a somewhat higher current inrush with the one-step device, although it is not excessively greater. The higher value in Fig. 2 is undoubtedly due in large measure to the use of a 1-ohm starting resistance, whereas the starting resistance in Fig. 1 was 1.35 ohms. The tests on which the curves of Figs. 1 and 2 and numerous others were based have led to several conclusions which bear closely upon the control problem for motors of the smaller power sizes, and which may be outlined as follows:

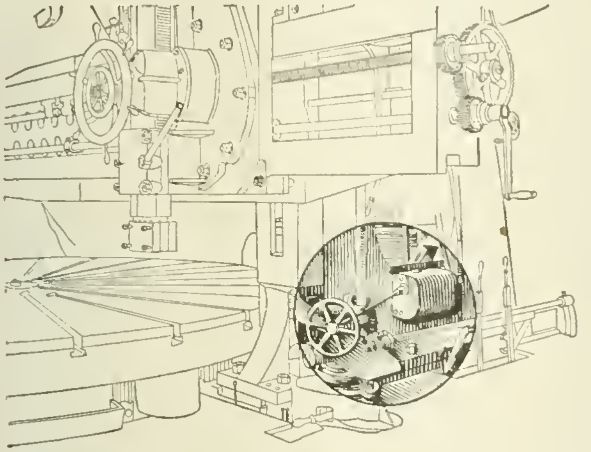

FIG. 3—BORING MILL OPERATED BY ONE 50-HP. AND TWO 15-HP. MOTORS

Note the controller with the extension handle and hand wheel.

1. With automatic acceleration it seems practicable to short-circuit the external armature resistance in one step for small motors except in certain special cases, this statement applying to sizes up to 15 hp.[2]
2. With a small or a zero value of the motor field at the start, the starting torque at the instant the switch is closed is also zero or a very small value, and it increases gradually, as indicated in Figs. 1 and 2, so that the motor and its load are not subject to undue mechanical stress as the lost motion is taken up.
3. The shunt field of small adjustable-speed motors may be reduced in one-step under normal load conditions, without a likelihood of excessive torque or current, for motors up to 50 hp. (Mr. James points out that practically all machine tools are started light, and since under this condition successful starting can be accomplished with the minimum strength of field, the field relay may be omitted. Thus it is possible to use the same controller for constant-speed and adjustable-speed motors, the latter merely being supplied with a separate field rheostat.)
4. The adjustable-speed motor may be dynamically braked with one step of resistance since the change in field strength tends to maintain a constant braking current over quite a range of speed.
5. The use of a fluttering relay is not advocated for hand-operated field rheostats unless a transfer relay is also employed for reversing its action when the motor regenerates.
6. The time required to accelerate to 95 per cent of normal speed did not exceed three seconds in the given tests and hence involves very short time intervals.

OTHER VIEWS

The six points enumerated refer to a limited series of tests, but the opinions expressed are based on a wide experience in the controller field. The discussion which resulted from the paper referred to was in some cases adverse, but in the main the general conclusion at which one is forced to arrive is that the principles enumerated by Mr. James on a basis of these tests are verified to a considerable extent by the performance of numerous installations. In one case exception is taken to the statement that machine tools practically always start light, since even where this may be the general rule nearly every motor and control installation is subject at certain times to starting conditions under load. Other cases occur where the motor must always start under load, the reciprocating pump being cited as an example. Obviously, counter-emf. contactor-switch controllers set for proper starting under light load will permit a larger peak of current than is indicated in the curves of Figs. 1 and 2[3], if subjected to full-torque starting, so readjustment is necessary under the latter condition.

In the cases of punches, presses, shears and most wood-working machinery and other high-speed motor drives R. G. Widdows points out that three acceleration contactors are usually required up to sizes of 15 hp., 220 volts, four from 20 hp. to 30 hp. and five for larger motors. In commenting on the use of one step of dynamic braking resistance for adjustable-speed motors he calls attention to the fact that the armature current during dynamic braking will remain fairly constant if the armature slows down at about the same rate as the field flux increases. It follows, of course, that if the field flux increases more rapidly than the armature speed falls off peaks will result in the dynamic braking current.

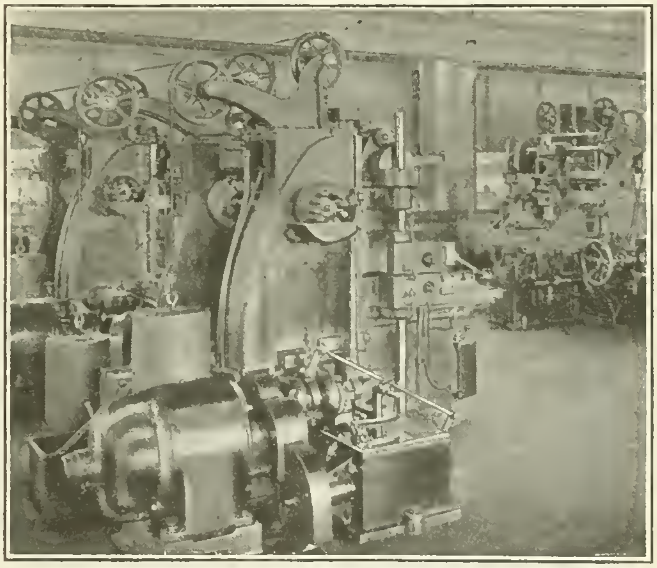

FIG. 4—A GROUP OF MILLING MACHINES EACH DRIVEN BY A 10-HP., 700-R.P.M. MOTOR

Note the location of the controller for the machine to the left, also clearance above the machine tools.

Finally, the same author points to the slower acceleration resulting from the elimination of the field relay (see the third conclusion above based on the paper by H. D. James) as a handicap on production. This point is well taken, since the one great feature of motor drive is that of increasing production in every possible way. Hence, to the extent that curtailed acceleration affects production adversely, the omission of a field relay can hardly be looked upon as an advantage despite the tendency which such a step has to simplify the controller equipment for joint constant-speed and adjustable-speed motor uses. Nevertheless, every step which leads to greater simplicity in controller design should be looked upon as a step forward in the economical development of industrial motor applications.

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[2] These points are derived from Mr. James' paper previously referred to, and while some of the conclusions have been the subject of adverse criticism, they are recorded here for the consideration of the reader.

[3] From discussion of C. T. Evans, *Transactions A. I. E. E.*, Vol. 36, p. 300.

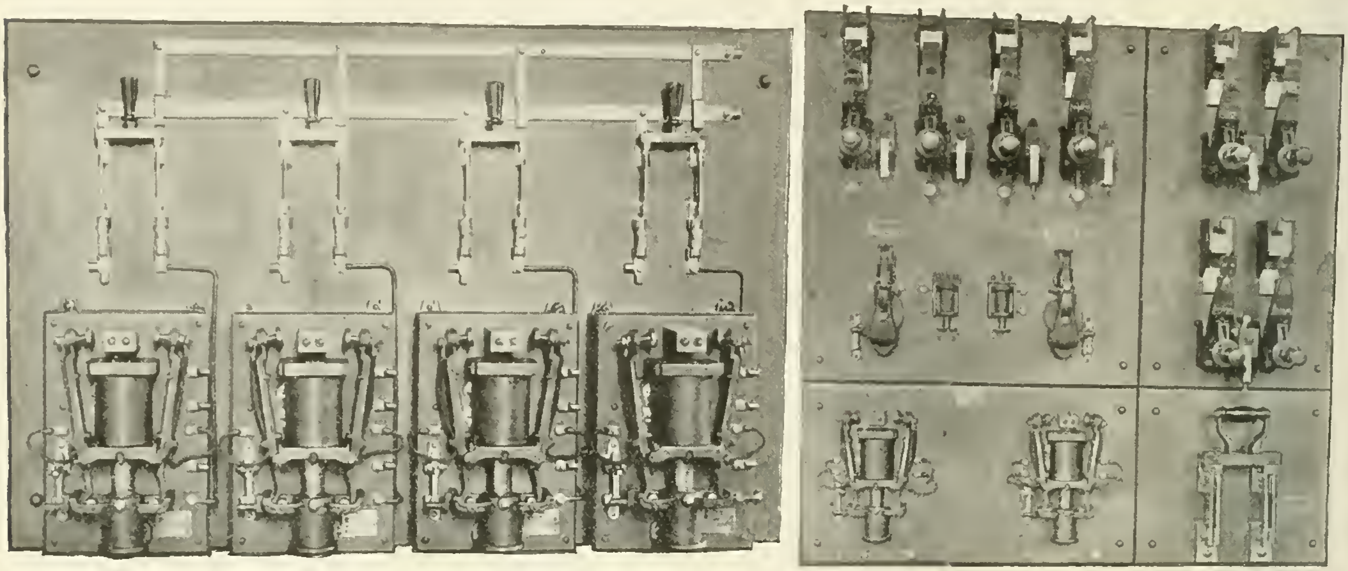

FIG. 5—CONTROLLER PANELS USED IN A BAKING FACTORY

VALUABLE POINTS OF REMOTE CONTROL

Remote control possesses some unusually important aspects from the practical operating standpoint. For example, motor-driven emery wheels are sometimes controlled through the medium of a platform in front of the wheel. This actuates a contact that permits automatic acceleration of the motor by magnetic contactor switches only at such times as the operator is standing on the platform. When he leaves the platform the motor is de-energized, thus preventing waste of energy.

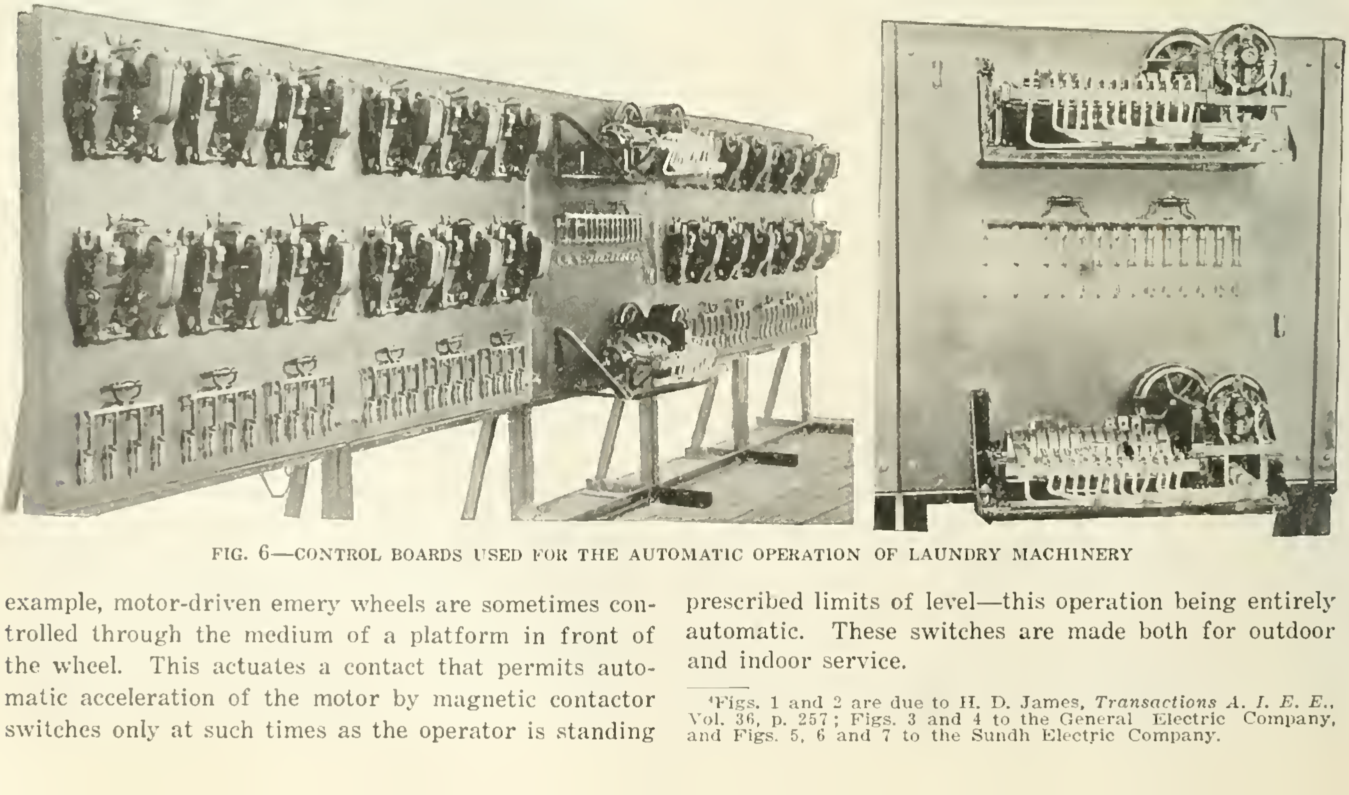

FIG. 6—CONTROL BOARDS USED FOR THE AUTOMATIC OPERATION OF LAUNDRY MACHINERY

Convenience for machine-tool operators is one of the most common and yet one of the most important reasons for placing control apparatus or handles at points near the normal position of work. The extension handle and hand wheel shown in Fig. 3 is an example of remote control applied to a large boring mill. Fig. 4 also brings out the fundamental advantage of the flexibility of arrangement with electric apparatus. In this latter case, the controller of the one milling machine to the left is shown at a convenient point in front of the machine tool, while the motor is out of the operator's way in the rear and to one side of the machine.[4]

Another good example of remote control is the use of float switches for the control of small motor-driven pumps, the pump being started and stopped by the switch at such times as to keep the water at certain prescribed limits of level—this operation being entirely automatic. These switches are made both for outdoor and indoor service.

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[4] Figs. 1 and 2 are due to H. D. James, *Transactions A. I. E. E.*, Vol. 36, p. 257; Figs. 3 and 4 to the General Electric Company, and Figs. 5, 6 and 7 to the Sundh Electric Company.

When used for alternating-current motors float switches may throw the motor directly on to the supply mains, and if used for direct-current motors they may be used to throw in a regular self-starter in the usual way. In other words, float switches may be looked upon as falling under the head of master switches. It is also possible, of course, to operate motors used for such general purposes by a push-button, knife switch, snap switch or by pressure-gage switch when the compressor or pump empties into a closed-pressure system.

CONTROL-PANEL DESIGNS

Considerable attention has been given to the plans for control-panel equipment both as regards the convenience of hand-operated switches or other devices and the general appearance of the complete outfits. Many good examples of control-panel practice might be included, but it is the purpose to include illustrations of this nature in connection with some of the final articles of this series as applied to specific installations of motor drive. The present examples are limited to several cases of control panels in a number of industries.

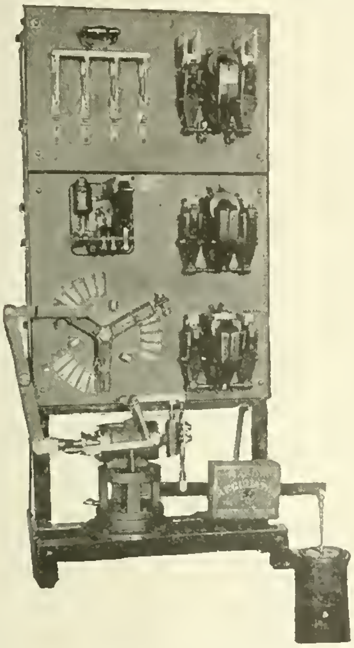


FIG. 7—AUTOMATIC STARTER WITH REGULATOR FOR VARYING AIR OR WATER SUPPLY IN BOILER-FEED OPERATION

As Mr. James aptly points out, the application of a controller calls for an analysis of the load to which the motor is to be connected and an equally careful analysis of the operating characteristics of the motor itself. The controller must, in brief, take the motor successfully through a duty cycle which is essential for the best operation of the driven machinery, and the application engineer can thus well afford to keep constantly in mind that the combined motor and its control, as a unit, is to perform a definite function in the industrial routine. Two things stand out, therefore, as of underlying importance in accomplishing the desired results. One is to plan the installation with as small an amount of apparatus as possible, and the other is to select equipment which will produce satisfactory results while requiring the least attention.

PUSHING THE ELECTRIC VEHICLE IN CHICAGO

At the N. E. L. A. Electric Vehicle Section Meeting in That City Opportune Conditions Are Pointed Out

D. E. Whipple of the Anderson Electric Car Company entertained the Electric Vehicle Section of the National Electric Light Association at a luncheon at the sales rooms of the company in Chicago recently. At a "get together" meeting problems connected with the electric vehicle were discussed.

Probable shortage of gasoline and possible prohibition of its use in pleasure cars make this an especially opportune time to push the sale of electric passenger cars and trucks. A number of persons who have had chauffeur-driven gasoline cars are either selling them or laying them up during the war and buying electric vehicles. The Anderson Electric Car Company took in forty or forty-five gasoline cars in trade for electric cars in one month.

The scarcity and inefficiency of the men looking for work in electric garages has led a number of garage owners to try women and boys for various positions. One who tried women for cleaning cars says that for the first time the cars are really clean and that he has received no complaints regarding dirty cars since the women have been employed. Another owner is trying youths of about eighteen years as "hikers," with apparent success. Others suggested the training of women for this work, although their employment late at night might not be successful.

I AM sure that every one of us, every member company, and I may indeed say the whole industry, will stand solidly behind the government in this emergency and will render every possible assistance and co-operation in the stupendous task before us of winning the war. As utility companies which enjoy local franchises and esteem the good will of the public, we are sure we have not failed to recognize in many ways our duty to our local communities. Now, as deeply concerned participants in the country's welfare and prosperity, a further and supreme duty devolves upon us and is emphasized at this time—our duty to the nation. We did not seek this war; it was thrust upon us, and to have refused the gage of battle when our national honor was at stake would have been unthinkable cowardice. Now that we are in it, we must see it through and stay in to the finish, for the war must not end until it is won, and we must win it!—*John W. Lieb, in his presidential address before the National Electric Light Association.*

Central-Station Accounting in War Time

William Schmidt, Jr., Shows that the Accountant Must Promote Maximum Economy and Efficiency in All Directions

In this paper, presented before the recent National Electric Light Association convention at Atlantic City, Mr. Schmidt, secretary and assistant treasurer Consolidated Gas, Electric Light & Power Company, Baltimore, made specific suggestions for war-time economies.

IN SPEAKING of the changes which war has brought to the N. E. L. A. accountant, Mr. Schmidt said that this company official "now finds that he is a soldier—a strategist—that his utility has taken up definite functions in the war program, that he must marshal his personnel to fit in with the great army of American manhood and womanhood that is working to win the war; that he must determine the essentials and non-essentials of his work; with military precision guide his forces into lines of endeavor that will count most toward the accomplishment of the great cause; that he must serve his company and through it his government by taking account of all facts, factors and tendencies that promote the maximum of economy, of efficiency and of both operating and financial stability of the industry as a war unit."

Progress in Accounting Efficiency

Taking up the specific subject of accounting efficiency, Mr. Schmidt referred to the work of some companies in this direction. It includes the elimination of cumbersome accounting methods and dispensing with non-essential reports and statements; establishing consolidations of accounts for the sake of simplification of work; eliminating numerous distributions of expenditures to an unnecessary aggregation of accounts; installing modern labor-saving accounting machinery; substituting standardized forms and cheaper grades of paper, cheaper binders and other stationery, and employing women throughout the accounting organization.

Mr. Schmidt is convinced that a great deal more could be accomplished along the lines of accounting efficiency. He also suggested that all central-station operating managers consider the introduction of an engineering efficiency department, saying that the time of the operating heads is usually occupied with routine business, leaving no time available for consideration of improvements leading to economies in operation.

One way to make economies in the accounting organization, said Mr. Schmidt, is for the chief executives to appoint a committee, consisting of himself as chairman and the other principal officers of the company. Have the committee instruct the various department heads to send to the chairman's office a statement showing the nature of work of each clerical employee; copies of the reports and statements; names of those to whom these are sent and the reason why they are sent to each recipient; also recommendations from the department head as to the necessity for continuing the work performed by the various clerical employees and for continuation of the statements and other suggestions.

Many questions can be raised in this way. Some of those mentioned by Mr. Schmidt are: Has the statement served its purpose and could it be dispensed with? Is it necessary to have it typewritten? If only a second copy is required, why not use an indelible pencil or a stylographic pen and insert a sheet of carbon for the second copy? Could a cheaper grade of paper be used? Is the statement or clerical operation being duplicated in some other department?

Mr. Schmidt declared that in some of the best-managed companies where this plan has been tried from 25 to 50 per cent of the expense in operating a department has been eliminated.

A number of short cuts were mentioned by Mr. Schmidt, in brief as follows:

One company in accounting for freight, expressage and drayage charges the amount of the bill to an account known as "Freight, expressage and drayage" instead of adding the cost of the freight, expressage or drayage to the unit cost of the material, and credits the account with all cash discounts allowed for prompt payment of bills, instead of taking the cash discount from the unit cost of the material. This saves thousands of calculations.

Another company, instead of adding the percentage of storeroom expense to each store order or requisition, adds the expense at the end of the month to the amount charged to each account that is charged with material issued during the month. The same company adds all overhead expense to the cost of jobs completed instead of adding the overhead monthly as is done in many companies.

Another company handling job order cost accounting posts the labor costs at the end of each pay period, whereas in many companies the labor costs are posted daily from each time ticket. The same company, instead of itemizing on the cost sheet the various kinds of material used, simply inserts a copy of the store order in an envelope bearing the job order number, and when the job is completed the amount of material used is listed on the cost sheet.

In handling customers' accounts a number of companies transfer the meter indexes and the consumption from meter readers' books to the billing sheet and from the billing sheet to the ledger. One company makes this a direct operation by posting the meter readings and the consumption to the bill and posts only the amount of the bill to the ledger. As a war measure the same company is now considering eliminating the meter indexes from consumers' bills.

One company is considering condensation of the classification of accounts.

Time in issuing checks is saved by one company through the adoption of two series of checks, one for payments up to and including $100, which require only one signature.

Clerical work on purchase orders is saved by one company by the adoption of a plan whereby all material up to and including $15 cost can be ordered in emergency by departments from local dealers without authority from the purchasing department. One company eliminates entry work in the cash disbursement book, omitting the name of the payee. Another company saves time in passing invoices for payment and taking advantage of all cash discounts by discontinuing the sending of invoices to several departments for approval.

So far as Mr. Schmidt is aware, only one company has changed from monthly to bi-monthly billings. A number of other companies came to the conclusion that the savings effected through decrease in the number of clerks and meter readers would be largely offset by the increase in worthless bills, the increase in customers' complaints and the interest on the additional working capital required.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

SERVICE INSTALLATION COMPLETED BY ONE CREW

Labor Costs Under Plan Used in St. Joseph Mo., Amount to $1.11 per Service, Including Maintenance Charge on Automobile

Handling all of the operations that go to make a customer's service installation complete in one job through the use of a single crew saves the St. Joseph (Mo.) Railway, Light & Power Company considerable money. Estimates made by the distribution department place this saving at $2 per service.

The crew, consisting of one foreman, two linemen, one groundman and one meterman, is able to string No. 6 B. & S. gage service wire to the consumer's premises, install the meter and connect the line so that energy is available in about one-half hour. The average cost of labor, including a charge of 30 cents per hour for maintenance of the crew's automobile, amounts to $1.11. The best record which such a crew ever made for installation of services in one day is sixty-five. Another advantage of this arrangement is the psychological effect upon the customer who sees the work completed by one set of men instead of by several crews with a long lapse of time between operations.

ELIMINATING OBJECTIONS TO EMPLOYEE BONUS SYSTEM

Western Plant Following This Plan Is Producing 1 Kw.-hr. with Every 2.9 Lb. of Fuel, Though Firing with Lignite Coal

One of the objections commonly raised by engineers who do not wish to establish a bonus system in the boiler room is that it tends to encourage dishonesty by the firemen. They contend that under such a system the men must be trusted to weigh coal and report all readings and that there is a tendency on their part to "juggle" the figures so that the bonus will be secured regardless of the real economy obtained.

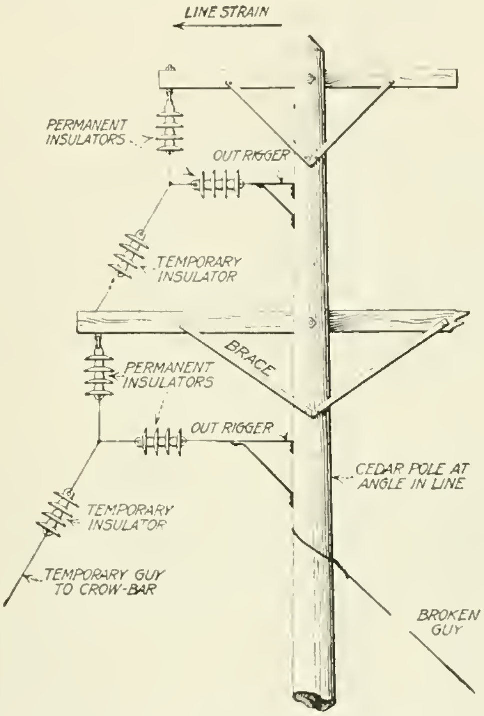
However, if the bonus is based on the weight of coal at the mine and on the kilowatt-hours delivered to the switchboard, this objection is obviated, according to a company in the West which operates an 11,700-hp. boiler room.

The men in this plant are provided with everything needed to assist in operating it efficiently. A permanent steam leak is a thing unknown. As soon as it appears a man is on the job fixing it, because in every free steam jet he sees his bonus escaping. Although the plant burns lignite, it has been possible since this system was installed to get an average economy of about 2.9 lb. of fuel per kilowatt-hour. It also keeps the men interested in the operation of the plant and creates a better feeling.

TEMPORARY REPAIR JOB ON POLE-LINE CORNER

Line Crew Effects Quick Repairs to Restore Service on High-Tension Line by Attaching Guys to Conductors

Finding the guy wire on one of its transmission-line corners broken and the line thereby grounded against the pole late one afternoon, a company in the Middle West was compelled to remedy the trouble quickly. The corners on this line are supported with strain insulators arranged at right angles, as shown in the accompanying illustration. In order to effect hasty temporary repairs temporary guy wires were installed with necessary insulators to obtain the needed right-angle position of the permanent insulators.



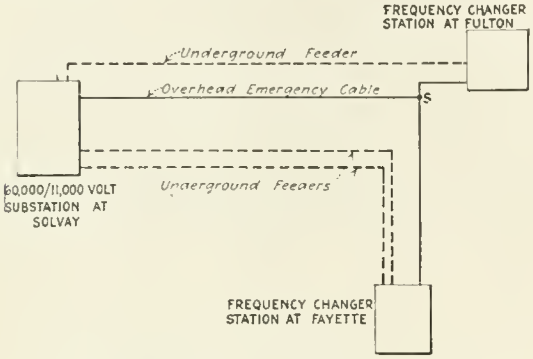
TEMPORARY GUY WIRES ATTACHED TO CONDUCTORS HELD INSULATORS IN PROPER POSITION

The top lead was easily repaired by attaching its guy to the end of the second cross-arm. The lower lead—which had given the trouble—was repaired by attaching the end of the guy wire to a crowbar driven into the frozen earth of a nearby field. This eliminated the necessity, for the time being, of righting the pole to its vertical position, which was impossible in the time available before darkness set in. In this way a serious interruption to service was prevented pending the completion of permanent repairs. The simplicity of the method and the workmanlike results obtained should recommend it to repair crews.

EMERGENCY FEEDER IS UTILIZED AS TIE LINE

Arranged so That It Can Be Quickly Changed Over for Original Purpose if Trouble Occurs on Main Lines

In using energy generated at Niagara Falls, the Rochester (N. Y.) Railway & Light Company is required to change the frequency from 25 cycles to 60 cycles. This is done at two distribution stations, designated as the Fayette and Fulton respectively, the relative positions of which are shown in the accompanying illustration. The first is connected with the Solvay substation, where Niagara energy is stepped down from 60,000 volts to 11,000 volts by two underground cables, and the Fulton station receives energy from one underground feeder. An emergency overhead cable is provided so that the step-down substation can be connected with either frequency-changer station when necessary.


FREQUENCY CHANGER STATION AT FULTON
Underground Feeder
Overhead Emergency Cable
S
60,000/11,000 VOLT SUBSTATION AT SOLVAY
Underground Feeders
FREQUENCY CHANGER STATION AT FAYETTE

USING EMERGENCY FEEDER AS TIE LINE

At present it so happens that the frequency changer at Fulton is insufficient at times to take care of the load required, whereas the rating of the frequency changer at Fayette is larger than is needed. Therefore the portion of the emergency feeder between Fulton and Fayette is utilized as a 2300-tie line, the main line being disconnected at point *S* on the diagram. This permits proper distribution of the load and eliminates the installation of machinery at Fulton and the expense of constructing a tie line. Arrangements are made so that the 11,000-volt emergency line can be switched back in case trouble occurs in the underground system.

WATT-HOUR METER REQUIREMENTS

Operative Conditions Expected by Purchasers of Alternating-Current Meters Outlined by Foreman

Some of the essential requirements of a meter, if it is to fulfill central-station needs, are as follows:

It must be accurate on all loads from a very small one (say 2 per cent of rated capacity) up to a large overload (say 50 per cent overload). This accuracy must be independent of the character of the load; that is, whether it is constant or variable or inductive. Furthermore, it should not be affected by variations in voltage, wave form or frequency or by ordinary variations in temperature or atmospheric pressure. The internal I^2R losses should be small. The potential losses should not exceed 1.5 watts, and the drop of pressure across the series coils should not be appreciable.

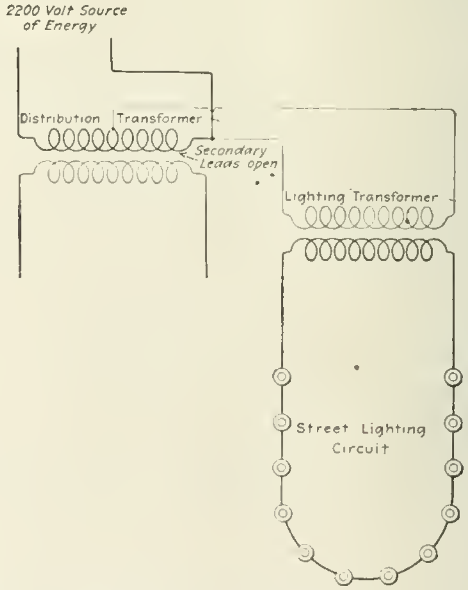
Other conditions equally important to usefulness in an integrating meter are that it should retain its original accuracy for long periods. The construction details should be such that the calibration is permanent. The meter must be dust-proof and moisture-proof to avoid possible deterioration, and it should be light in weight, compact and of a pleasing appearance so that it may be installed in any location. It must be easy to read and test, and its adjustments should be simple and accurate. The methods of hanging and connecting must be simple so that mistakes are practically impossible, yet it must be of a design well adapted to prevent tampering by unauthorized parties.

These requirements were outlined by George M. Hewitt, foreman of the meter department of the Minneapolis General Electric Company, recently.

USE OF AUTO-TRANSFORMER BETTERS THE POWER FACTOR

Distribution Transformer Connected with Secondary Open Improves Street-Lighting Circuit Conditions

After the installation of more efficient lamps on a series street-lighting system, a central station in New York State found that the power factor was very materially lowered, owing to the lower voltage at which the transformers were required to operate. This was due to the fact that the desired illumination could be secured with the more efficient lamps of the old current rating with lower voltage units. To improve conditions a distribution transformer was connected across the source of supply as shown in the accompanying diagram so that its primary acted as an auto-transformer and its secondary was open. The primary was tapped midway between the two terminals, 1100 volts being impressed upon the terminals of the lighting transformer. This greatly increased the power factor of the system and obviated the purchase of an additional step-up transformer of correct size. Of course, this connection was facilitated by the fact that the distribution transformer had 50 per cent taps on the primary.



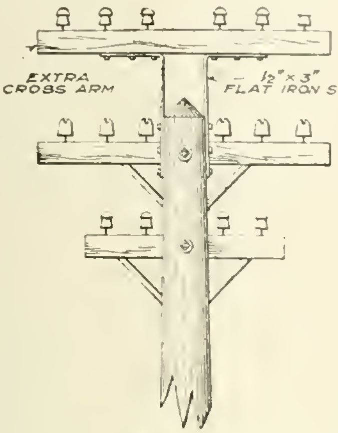
HOW AUTO-TRANSFORMER MAY HELP POWER FACTOR

EXTENSION TO POLE TOP PROVIDES FOR EXTRA ARM

Additional Conductor Space Afforded on Pole Line Without Decreasing Minimum Ground Clearance

BY FRANK HUSKINSON

Having a pole already well filled with cross-arms and requiring six additional transmission conductors to parallel this line, an extra cross-arm was attached to the pole as shown in the illustration. Flat iron strips 3 in. by 0.5 in. (7.6 cm. by 1.3 cm.) were attached to the pole near the top and bent at right angles at a suitable distance above the pole top. The extra cross-arm providing for six insulators was attached to these iron strips by means of lag screws. This scheme gave additional height to the pole and eliminated the necessity of another pole line. It has given satisfactory service on a transmission line one mile in length.



EXTRA CROSS-ARM ON POLE-TOP EXTENSION

METHODS OF IMPROVING SMALL UNDERGROUND SYSTEM

Circuits Installed in Conduit Without Manholes Prove Troublesome in Winter When Distinguishing Marks Are Lost

Until recently the underground system of the Lenox (Mass.) Electric Company consisted of a single distribution network tied together and paralleling without methods of sectionalizing. The effect of local troubles was widespread, often leading to a complete shut-down of service until the disturbance was located. The company serves a small town in the Berkshire Hills and most of the lines are underground. In order to make it possible to install such a system without prohibitive rates a conduit system was installed without manholes, the cable joints being made in 2-ft. by 2-ft. (61-cm. by 61-cm.) holes about 2 ft. deep and brought within about 2 ft. of the ground surface. The holes were provided with iron covers and were supposed to be marked by marble monuments about 18 in. (45 cm.) high. In winter it was found difficult to locate the monuments, many of which had disappeared, and at times several days would be required to localize the trouble. Lately the monuments have been replaced and a number of standard manholes have been constructed in place of the small ground openings formerly used. A considerable number of sectionalizing switches mounted in pillars above ground have been installed, and the localization and isolation of disturbances is thereby facilitated.

WIRE-TENSION BOARD FOR USE IN WINDING COILS

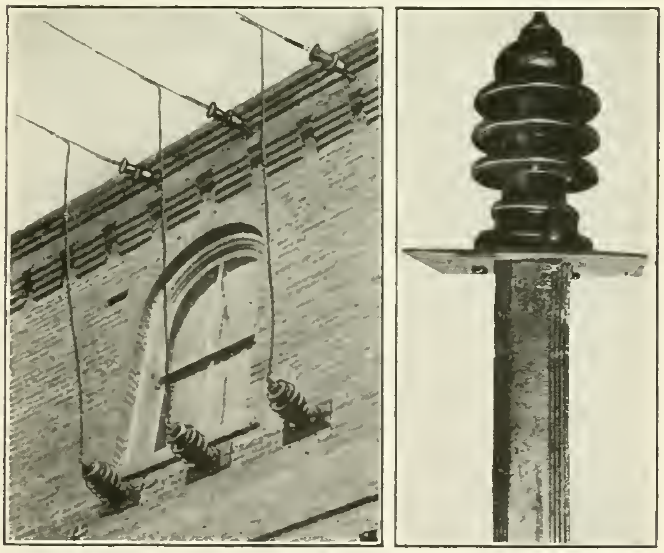
Arrangement of Spools on Board Placed Between Winding Lathe and Wire Reel Affords Flexible Device

Constant tension for coil-winding can be obtained by means of a simple device consisting of eight spools mounted on a board that is interposed between the winding machine and the reel of wire. The spools are arranged in two rows and are supported on bolts that extend through the board. Free movement of the spools is prevented by a spring wound on the projecting bolts and held in place by movable nuts. By adjusting the nuts the desired tension on each spool is had. The device is flexible because the wire may be wound around the spools in a number of ways. Triangular grooves in the wooden spools permit the use of the tensioner with practically any size of wire.

TRANSFORMER BUSHINGS USED AS WALL BUSHINGS

Utilized in an Emergency to Provide Insulation for a Temporary Feeder Which Had to Be Run Through a Brick Wall

When high-voltage leads have to be run through a building wall in an emergency which precludes securing regular wall or roof bushings, standard transformer bushings can be used with good results. The accompanying illustration shows bushings taken from two 2200-volt, 10-kw. transformers and used to insulate a temporary feeder running through an 18-in. (45.6-cm.) brick wall. Steel plates ¼ in. (6.4 mm.) thick were bolted to the wall and drilled to hold the bushings in position. In order to make a neat installation and protect the stem of the bushing, an 18-in. (45.6-cm.) standard tile was slipped over the bushings.



TRANSFORMER BUSHINGS HELD AGAINST WALL BY MEANS OF STEEL PLATE

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

THE VALUE OF CHECKS IN PAYING EMPLOYEE PREMIUMS

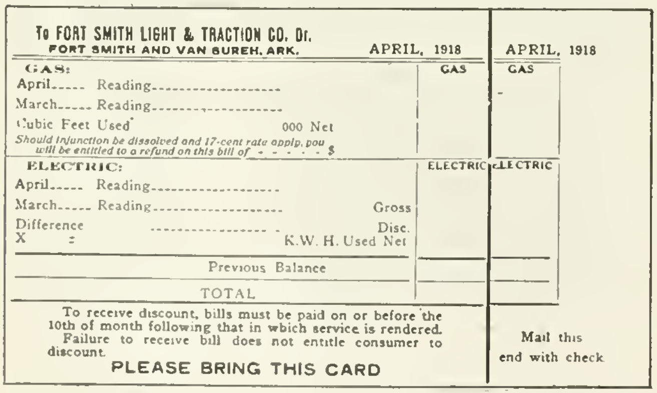
Experience Indicates that by This Means Other Employees Will Be Spurred to Action in Selling Electrical Goods

When the Public Service Company of Northern Illinois first adopted the policy of paying its employees outside of the sales department a 5 per cent bonus on all appliance sales which they made, there was not immediately a great show of interest in the plan. Many of the employees were rather slow to take up the idea as a definite method of adding to their income. It was noted on many occasions, however, that when employees who had succeeded in making a sale received their 5 per cent compensation in the form of a check they took considerable pride in exhibiting it among their fellow employees and thus created a spirit of rivalry which spurred others to interested action. As a result of the definite policy of paying these 5 per cent employees' premiums by check, interest has spread throughout the organization until now a large number are participating in the plan. John G. Learned, under whose direction the plan is being carried out, is a very strong adherent of this method of increasing appliance sales.

GAS AND ELECTRIC BILLS PUT ON SAME POST CARD

A Combination Bill Contained in Small Space—Merchandising Accounts May Be Added on the Same Form

While the post-card bill has been used rather extensively by both gas companies and electric companies, it is rather unusual to find a combination gas and electric company placing both electric and gas bills on the same post card. This practice, however, has been resorted to by the Fort Smith (Ark.) Light & Traction Company in an effort to keep its billing costs as low as possible.



To FORT SMITH LIGHT & TRACTION CO. Dr.
FORT SMITH AND VAN BUREN, ARK. APRIL, 1918 | APRIL, 1918
GAS: | GAS | GAS
April..... Reading..................
March..... Reading..................
Cubic Feet Used 000 Net
Should injunction be dissolved and 17-cent rate apply, you will be entitled to a refund on this bill of . . . . . . $
ELECTRIC: | ELECTRIC | ELECTRIC
April..... Reading..................
March..... Reading.................. Gross
Difference .... Disc.
X = K.W. H. Used Net
Previous Balance
TOTAL
To receive discount, bills must be paid on or before the 10th of month following that in which service is rendered.
Failure to receive bill does not entitle consumer to discount.
PLEASE BRING THIS CARD
Mail this end with check

COMBINATION BILL OF ARKANSAS COMPANY

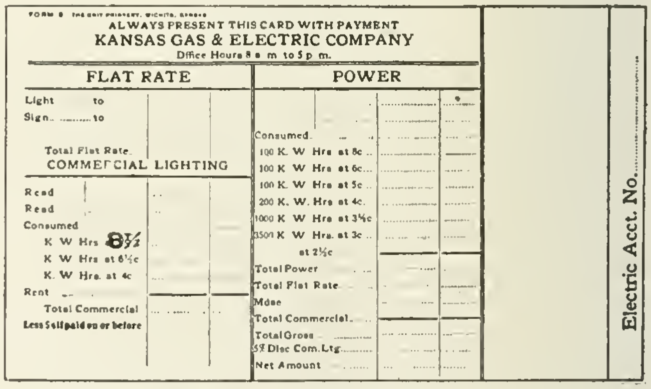
The accompanying illustration shows how the meter readings and the items indicating cost of service are arranged on the card. It is the intention of the auditing department of the company to add a place on this post-card bill later for merchandise accounts, thus further reducing the number of different forms used by the company to cut down billing expense. The company has about 4010 electric meters and 6459 gas meters, making a total of 10,469 meters in service in the two cities of Fort Smith and Van Buren which it serves.

METHOD OF HANDLING BILLING IN CITY OF 70,000

Boys Are Employed in Delivery Work—Advertising Is Wrapped Around Post-Card Bill and Used Like Transparent Face Envelope

Two youths aged about eighteen deliver the 23,000 monthly bills of the Kansas Gas & Electric Company at Wichita, a city of 70,000 inhabitants according to the 1910 census. These boys are paid from $45 to $50 a month. When they are hired they are told that the position is permanent and affords them an opportunity to work up to the next position, that of meter reader, which pays $65 a month with a 10 per cent commission on all appliance sales made.

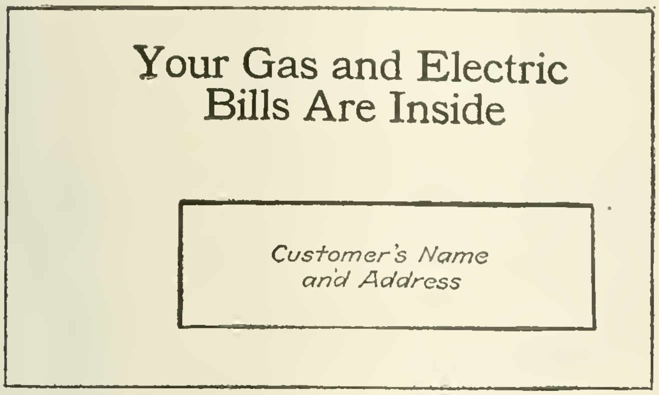
When the bills are ready for delivery they are first routed by an office girl, who at the same time wraps advertising literature around the post card on which the bill itself is made out. This advertising literature is arranged with a 1-in. by 3-in. cut-out so that the customer's name and address on the post card show through the advertising just as the name and address on a letterhead show through the face of a transparent envelope.



ALWAYS PRESENT THIS CARD WITH PAYMENT
KANSAS GAS & ELECTRIC COMPANY
Office Hours 8 a. m. to 5 p. m.
FLAT RATE
Light to
Sign.......... to
Total Flat Rate
COMMERCIAL LIGHTING
Read
Read
Consumed
K. W. Hrs. 8½
K. W. Hrs. at 6½c
K. W. Hrs. at 4c
Rent
Total Commercial
Less 5% if paid on or before
POWER
Consumed
100 K. W. Hrs. at 8c
100 K. W. Hrs. at 6c
100 K. W. Hrs. at 5c
200 K. W. Hrs. at 4c.
1000 K. W. Hrs. at 3½c
3500 K. W. Hrs. at 3c
at 2½c
Total Power
Total Flat Rate
Mdse
Total Commercial
Total Gross
5% Disc Com. Ltg.
Net Amount
Electric Acct. No.

POST-CARD BILL FORM OF WICHITA (KAN.) COMPANY

This method of combining advertising matter with the bill has been worked out as the Kansas Gas & Electric Company's solution of the problem of using the economical post-card bill and at the same time enjoying the advantage of sending an advertisment with each bill. The cost of this advertising alone is about $60 per month. Since the United States entered the war the company has made it a practice to include patriotic advertising in support of the Red Cross, the Liberty loan, "smileage books," etc., on one side of its leaflet while using the other side for promoting the use of electrical appliances.


Your Gas and Electric Bills Are Inside

Customer's Name and Address

HOW ADVERTISING MATTER INCLOSES BILL

SUBSTITUTING WOMEN FOR MEN IN UTILITY WORK

Iowa Companies Are Using Them in Meter Departments with Good Results, and Some Are Using Them for District Managers

It seemed to be the general opinion of those who spoke in the discussion at the labor session of the recent convention of the Iowa Section, N. E. L. A., that it would be good policy to secure as early as possible the women who will be needed to take the place of men to be called to the colors. Harold Boehmer of Malvern stated that he had had a woman reading meters for approximately two months and that he was well satisfied with her work. She is also delivering bills. He said she enters the homes more quickly than a man, causing less disturbance. The customers are better satisfied, as she reads the meters with greater accuracy and there is less re-reading to do than formerly.

J. W. Walsh of Burlington expressed the opinion that where organized labor was to be contended with it would be necessary to handle the question of employing women rather carefully.

M. G. Linn of Des Moines stated that his company was using some women as meter readers though still retaining a few men in the department to handle the meters which it would be difficult for the women to get to.

John M. Drabelle expressed the opinion that women could be employed successfully for meter testing and for calculating all power-house records.

A representative of the Lee Light & Power Company, Clarinda, said that the company was using women for collecting and for repairing on the customers' premises, as well as for handling all light supply work. The company has not now a single man in some of its small towns. The local manager is a woman. Arrangements have been made, however, for a man to go to each of these towns once a week. He climbs poles and does the heavy work that women are not physically able to do.

In another Iowa town it was reported that a woman is acting as local manager and has a male "troubleshooter" under her direction. This combination is working out satisfactorily. All of the companies that were employing women expressed the belief that they were more honest as a rule than men.

READJUSTING LAMP PRICES TO INCREASE HIGH RATE LOAD

Price of 30 Cents on 10-Watt Lamps and 15 Cents on 60-Watt Lamps Helps in Controlling Wattage of Lighting Installations

Realizing the importance of governing as far as possible the size of incandescent lamps for the customer's original installation and for removal purposes, a Middle Western company serving many towns has readjusted its incandescent lamp prices with a view toward increasing the wattage of lighting customers' installations. This company's former lamp schedule and its new lamp schedule, which has just gone into effect, are given in the table.

In connection with this change in prices the commercial head of the company stated that the customer should be encouraged to use either 50-watt or 60-watt lamps, preferably the latter. This can be done by establishing a lower price for that particular lamp. The result will be an increased wattage in the customer's installation, which will be reflected in increased gross income.

It was his belief that this may be accomplished without pronounced resistance since the average customer is subconsciously in a receptive frame of mind for a higher intensity of light in his home because of his frequent direct contact with lighting of high intensity while riding on street cars and while passing through well-lighted stores or sitting in modern theaters. The question of what size of lamp the customer will choose apparently resolves itself into one of salesmanship, so that those having to do with the placing of lamps with customers have an opportunity to prevail upon them to use the large lamp.

Other companies which have considered adopting some such policy as this are of the belief that the same result can be accomplished with less public antagonism by revising lamp prices and adopting a schedule wherein all lamps from 10-watt to 60-watt are sold at identically the same price. The representatives of these companies argue that the natural cupidity of the human being may be very largely depended upon to cause him to choose the larger lamp on a schedule of this kind, whereas the inverted schedule is likely to make the customer think that the lighting company is forcing the larger lamps on him against his will.

TABLE SHOWING CHANGE IN LAMP PRICES

Size of Lamp	Former Schedule	New Schedule
10-watt	27 cents	30 cents
15-watt	27 cents	30 cents
25-watt	22 cents	30 cents
40-watt	22 cents	25 cents
50-watt	18 cents	20 cents
60-watt	18 cents	15 cents

SURCHARGE METHOD USEFUL

Increases from 15 Cents per Kw.-hr. to 20 Cents per Kw.-hr. Successfully Made by This Plan

In several small cities of the Central West served by one company the top step of the rate for electric service was 15 cents. In spite of this apparently high price which the company was getting it was not able to make money enough to pay its operating expenses and was faced with the necessity of shutting down its plant or increasing the price which it knew was already high. Realizing that electricity at 20 cents a kilowatt-hour can hardly compete with gasoline or kerosene lighting, the company decided to let its base rate remain at 15 cents per kilowatt-hour and add a surcharge of 5 cents per kilowatt-hour. While this plan in effect increases the rate per kilowatt-hour to 20 cents, it also holds out hope to the customers of the company that the increase is of a temporary nature. The result is that the rate increase has gone into effect and not many customers have asked to have their service discontinued. The manager of the property is certain that if a straight increase in rates to 20 cents per kilowatt-hour had been made effective, the curtailment of service would have been quite disastrous.

WINNING PUBLIC BRINGS COMPANY INCREASED INCOME

Newspaper Advertising and Attention to Office Detail Under a New Manager Accomplish an Apparently Miraculous Result

One year and three months ago a combination electric light and railway company in a Southwestern city of about 20,000 inhabitants was losing money. The public was at loggerheads with the company and all of the newspapers in town were deriding it in sarcastic editorials. In fact, the whole situation was one that demanded drastic action. Then a change was made in managers. Shortly afterward things began to take a turn for the better. In a little less than one year the company was on a paying basis, and during the first four months of the second year of this new manager's tenure of office the company's earnings showed an increase of 108 per cent over the same period for the preceding year.

A discussion with the new manager of the underlying causes of the change disclosed his belief that the increased revenues are largely due to the change in public attitude. When he took the reins one of the first important things he did was to begin advertising in the newspapers, setting forth the company's point of view. This advertising was of a general good-will character, and attempted to teach the public that a utility can be in sympathy with the city it serves and is not necessarily soulless. As a result the newspapers soon desisted from the publication of sarcastic editorials, and the men who had been writing them began to admit publicly that the new manager was not "the autocratic price-boosting highbinder" they had called him upon his arrival.

Another thing which aided in winning the public was prompt and strict attention to detail in the office. Instantaneous replies to all telephone calls were insisted on. Arrangements were made so that there would be a minimum of waiting for customers who came to the office to pay bills. Repairs were effected on the tracks of the street railway where large numbers of automobiles crossed them, so that these crossings became a part of the easy-riding boulevard instead of notorious automobile-spring breakers. In addition to this, prompt attention was given to all complaints of customers at an "adjustment bureau" which was established expressly for the purpose.

The net result of this work has been that the company's earnings have taken on a satisfactory complexion and that the attitude of the public is now such that the newspapers in the city would not dare to attack it.

UNIFORMS FOR WEAR BY WOMEN EMPLOYEES WHO MEET PUBLIC

Kansas City Light & Power Company Supplies Plain Dresses at Cost of $3 Each and Launders Each Uniform Twice a Week at Cost of 25 Cents

All women employees of the Kansas City (Mo.) Light & Power Company who meet the public on the company's first-floor office and salesroom are dressed in a standard uniform. The uniforms, which are neat but plain dresses, are made of cambric with poplin collars and cuffs. The total cost of material and making is $3 per uniform. The company also provides free laundry service for these uniforms twice a week, which costs in addition 25 cents for each dress.

UNIFORM OF KANSAS CITY WOMEN EMPLOYEES

Uniforms were provided in order to prevent discrepancy in costume. Some of these girls have recently taken the places of young men. The company formerly employed boys in its lamp-renewal department, paying wages ranging from $50 to $60 a month. The boys were a source of continual trouble to the company, particularly because arguments were constantly arising between them and other youths whom customers of the company would send to the lamp-renewal department to transact their business.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Automatic Extinction of Fires in Transformer Chambers.—In a recent issue of the *Elektrotechnische Zeitschrift* an apparatus for automatically extinguishing fires which is specially applicable to transformer chambers, oil switches, etc., is described. The principle is similar to that of other forms of automatic extinguishers, except in details.—London *Electrician*, May 24, 1918.

Faults of Direct-Current Motor Windings.—GORDON FOX.—Methods of local faults and suggestions for making temporary repairs are discussed in this article. In addition common faults that occur in the armature and field windings of direct-current motors or generators are outlined and the methods of diagnosing these troubles are explained. The tests include the trouble lamp test for a dead ground, trouble lamp and receiver test for a partial ground, high-potential tests for grounds, magneto tests for open circuits, short circuits and grounds and buzzer tests for open and short circuits and grounds. The use of jumpers for repairing both lap-wound and wave-wound armatures is mentioned.—*Southern Engineer*, May, 1918.

Elementary Principles of Continuous-Current Armature Winding.—F. M. DENTON.—This article concludes with a discussion regarding the number of commutator segments and armature slots to use and the effect that the number of slots has on commutation. A schedule of winding rules applying to simplex-lap, multiplex-lap, simplex-wave and multiplex-wave windings is presented. —London *Electrician*, May 3, 1918.

Increasing the Efficiency of an Electric Generator.—CH. VALLET.—First part of a study of the heat losses of an electric generator in which the importance of ventilation is dwelt upon and air-washing apparatus advocated. The double advantage derived from ridding the air of impurities while at the same time lowering its temperature is pointed out.—*L'Industrie Electrique*, May 25, 1918.

Selection of Direct-Current Motors.—In choosing a motor for any application careful consideration should be given to the motor characteristics. The article deals with service conditions, starting and speed adjustments and direct-current connections.—*Southern Engineer*, June, 1918.

Lamps and Lighting

Industrial Lighting.—F. H. BERNHARD.—That the industries need more light for war-time conditions and that central stations can serve the country by developing better lighting are discussed under the following headings: Central stations prompt in meeting war power needs; necessity for intensive production calls for best possible lighting; improved lighting not only for war but to meet after-war conditions; function of the central station in improving industrial lighting, and offsetting the loss from daylight saving.—*Electrical Review*, Chicago, June 15, 1918.

Choice of Current for Mazda Series Lamp.—W. P. HURLEY.—The current ratings which have been most commonly used in this country were chosen to agree with those which were selected in developing arc lamps. Dealing with standardization, the writer says that the 6.6-amp. or 7.5-amp. street series lamps are best and that much of the distribution apparatus used with street-lighting systems for inclosed carbon arc lamps and Mazda B lamps is of this rating, the 6.6-amp. size predominating.—*Electric Journal*, June, 1918.

Generation, Transmission and Distribution

Control of Large Amounts of Power.—E. B. WEDMORE.—This paper contains an extensive discussion on limitation of disturbances, improvement of power factors, interconnection of stations, rupturing capacity of oil switches, rating of reactors, arrangement of busbars, transfer of load through reactors, design of reactors, and heating and stresses due to heavy currents. Limitation of disturbances is considered by several means, among them being sectionalization, use of generator, feeder and busbar reactors, and the employment of other protective apparatus such as relays.—*Journal of Institution of Electrical Engineers*, London, May, 1918.

Fuel Economy in Hand-Fired Plants.—To enable the plant owner to determine whether or not his installation conforms with the best practice and to check up his methods of operation information has been compiled in one pamphlet under the following headings: Principles to be observed in firing; features of boiler installations; stocks and breechings; feed water and fuel; steam-piping requirements, and the recording of operations.—*University of Illinois Bulletin*, April 1, 1918.

Lightning Protection for Special Transmission Lines. —G. C. DILL.—Fuses that automatically disconnect the electrolytic lightning arresters are advocated, but it is pointed out that the space taken up by the fuse and the loss of protection until a blown fuse is replaced are objections. With indoor installations the space consideration is of some importance, but on outdoor installations where space is no consideration this factor is of considerably less importance. The fuses furnished on electrolytic arresters are usually sufficiently heavy so that they will only burn out under the most severe conditions. In such cases it is necessary merely to replace the burnt-out fuse, which takes only a few moments, and then, in case of the low film, impress a voltage of about 220 across each cell through a lamp bank to build up the film. If the fuse is not present to take care of these cases, there is the possibility of serious damage or destruction of the arrester and necessity of rebuilding it and in many cases waiting for repair parts to be supplied from the factory, which would leave the arrester out of service and the line unprotected for a much greater length of time than is required to replace a fuse. Various combinations of horn gaps, choke coils, electrolytic elements and fuses on single-phase, two-phase and three-phase systems are discussed and illustrated.—*Electric Journal*, June, 1918.

New High-Speed Hydraulic Turbine.—J. Reyval.—Description of an Ascher-Wyss hydraulic turbine lately installed at the hydroelectric central station at La Vourdiat, France. This turbine has the following characteristics: (1) elevated waterwheel, facilitating the direct attachment of the electrical machines; (2) a guaranteed output of 83 or 84 per cent without drop in speed; (3) high speed and large output under variable fall, the speed remaining constant; (4) with reduced fall, because of floods, and constant speed, the variations of power are relatively small. This turbine appears to be designed for use where the fall is low and the flow very variable. It was tried with satisfactory results with three different water powers of which the heads averaged 1.6 m., 2 m. and 3 m.—*Revue Générale de l'Electricité*, June 1, 1918.

Installations, Systems and Appliances

Recent Protective Relay Developments.—E. A. Hester.—In this article temperature relays are considered. Relays are described in which mercury is used, also those of the Wheatstone bridge, search-coil type, induction and moving-coil types. Watt relays, voltage relays, reverse-phase relays and transfer relays are mentioned among other types which have been recently developed. Methods of connecting and operating them are also explained.—*Electric Journal*, June, 1918.

Rolling Mills and the Electric Drive.—L. Rothera.—The author refers to the increasing development of electric drive as compared with steam methods in rolling mills and presents some diagrams showing the relation between the power demanded and time in typical processes. The advantages of the electric drive can be summarized as follows, he says: (1) Economy of working, i.e., reduction in cost per ton of material rolled. This results from the great rapidity of working and high efficiency of the electric plant at all loads. This economy of working persists throughout the whole life of the plant. (2) Reduced space taken up, partly on account of the small size of a motor as compared with its output, and partly due to placing the motor in the most convenient position, without having to consider the run of steam pipes or the relative position of the boiler house. (3) Ease of control, such as stopping, starting or varying the speed of the drive. (4) Constant check on the power consumed; a recording instrument gives immediate information of any abnormal consumption of power, thus enabling defects to be promptly located and remedied. (5) Increased output from a given plant, resulting from the large overload capacity and constant speed of the electric motor under all conditions of load. (6) More uniform drive; the turning moment of a motor is constant for any position of the rotor, whereas a steam engine's turning moment fluctuates, depending on the position of the cranks. (7) Smaller initial cost, especially where electric power is available from a neighboring central station and additional boilers would be required in the event of a new steam engine being installed.—London *Electrician*, May 24, 1918.

Electrophysics and Magnetism

Effect of Electric Field on the Spectrum of Hydrogen; Part II.—Toshio Takamine and Usaburo Yoshida.—The authors observe that the outer components of the Balmer lines often extend beyond the unaffected neighboring lines belonging to the secondary spectrum. In other words, the branches of the affected Balmer lines cross through the secondary spectrum lines which lie near them. Judging from the phenomenon observed, which appears to show no mutual influence between the secondary lines and the Balmer lines, it seems probable that they are due to different sorts of carriers. They also refer to the observations of other investigators. —*Memoirs of the College of Science*, Kyoto Imperial University, October, 1917.

Tests of Aluminum.—An official note of the French Electrotechnical Committee gives the results of its investigation into the mechanical, chemical and electrical properties of aluminum. The Central Electrical Laboratory was intrusted with the determination of the resistivity and the temperature coefficient of the aluminum used for transmission lines, and a full account is given of the way in which its tests were made. At 20 deg. C. the resistivity of various samples, in microhms per centimeter, ranged from 2.803 to 2.971 and the coefficient of variation of resistance with temperature, between the limits of 20 deg. C. and 60 deg. C., ranged from 0.00364 to 0.00444 per cent.—*Revue Générale de l'Electricité.*

Experimental Study of Vibrations.—A. Poucholle.—The author in his investigation of vibrations describes a modification of Atwood's machine which plots experimentally a graph of vibratory motion. The paper contains numerous diagrams of the apparatus and the curves traced by it.—*Science Abstracts, Section A*, May 31, 1918 (abstracted from the *Revue Générale de l'Electricité*).

Oscillations in a Field of Force.—A. Schmidt.—The paper contains an analysis of the theory of oscillations in a variable field of irregular outline in connection with observations of terrestrial magnetism.—*Science Abstracts, Section A*, May 31, 1918 (abstracted from *Preuss. Akad. Wiss.*, Berlin, Ber. 46, 1917).

Electrochemistry and Batteries

Electric Storage Batteries.—Concluding section of an article on this subject, this part dealing particularly with the rating of batteries, maintaining electrolyte efficiency, specific gravity readings and efficiency of batteries. It is pointed out that some impurities will exist in the water used for the replacement of that evaporated, but that under no conditions should such impurities exceed the maximum limits as follows: Suspended matter, trace; nitrates as NO_3, one part per 100,000; total solids, ten parts per 100,000; calcium and magnesium oxides, four parts per 100,000; iron, 0.05 part per 100,000; organic matter, 0.10 part per 100,000; nitrates as NO_2, 0.50 part per 100,000; chlorine, one part per 100,000.—*Power Plant Engineering*, June 15, 1918.

Units, Measurements and Instruments

Variance of Measuring Instruments.—Frederick J. Schlink.—This subject is considered particularly with regard to its relation to accuracy and sensivity.

Summarizing, the author says that the factors of maximum or mean accuracy, sensitivity, variancy, etc., may be referred to the total range of graduation instead of to particular values of the measured quantity under observation to arrive at a "figure of merit" for any instrument whose characteristics are being determined.—*Journal of Washington Academy of Sciences*, June 19, 1918.

Telegraphy, Telephony and Signals

The Quenched Spark.—V. PIECK.—Abstract of a dissertation by Gottingen referring to an elaborate investigation of the phenomena associated with the quenched spark. The results obtained show that the quenching effect increases with higher gas pressure and greater spark length, but the rate of increase of the effect with spark length and gas pressure diminishes as the spark length increases and the gas pressure is raised. The effect is approximately the same in air, CO_2 and nitrogen, but is much better in hydrogen. Experiments on the effect of the material constituting the electrodes show that the nature of the material has a considerable influence. A greater quenching effect is obtained with magnesium electrodes than with silver electrodes in nitrogen. The shape of the electrodes, whether rods or plates, also has a decided effect, and curves are given illustrating the variation in the results with two plate electrodes, two rod electrodes, or one rod and one plate. The effect of varying the frequency of the oscillations was investigated in air and in hydrogen, and it was found with both gases that the quenching effect was greater for short waves than for long waves at the lower gas pressures used. With the higher pressures there was little difference between the two. The latter part of the paper gives a theoretical discussion of the subject, with special reference to the experimental results obtained.—*Science Abstracts, Section A*, May 31, 1918 (abstracted from *Annalen der Physik*, Feb. 22, 1918).

Miscellaneous

Electric Cast-Steel Chain.—W. L. MERRILL.—The first attempt to produce an electric cast-steel anchor was made by die-casting the links in a form. Afterward the studs were placed in position, the same as in handling welded chain. It was found, however, that while it was possible to make die-cast chain from electric steel, the method was not feasible for a large production since there is a critical time at which the molds should be opened to prevent cracks due to shrinkage. If opened too soon, the metal is congealed. Therefore dry sand molds were resorted to and successful chain was made by this method.—*General Electric Review*, June, 1918.

Substitutes for Copper in Germany.—Copper can now be obtained in Germany only for military uses. For other needs iron and zinc have been substituted. Thus iron conductors are taking the place of copper wire for aërial transmission. It is recommended that the diameter be not under 6 mm., that special apparatus be used in unrolling and flattening the cable to avoid kinks and breaks, that rust be prevented by careful attention to galvanizing, that soldered joints of a suitable thickness be used, that all the poles be furnished with lightning rods, as iron conductors become heated more easily than copper ones, that the junction boxes between connections in iron and those in copper be made absolutely proof against humidity, and that, in view of the greater elasticity of iron, poles, cross-arms, insulators and all appurtenances of the line be on a stronger scale. The estimated cost of a two-conductor iron line 50 m. long and carrying a direct current of 7 kw. is 154 marks, as against 128 marks for copper; for a 100-m. line, 540 marks as against 295 marks. As regards zinc conductors, their conductivity is 29 or 30 per cent that of copper. Their durability is still in doubt, but two points have been established: zinc will not resist a temperature above 130 deg. and it offers poor resistance to tension, the treated zinc used for electrical purposes developing a tendency to assume the texture of the commercial article. In cost the comparison ordinarily favors copper lines, though the price of the treated zinc is more per kilogram than that of copper in time of peace. In view of the greater resistance of the iron wire and the greater conductivity of the zinc wire, attempts to combine them so as to obtain both advantages are being made.—*Revue Générale de l'Electricité*, June 8, 1918 (abstracted from *Annalen für Gewerbe und Bauwesen*).

Electric Welding in Shipbuilding.—H. A. HORNOR.—Different methods of welding by electricity are outlined and their relative merits and most suitable applications are mentioned. Spot welding, though first applied to thin sheet steel, has now been adapted to very thick plating. The author goes on to observe that spot welding and arc welding will be most generally used for ship-construction purposes, the latter probably most extensively. He concludes that electrically welded ships can be built at least as strong as riveted ships. Furthermore, ships designed to be riveted throughout can easily be modified so as to adapt them to extensive electric welding without departing appreciably from the use of materials originally required, with a considerable saving in cost and in the time required for hull construction. Ships especially designed for electric welding can be built at a saving of 25 per cent in both labor and material over present methods and in less time; moreover, a class of labor not now used for shipbuilding can be largely employed.—*Nauticus*, June 1, 1918.

Effects of Moisture on Spontaneous Heating of Coal.—S. H. KATZ and H. C. PORTER.—With thoroughly dried Illinois coal the rate of oxidation at ordinary temperatures is greater than with a similar sample of moist coal. On the other hand, a thoroughly dried sample of Pittsburgh coal oxidizes at a slower rate than a moist sample of the same coal. This difference between the two coals probably explains the discrepancies in the observations of different experimenters and indicates that the rates of oxidation of different coals are not affected uniformly by moisture, says the author. Under actual conditions of storage both the coal and the air always contain moisture, hence it seems doubtful whether water, other than the excess that actually wets the coal, plays an important part in the rate at which coal oxidizes at the lower temperature. The experiments conducted on a working scale by Fayol, who could find no influence of wet weather on spontaneous combustion, and by the New South Wales commission, which found that actual wetting of the coal produced a cooling effect during storage, tend to confirm this idea.—*Technical Paper 172, Bureau of Mines.*

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ECONOMY PROGRAM FOR POWER PLANTS

State Administrative Engineers Meet in Washington to Develop Plan of Organization for Conservation of Fuel

State administrative engineers of the United States Fuel Administration held a conference in Washington on June 28 and 29, discussing the plan of organization in connection with conservation of fuel in power plants throughout the United States.

This plan is the result of conferences with the federal administrators and their committees for the group of states which together consume about 70 per cent of all coal used in the United States, exclusive of railroads. The plan has received the indorsement of all of these states, as well as approval by the United States Bureau of Mines and the committee of consulting engineers on conservation and publicity, which represents the Engineering Council of the four national engineering societies.

It is considered most important that all existing fuel conservation committees, committees of chambers of commerce and national defense, manufacturers' associations and other bodies be continued in full force, and that the co-operation of such organizations be obtained.

The administrative engineer in each state will work under the supervision of the present federal administrator. No separate or new organization is contemplated, but sufficient addition to the working force in each state will be made to insure efficient execution of the new function.

The ratings of plants will be based upon recorded answers to questions, each of which will be given a value depending upon its relative importance to the other questions. Depending upon the efficiency of methods in use in any plant, it may be rated in Class 1, 2, 3 or 4.

The administrative engineer in each state will have supervision of electrical and mechanical problems connected with fuel conservation activities contemplated under this plan.

In advance of the first inspection a questionnaire is being sent to every power plant in each district, with notice to the owner that within, say, sixty days his plant will be inspected personally and the questionnaire will be checked up by the inspector upon his visit. This action will give a reasonable time to any plant owner to improve the operation of his plant and conform to recommendations before his plant is actually rated. Thus, when the inspector calls for the purpose of obtaining and checking up the information form, the plant may receive a much higher rating than would have been the case if no time were allowed between the sending and collecting of the questionnaire.

It is recommended that a board of competent engineers be attached to the conservation committee in each state; also a corps of lecturers to arouse public interest and disseminate engineering information.

As the work develops, still further constructive assistance is contemplated for helping owners to bring their plants up to a high plane of economic operation.

TO THE CENTRAL STATION AND THE ISOLATED PLANT

If a Connection Can Be Made That Will Save Fuel, the Fuel Administration Asks That It Be Done

Active measures for fuel conservation are being urged by the United States Fuel Administration.

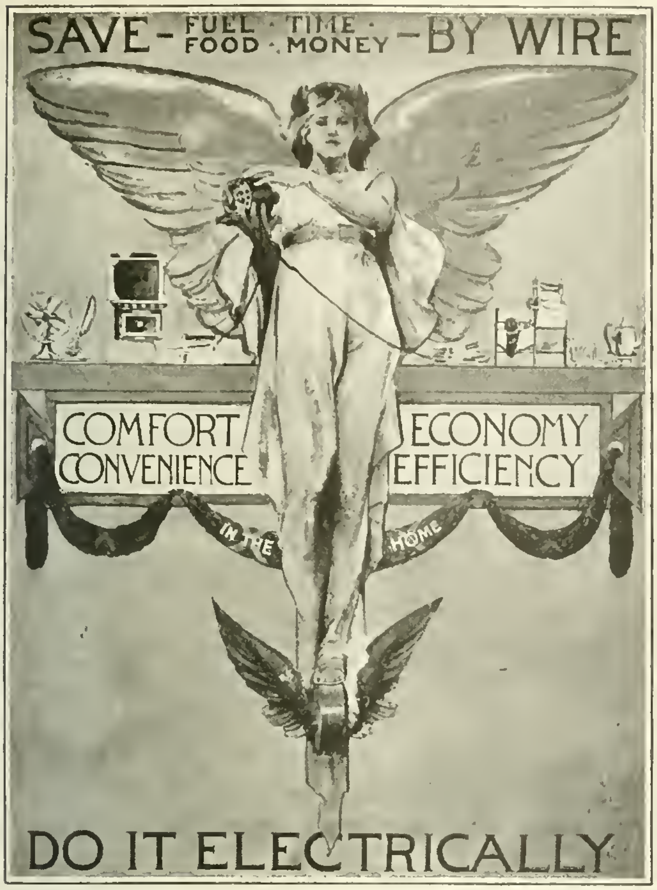
A letter addressed by the administration to central-station executives and isolated-plant owners urges them to consider their relationship to each other, saying in part:

> While in certain sections of the country the central stations are operating under maximum load, there is available in other sections a surplus of primary, secondary and off-peak power which, if utilized, would considerably decrease the shortage.
>
> The Fuel Administration urges every central-station executive and isolated-plant owner to consider their relationship to each other. If a connection can be made that will save fuel, the Fuel Administration asks that the central station and isolated plant form such connection. If the loads of two or more plants could be handled, with less consumption of fuel, by one of these plants than by any other method, the administration urges that this arrangement be made without delay.
>
> Drastic measures for conserving fuel have been unavoidable in the countries of our allies. In the face of our serious shortage, it may become necessary for the Fuel Administration to discriminate in the distribution of fuel between industries essential and those least essential to the war program and between efficient and less efficient plants. Therefore we appeal to every power-plant owner to investigate immediately whether he can or cannot make connection with the central power plants or in some other way assist to the utmost in the conservation of fuel essential to our country. He will thus assist the Fuel Administration to avoid such extreme measures as otherwise may be inevitable.

The order of the administration curtailing unnecessary lighting, which will go into effect shortly, is far-reaching. As now proposed, the order restricts display illumination, store-window illumination, electric advertising and other forms of lighting, which in ordinary times are considered legitimate merchandising propaganda, to four nights a week in the Eastern States, where coal is particularly short, and to two nights a week in other parts of the country.

This is to be followed by another order, in preparation, establishing rules for lighting and heating large public buildings, including office buildings, hotels and apartment houses. These regulations will reduce the present practice very considerably. The public will be asked at the same time to reduce lighting in homes.

For the Economy Service Outlet Campaign



The feature of the September service outlet campaign of the Society for Electrical Development, New York, will be a poster in six colors by Vincent Aderente, which won the "public choice" prize in the society's poster contest. Hangers for window displays and other advertising will be sent broadcast, along with other liberal supplies of display material. The society will furnish dealers, contractors and jobbers with special co-operative sales helps, literature, cuts, slides and movies.

PROGRAM FOR THE NATIONAL CONTRACTORS' CONVENTION

Full Week of Work Planned for the Cleveland Meeting and Attendance Prospects Are Excellent.

Advance registration for the annual convention of the National Association of Electrical Contractors and Dealers, to be held at the Hollenden Hotel, Cleveland, on July 15 to 20, is promising for an excellent attendance, said H. C. Brown, the secretary, in New York on Wednesday of this week. The program follows:

Monday, July 15.—10 a.m. and 2 p.m., meeting of executive committee.

Tuesday, July 16.—10 a.m., meeting of executive committee. 2 p.m., meeting of state secretaries.

Wednesday, July 17.—10 a.m., opening of the convention, A. L. Oppenheimer, president Electrical Contractors' Association of Cleveland; address of welcome, Harry L. Davis, Mayor of Cleveland; response, W. Creighton Peet, national chairman, New York; address, William Ganson Rose, president Cleveland Advertising Club. 2 p.m., "Scientific System of Wage Adjustment," L. K. Comstock, New York; labor-cost data "round table" conference, J. N. Pierce, Chicago, chairman labor committee; F. W. Lord Company, and Estimators' Club of Chicago. 9 p.m., reception and dance.

Thursday, July 18.—10 a.m., "organization," James R Strong, past-president National Electrical Contractors' Association; "The Goodwin Plan," William L. Goodwin. 2 p.m., "The Electrical Contractor-Dealer in War Time," Sullivan W. Jones, Washington; "The Application of Electricity to Industrial Plants," Dwight D. Miller, Society for Electrical Development, Inc.; "Differentials from a Legal Standpoint," Franz Nielsen, association attorney, New York.

Friday, July 19.—10 a.m., report of resolutions committee on proposed changes of national constitution and by-laws; "Credit and Accounting," J. E. Sweeney, Waterloo, Iowa; "How to Open a Retail Electric Shop," R. E. Flower, Cleveland; "The Real Causes of Prosperity and Depression," George McIlwain, Babson Statistical Bureau, Wellesley Hills, Mass. 2 p.m., "Farm Lighting," Evan J. Edwards, Cleveland; "The Goodwin Question Box," W. L. Goodwin. 6.30 p.m., dinner dance.

Saturday, July 20.—10 a.m., meeting of executive committee.

All meetings, including those of the national executive committee, are open to all persons who wish to attend.

OPENING SESSIONS OF THE OHIO CONVENTION

Reports of the Committees on Illumination, Meters and Station Operation Presented on Wednesday at Cedar Point

Opening sessions of the twenty-fourth annual convention of the Ohio Electric Light Association at Cedar Point, Ohio, on July 10, 11 and 12 bore out the prediction that this year's meeting, following the postponement of last year's meeting, would be a good one. Reports of the committees on illumination, on meters and on station operation, presented respectively by D. L. Gaskill of Greenville, George A. Snider of Toledo and Henry B. Bates of Cleveland, were discussed fully.

The spirit of the meeting indicated that central-station managers will patriotically assist in encouraging the purchase of efficient tungsten lamps to replace burned-out and inefficient carbon and "gem" lamps. No wholesale change can be contemplated, however, because it would require the entire output of all American lamp factories for two years to effect a complete substitution of tungsten for carbon and "gem" lamps.

Discussions of voltage standardization indicated a continued and marked trend upward and toward 110, 115 and 120 volts, not only in Ohio but in many other states. Assistance which central stations have given lamp companies in working toward standardization has been a large factor in holding down the prices of lamps and will continue to be a factor. The illumination committee proposes to inaugurate a policy of holding open meetings and to begin a popular campaign of education on good lighting. The discussions on the meter committee and the station operating committee reports dealt largely with methods of securing and handling labor.

Western Society Holds Fuel Meeting

At a recent meeting of the Western Society of Engineers devoted to the subject of fuel supply David Moffat Myers, consulting engineer for the federal Fuel Administration, explained the government's coal-saving and plant-inspection plans. An animated discussion was participated in by Prof. H. H. Stoek, Dr. F. C. Honnold, C. W. Naylor, Osborn Monnett, A. L. Langtry, R. H. Holbrook, A. Bement and Robert Kuss.

Attitude of the War Industries Board

Point of View of the Washington Authorities on Questions Touching the Supply of Raw Materials for Electrical Manufacturers and the Control and Distribution of Their Products

This is a complete copy of Bulletin No 9 of the General War Service Committee of the Electrical Manufacturing Industry, issued under date of July 9 and constituting a report of the conference with the War Industries Board regarding the listing of individual plants for material requirements. An unofficial report of this conference was published in the ELECTRICAL WORLD of July 6, page 23.

AT THE war service convention of the manufacturers of electrical apparatus in the latter part of May the steel situation had careful consideration and their War Service Committee was asked to obtain accurate information at Washington as to the proper steps to be taken to assure a continued supply of steel and iron products. This situation was especially acute because of the methods of manufacture in, and the deliveries required of, the electrical industry. In most cases the articles are manufactured for stock and the cycle of manufacture is very much longer than the deliveries required by the government to meet its essential war needs. Furthermore, the orders for stock cover large quantities of each class and size of products, which are later distributed throughout multitudinous individual orders to meet both the direct and indirect requirements of the United States government and its allies and those of all essential industries.

JOINT CONFERENCE WITH PRIORITIES BOARD

In pursuance of the request made, the General War Service Committee of the Manufacturers of Electrical Apparatus arranged for a joint conference with the Priorities Board and the Director of Steel Supply, which was held at Washington on June 24. At this conference were present fifteen chairmen of group committees in both the apparatus and supplies divisions of the industry, into whose manufacture steel and iron products enter as an important raw material.

A preliminary meeting, attended by the manufacturers only, was held in the morning, in order to formulate definite recommendations to be placed before the War Industries Board and to consider any concrete problems affecting the supply of raw materials to the electrical industry.

In the afternoon the war service committees met with E. B. Parker, Priorities Commissioner; J. Leonard Replogle, Director of Steel; C. K. Foster of the priorities committee, and Walter Robbins, chief of the electrical and power equipment section—all of the War Industries Board.

The following recommendations, formulated at the morning conference, were presented, covering the problem of stock manufacture:

1. That the individual manufacturing companies in the electrical industry be given some form of preference listings for the supply of steel products.
2. That on the basis of proper information as to the character of the current business done, and of any necessary general guarantee or pledge as to the ultimate use of the finished products manufactured from the steel so supplied, priority certificates be issued on application of individual manufacturers covering steel to be used in manufacturing for stock.
3. That each company on the preference listings furnish: (a) Information similar to that required on P. L. Form No. 3 regarding all unfilled sales orders on hand June 1, 1918; (b) also on the first of each month thereafter a monthly report similar to P. L. Form No. 3 based on business entered during previous month; (c) in both cases the per cent of normal capacity.
4. That if the preference listings of individual companies for steel and the form of monthly information suggested above can be adopted, the detailed information requested with each priority certificate application for steel be simplified.
5. That any extension by the War Industries Board of government regulation to other raw materials be properly co-ordinated with any plan adopted or perfected for steel.

In considering these recommendations, the representatives of the War Industries Board very forcibly brought out the fact that, in order to adopt the plan proposed, it would be necessary to have detailed information, comparative over the past year, regarding the consumption of the various grades of raw materials, the stocks of raw materials now on hand, estimated requirements for the six months, the classes of apparatus and supplies manufactured and the essential character and the volume of business done.

After considerable discussion, the officials representing the War Industries Board offered general acceptance of the principles set forth in the recommendations, authorized broadening the plan so as to include other important materials and referred to a committee of manufacturers and Mr. Robbins the working out of all details. A committee of six was chosen from the war service committees in attendance.

Following an agreement to these principles, Judge Parker took the opportunity to urge upon the electrical industry the absolute necessity of conservation in the use of all raw material and the elimination as far as possible of uses of electrical apparatus and supplies which can be placed in the luxury class or which do not contribute to the winning of the war or to the general welfare. Judge Parker referred to the energy which had been shown by the electrical industry in developing new uses for its products and in promoting their sale, and urged the modification of these methods under the present emergency to apply only to essential needs. To use his own word, the manufacturers present were "drafted" to see that all manufacturers in the electrical industry are committed to the policy of conservation and to the direction of all efforts toward what contributes most to the winning of the war.

THE MANUFACTURERS' PROBLEMS

The following specific problems were submitted by the manufacturers:

1. What possibility is there of stocking up on both raw steel products and finished electrical products before winter sets in, in order to avoid or assist in the solution of the transportation difficulties of next winter?

It was stated that any effort in this direction in connection with raw materials, even though desirable, would merely add to the acuteness of the present shortage and would therefore be inadvisable. In relation to finished products, however, any distribution to strategic points which would facilitate transportation problems during the winter was recommended.

2. What information from the manufacturers regarding the distribution of small electrical supplies through the dealer or jobber for essential uses and purposes will permit of manufacturer having proper recognition in his supply of raw materials for essential business so distributed?

It was recognized that a large amount of essential material and supplies can best be distributed through dealers and jobbers, but in so doing steps must be taken to insure the proper use and conservation of materials and supplies in the hands of dealers and jobbers. Dealers and jobbers should be brought within the limitations of any pledge taken by individual manufacturers, and "each individual manufacturer should exercise policing power in this respect with the dealers and jobbers."

IMPORTANT NOTICE

By agreement with the government, we are conserving our stock of materials and finished products for direct and indirect government requirements and have only slight discretion in the matter.

If you favor us with an order—if for government work—give name of the first contractor, the government and departmental order numbers and the priority certificate numbers.

IF NOT for government work, state the name of the ultimate user, character of product produced and relation of apparatus or supplies thereto.

WITHOUT THE ABOVE INFORMATION WE CANNOT ENTER YOUR ORDER.

FORM OF NOTICE TO CUSTOMERS

3. Does the granting of an export license by the War Trade Board carry with it the necessary recognition of a supply of materials for the manufacture of the product exported?

This does not follow, because the War Trade Board considers the matter from the standpoint of trade relations with various countries and not from considerations of shortage of supply within the United States. In data furnished by the electrical manufacturers an opportunity will be given to show what part of their business enters the export field.

The following problem was also considered by the manufacturers, but not submitted to the War Industries Board:

Is there any information or statistics regarding the use of electrical products or supplies not contributing directly or indirectly to the war or the production of war materials, although promoting the general welfare, which, if placed in the hands of the War Industries Board, would permit of such uses being given careful consideration for some form of preference listing?

It was felt by the manufacturers at the morning conference that any direct uses of electrical apparatus and supplies, such as motor-driven labor-saving devices for either home or the office, can best be handled by the manufacturers of such devices, and that restrictions placed on these indirect industries and uses of electrical material will naturally influence the manufacture of such electrical apparatus and supplies.

At the conference between Mr. Robbins and the committee of manufacturers the following procedure was arranged:

1. A pledge to be taken by the manufacturer for himself and his organization similar to the pledge of the steel manufacturers.

2. Form P. C. 20 of the priorities committee covering requirements for raw material.

3. Form P. C. 21 of the priorities committee—a monthly report of operation.

The pledge and above forms are sent herewith in triplicate, two copies for your use, and the originals to be mailed to the Electrical and Power Equipment Section, War Industries Board, Washington, D. C. Additional forms will be supplied on request by the priorities committee.

Circular No. 4 of the priorities committee, bearing date of July 1, 1918, gives full information as to the method of obtaining materials under the above plan.

In order to obtain uniform practice a sample form under caption "Important Notice" is sent herewith for use in calling attention to the pledge. This is to be printed by each manufacturer over his own name to be attached to all his quotations, proposals, etc., to insure his obtaining detailed information necessary to determine the proper priority classification of the order. Each manufacturer at his own option can prepare additional blank forms on which the necessary information can be furnished by the purchaser.

Electrical Manufacturers' Pledge

For myself, my corporation, or my firm, I pledge

I The conservation of all raw materials and supplies now on hand or later to be issued to me;

II The maximum possible utilization of all materials and supplies for essential war purposes;

III The prompt production and delivery of the largest possible quantity of finished product that is or shall be required by the United States Government for the interests of itself or its allies;

And I further agree that all other lines of our business shall be subordinated to this pledge, and

All this in accordance with the suggestion of the War Industries Board.

The war service organization of the electrical industry has established a practical working relation with the War Industries Board, and expresses its apreciation of the liberal spirit in which material problems affecting the electrical industry are being considered by the government officials.

This report was signed by A. W. Berresford, Clarence L. Collens, 2d., James C. Hobart, J. R. McKee, William Wallace Nichols and Charles A. Terry, constituting the committee.

Form P. C. 20, referred to in the foregoing bulletin, is for requests to the priorities committee for favorable consideration "for general material needs in advance of manufacture to insure maximum continuous production."

Among the definitions of terms are:

> "Direct government order" signifies any order or contract placed by the War Department or the Navy Department of the United States, or the United States Shipping Board Emergency Fleet Corporation, or by the Allies.
>
> "Indirect government order" signifies materials, supplies or equipment necessary in the manufacture of or as component parts of direct government orders.
>
> "Work of exceptional or national importance" shall be taken to mean work which, while not primarily designed for the prosecution of the war, yet is of great public interest and essential to the national welfare, such as equipment and supplies for railroads and other public utilities, equipment and tools for mining of fuel and ores required in war work, agricultural implements, food containers, repairs to existing industrial machinery, and any other work of similar character.

This form provides for a statement of close approximation of monthly purchase requirements in raw materials and supplies for all purposes and products on steel and iron, copper, brass, bronze, tin, babbitt, solder, mica, duck, other cotton products and oiled silks. The data are to cover:

> Average monthly consumption over period of one year ending Dec. 31, 1917.
>
> Average monthly consumption over period of six months ending June 30, 1918.
>
> Stock on hand on first of month in which application is filed.
>
> Estimated average monthly requirements for period of six months ending Dec. 31, 1918, having reference to voluntary curtailment as covered by separate pledges and increased demands for finished product for war.

There is an inquiry as to whether the applicant has the plant and equipment necessary and now available to execute all war orders upon which he is now engaged.

Provision is made for a record of all unfilled sales orders on hand or booked business which is unshipped as of first of month in which application is filed. This record must be exclusive of all orders for shipments to stock, to warehouses of applicant, on consignment, etc., and should include only bona fide sales. Where applicant feels that the information so supplied is not sufficiently representative of the character of his business, similar data may be submitted as a supplementary statement based on a close approximation of the business shipped during the two months prior to the first of the month under which the record of unfilled orders is filled. The sales values in dollars is to be used in arriving at percentages. This record is divided into the sales value in dollars of unfilled orders (per cent) and shipments during preceding two months (per cent) for the following classes:

1. Direct government orders.
2. Indirect government orders.
3. Work of exceptional or national importance (as defined in this application).
4. Orders from jobbers and dealers.
5. Orders for export on which export licenses have been issued by the War Trade Board: (a) To active allies; (b) to neutral countries.
6. All other work.

A record of the business done in dollars sales value, divided between booked or entered and shipped, is to be made for the year ended Dec. 31, 1917, and the six months ended June 30, 1918, on the same basis as that provided for the statement of raw-material requirements.

This is to be a sworn statement.

MONTHLY REPORT

Form P. C. 21, the monthly report of operation, states that the priorities committee will be guided by this report in considering the merits of the plant for continued supply of materials. Business booked is exclusive of all orders for shipment to stock, to warehouse of company reporting, consigned stock, etc., and must include only bona fide sales. Sales made during the month from products previously shipped to stock, consigned, etc., are to be included.

In compiling reports covering orders placed subsequent to Aug. 1, 1918, the term "work of exceptional or national importance" shall be taken to mean orders covered by Class B priority certificates or taking Class B automatic rating under Circular No. 4 of the priorities committee bearing date of July 1, 1918.

Sales orders booked are to be divided in dollars and per cent of total into the six classes shown for the record of sales under form P. C. 20.

This is also to be a sworn statement.

PROGRESS OF CALIFORNIA CO-OPERATIVE CAMPAIGN

Policy Adopted by the Advisory Committee Regarding Sales of Energy-Consuming Devices by Central Stations and Dealers

The advisory committee of the California Electrical Co-operative Campaign at its meeting in June adopted the following policy as to the sale of energy-consuming devices by central stations and dealers:

> It is the policy of the advisory committee not to ask or urge central stations to go out of or to stay out of the business of selling lamps, appliances, etc., at retail to their regular consumers. It is, however, the policy to encourage the central stations to conduct their selling of appliances, etc., in a manner which shall conform to the business ethics of the retail merchants in whatever territory the central station shall conduct a retail merchandise business.
>
> It is also the policy of the committee to help and encourage dealers to improve their business methods and so to serve the public in the retailing of lamps and appliances that a large volume of the business will naturally flow to them. This policy will be followed by the committee to the end that these two branches of the electrical industry may both profit to the greatest extent, and that the consumer may enjoy electrical service at the lowest cost consistent with the quality of the service.

The committee also arranged to issue and distribute a monthly bulletin which would carry to the contractor-dealers and other contributors information about the progress and plans of the campaign.

The committee accepted an invitation from the executive committe of the California Association of Electrical Contractors and Dealers to present the story and plan of the campaign at the evening meeting of the contractor-dealers' association, which is to be held in Oakland on July 27.

A get-together dinner for the central district of California is to be held in Fresno early in August.

NIAGARA POWER SUPPLY ENLISTED FOR THE WAR

War Department in an Official Statement Shows that Enlargement of Plants Will Provide Greater Facilities

An official statement bearing on the Niagara power situation has been issued by the War Department. Practically all the power available in the district is used to aid the prosecution of the war, direct war industries securing an average of 85.29 per cent of the total power of the two requisitioned companies, the Hydraulic Power Company and the Niagara Falls Power Company, and an average of 54.29 per cent of the total power of the co-operating companies. About 200,000 hp. additional could be absorbed by industries now operating. Some of this shortage will be relieved by the proposed enlargements of the steam plants of the Buffalo General Electric Company and the Niagara, Lockport & Ontario Power Company. Additions to these two plants will aggregate 62,000 hp. By means of a further development by the American hydroelectric companies at Niagara Falls their existing supply of power, amounting to about 250,000 hp., will be increased by about 160,000 hp. Co-operation to secure fuel supply for the steam plants in the district has been arranged with the Fuel Administration.

NEW CONSTRUCTION BEGUN AT NIAGARA FALLS, N. Y.

Addition to Hydraulic Power Company Plant Being Rushed to Make More Power Available for Essential Industries

Construction work has been started on an addition to the plant of the Hydraulic Power Company, Niagara Falls, N. Y. The work is being rushed at top speed so that 66,000 additional horsepower will be available soon. More than $1,000,000 will be spent on improvements and additions to the power plant immediately. The ultimate power development scheme will not be undertaken until legislation at Washington permits greater diversion of water at Niagara Falls.

The present construction work is the result of an agreement reached between representatives of the company and the War Department. The immediate necessity for more electric power for war industries in western New York aided in effecting a consolidation of the Niagara Falls Power Company and the Hydraulic company, and under the terms of the merger the Hydraulic company is to make immediate additions to power generating equipment so as to relieve the power shortage to some extent until permanent improvements can be made after the necessary legislation is enacted.

Present plans call for installation of two units of 33,000 hp. each. Ultimate development plans call for the installation of ten such units. With all the units in operation the plant will be capable of producing 450,000 hp. and would probably generate 400,000 hp., holding 50,000 hp. in reserve.

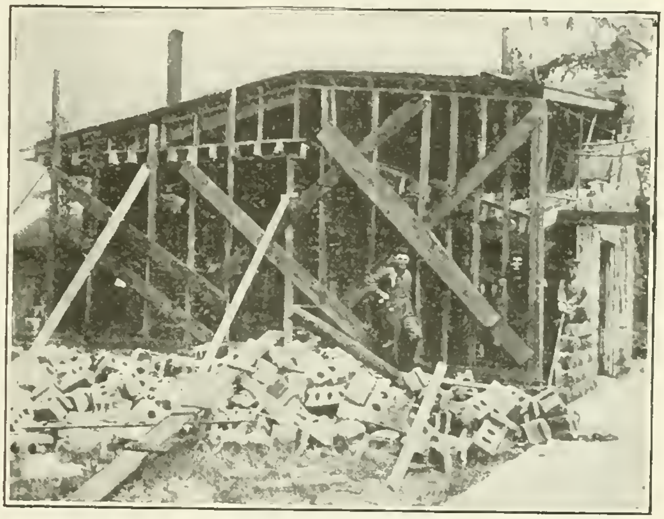
Contracts have been placed with the Great Lakes Dredge & Dock Company of Buffalo for dredging the power canal. The Allis-Chalmers Manufacturing Company, Milwaukee; General Electric Company, Schenectady, and the I. P. Morris Company, Philadelphia, have contracts for equipment. Delivery of waterwheels has been promised in seven months, and eight months is allowed for delivery of the generators.

With the installation of the two new units Niagara Falls will have the largest waterwheels and hydroelectric generators ever built. With the proposed battery of ten such units 330,000 additional horsepower will become available. The War Department is anxious to have the additional power available at the earliest possible moment. Even when the signing of the power merger bills by Governor Whitman of New York was still in doubt, the company patriotically agreed to the department's plans to award contracts immediately for the installation of two additional generating units.

WISCONSIN CYCLONE CARRIES STATION RECORDS 60 MILES

Storm Blows Out Wall of Electric Plant at Lone Rock, Demolishes Plant at Poynette and Interrupts Service at Madison for Two Hours

On the evening of May 21 a tornado struck two towns in southern Wisconsin and damaged the electric light plants in each place. The plant at Lone Rock, shown in the accompanying picture, had only one side and a few blocks on each end displaced by the storm, while the plant at Poynette was entirely demolished, there being only eight or ten concrete blocks left in place. At Lone Rock the storage battery was just inside of the wall which was blown down, but only one glass jar was broken. At Poynette the switchboard was carried out with the roof and some of the steam pipes were broken. Damage was done to the distribution system at each place, the total damage at Lone Rock being estimated at $1,000 and that at Poynette at $500. The plant at Lone Rock was started and furnished service to most of the town the following night, while Poynette was out of service for ten days.



20-KW. PLANT AT LONE ROCK (WIS.) AFTER THE TORNADO

Some of the station records from the Lone Rock plant were mailed back from Kingston, which is about 60 miles away. The cyclone put a short-circuit on both of the transmission lines from Prairie du Sac to Madison and thereby interrupted the service at Madison until the steam plant could be put on the line.

INDIANA COMMERCIAL MEN DISCUSS WAR-TIME PROBLEMS

Delegates from Twenty-two Central Stations Voice the General Sentiment Against Cessation of New-Business Activity

Methods of handling line extensions, the influence of the war on merchandising electrical goods, saving money on billing and collecting and selling lamps were the principal topics discussed before a meeting of the Commercial Section of the Indiana Electric Light Association at Indianapolis July 2. Twenty-two central-station companies were represented at the meeting, which was called primarily to discuss new problems confronting central-station sales departments. In an executive committee meeting of the Indiana Electric Light Association held at the same time it was decided to hold the regular annual convention at the Claypool Hotel, Indianapolis, on Aug. 7. This convention will be a one-day meeting.

R. Thurman of Muncie, who read a paper on "Methods of Supplying Service for Purposes Which Are Considered Essential," presented details of the methods most commonly used for financing extensions in Indiana. It appeared that the majority of companies, although not all of them, are passing on to the customers the extraordinary burden which making extensions at this time imposes.

J. D. A. Cross of the Edison Electric Appliance Company of Chicago pointed out the opportunity of using salesmen who formerly sold housewiring in selling energy-consuming devices to existing customers as a means of increasing central-station revenue without adding to capital account. O. M. Booker of Kokomo, speaking on "Distribution of Lighting and Power Statements and Collecting Customers' Accounts," told how Indiana companies are reducing expenses by having meter readers deliver bills. He urged greater attention to efficient collection of money. C. C. Perry of Indianapolis advised all electric light companies to retain control of the local incandescent-lamp situation and spoke against cutting lamp prices.

The discussion, directed by J. P. Ohmer of Elkhart, president of the Indiana Electric Light Association, brought out that there is a general sentiment against letting new-business departments go into decline. Many favored shifting the best men from the sales work to other departments temporarily. It was felt that salesmen should welcome this opportunity to get into other departments for the time being as the broader knowledge of the business they thus gain will be of real value later when direct sales work is resumed.

There was also some discussion of the advisability of association action on the matter of getting the daylight-saving law extended to cover the entire year. Such an extension would, of course, benefit nearly all electric light companies by increasing annual load factors and would benefit the government by making available power-producing apparatus which is now useful only a short time on the winter peak. This question will probably come up at the annual meeting of the state association. Some operators avowed their intention to endeavor to promulgate the idea in their own cities regardless of what national legislation may be passed on the question.

INCREASES IN RESIDENTIAL RATES GRANTED IN ILLINOIS

Commission Increases Rates for Lighting in Smaller Towns, Inserting in the Order a Refund Provision in Case Rates Prove Too High

The Public Utilities Commission of Illinois has passed several orders recently which are interesting. One order grants the Illinois Northern Utilities Company emergency relief as regards electric rates to the amount of 1 cent per kilowatt-hour for lighting purposes and some increase on the power rates. In that portion of the Illinois Northern Utilities Company's territory which was formerly operated by the Tri-County Light & Power Company in the vicinity of Aledo the commission authorized an increase of 1½ cents per kilowatt-hour on the lighting rates which were in excess of 10 cents per kilowatt-hour and 1 cent per kilowatt-hour on the rates which were less than 10 cents per kilowatt-hour. In both of these cases the order of the commission carried with it a refund provision if the commission should by subsequent investigation determine that the rates temporarily authorized were higher than the company should be permitted to ask.

The commission has also granted emergency relief to the Southern Illinois Light & Power Company, which operates in about twenty-five cities in the southern part of the state. This increase involves an increase in gas rates to $1.50 per 1000 cu.ft. and an increase of lighting rates of 1 cent per kilowatt-hour. This order also carries with it a similar refund provision. The Southern Illinois Light & Power Company subsequent to filing the application for the first increase, which is that mentioned above, filed an application for a further increase which for the lighting business will amount to perhaps 2½ cents per kilowatt-hour.

The Central Illinois Public Service Company is asking to increase its rates for electric lighting service by 1 cent per kilowatt-hour and to increase rates for street-lighting service by an amount of about 10 or 15 per cent. The commission is conducting an investigation in all of these cases at the present time, and its conclusions are awaited with considerable interest by the Illinois companies chiefly concerned.

HIGHER RATES ARE ALLOWED IN ST. LOUIS

Union Electric Light & Power Company Authorized by Missouri Commission to Add Flat Charge as Emergency Measure

The Missouri Public Service Commission has authorized the Union Electric Light & Power Company, St. Louis, to increase rates for large consumers of electrical energy as an emergency measure.

Holding that rates for energy in excess of 1000 kw. a month are unreasonably low, the commission authorized the company to add a flat charge to cover increased cost of coal, labor and taxes. The company, with the aid of the commission and a representative of the interveners, if they so desire, was directed to prescribe a charge to cover the increase in cost of labor and taxes for which the proposed charges are meant to apply along with a coal rider.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Right of Municipality to Exceed Contract.—An order of the district court requiring a public service corporation under a contract to furnish a municipal corporation with electricity for lighting for seventeen hours each day where the contract calls for about eleven hours' service exceeds the terms of the contract and is unauthorized, the Supreme Court of Minnesota held in Village of Clinton versus Ottertail Power Company (167 N. W., 794).

Death from Electric Shock.—In a widow's suit for damages because of her husband's death in service, he being killed by an electric current, natural or generated, when he went into a frame building on the premises of defendant, or was forced to take refuge therein from rain, the petition, which did not explain why defendant was responsible for the husband's being in the building at the time, though stating that the husband was in defendant's employ and that he had a right to be in the building, did not state a cause of action, according to the Supreme Court of Louisiana (78 S. 469).

Granting of Water Rights.—A deed to a city granting the exclusive right to appropriate water flowing into a river through certain described real estate, with right to enter upon such lands for constructing flumes and right to overflow same, conveys an easement and not title to the water itself, the Supreme Court of Washington held in City of Raymond versus Willapa Power Company (172 P. 1176). Where a deed conferring on a city the power to appropriate the waters of a river on a tract of land conveyed an easement merely, the owner of the servient estate may make such use of his estate as is not inconsistent with the easement. There can be title by prescription to a water right where there has been no adverse or hostile assertion of right.

Use of State Roads.—The law authorizing telegraph and telephone companies to construct lines, poles and conduits along roads without liability as for a nuisance does not place the State under any contractual or other obligation to permit a telephone company to use the highways without compensation, the Court of Appeals of Maryland held (103 A. 447). The State may exact compensation from telephone and telegraph companies for the use of the highways for erection of fixtures and telegraph lines. Where the state roads commission attempted without authority to impose a charge for permission to telephone company to use roads, but offered a permit without charge "without prejudice to its right in the future to collect a charge," the telephone company was not entitled to an injunction to restrain the imposition of a charge, since acceptance of such free permit with reservation would not have affected the company's right to object to the imposition of a charge at a future date if attempted.

Contract Obligations Arising from Franchise Rates.—Under the law providing that telephone companies shall obtain the consent of the City Council to construct and maintain city lines, the city may contract for a minimum monthly charge to users within the city as a condition for a franchise, according to the Supreme Court of Washington (172 P. 899). An accepted telephone franchise ordinance is a contract, and the company cannot destroy the right of persons residing in the city to the minimum service rate provided therein by declaring the provision abrogated so long as it operates thereunder. If the Public Service Commission can change the minimum rate to users of telephones as fixed by the franchise ordinance, the franchise rate must remain in effect until the commission has acted and cannot be terminated by the telephone company filing a schedule with the commission. An action to compel a telephone company to render service to plaintiff at the minimum rate provided in the franchise ordinance, where the commission has not acted, involves a contract and not the reasonableness of the rate, and plaintiff's remedy was in the courts and not in the Public Service Commission.

Damages from Permanent Dams.—Where a permanent dam is constructed the measure of damages from flooding is the difference between the market value of the flooded land before and immediately after the dam is constructed, the Supreme Court of Iowa held in Wapsipinicon Power Company versus Waterhouse (167 N. W. 623). Where a permanent dam was constructed without a license the cause of action for damages for flooding occurred immediately upon its construction and did not pass under a warranty deed executed before a proceeding to obtain a license was commenced, and the vendee was not entitled to damages. Although a vendee of land flooded by construction of a permanent dam without a license has no cause of action for damages, he is a necessary party to a proceeding by the owner of the dam to obtain a license. Where a permanent dam is constructed, causing damages to land, transactions showing waiver or settlement for damages are not within the statute of frauds and may be shown by parole evidence. Where land was permanently damaged by construction of a permanent dam, if a settlement of such damages was within the statute of frauds, a vendee of the land could not set up such statute to prevent the dam owners from proving a settlement with his vendor, not being a party to such transaction.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Engineers' Club of Harrisburg, Pa.—C. A. Emerson, Jr., was elected president and H. E. Moses secretary of the Engineers' Club of Harrisburg, Pa., for the ensuing year at a recent meeting.

San Francisco Electrical Development League.—At the June 26 meeting Sergeant Dick Schneider related personal experiences at the front. Charles K. Field, editor *Sunset Magazine*, spoke on the topic "Back of the Front."

Jovian Electric League, Los Angeles.—Robert Wagner discussed phases of the moving-picture business at the June 25 meeting of the league. Dr. George A. Damon acted as chairman of the day. This was the last meeting of the league for the summer months.

Empire State Gas and Electric Association.—It has been decided that the Empire State Gas and Electric Association will hold an annual convention at New York City on Oct. 10. A committee has been appointed to arrange the program, which will be announced in the ELECTRICAL WORLD at a later date. A nominating committee has also been appointed.

Jovian League Annual Convention.—It has been announced that the sixteenth annual convention of the Jovian Order will be held at Dallas, Tex., on Oct. 14, 15 and 16. The business at the convention will be a brief review of the progress of the order during the current year, its major effort being to plan constructively for the task ahead, particularly with relation to the part the order may play in winning the war.

Mississippi Power Company.—The High-Tension Club of the Mississippi Power Company held its annual banquet at the Hotel Iowa, Keokuk, recently. After the banquet Judge William Logan acted as the toastmaster and gave a very interesting and instructive talk on "The Early History of the Keokuk Development." C. W. Kellogg, manager of the Mississippi River Power Company, gave an address on the Hog Island shipyards.

Municipal Electrical Engineers of Ontario.—The first annual convention of the municipal electrical engineers of Ontario was held in Niagara Falls, Ont., recently. President E. B. Buchanan of London, Ont., commented on the appropriateness of meeting at a place where 5,000,000 hp. or 6,000,000 hp. is ready for harnessing. He spoke of Canada's power resources as unlimited, saying that, in addition to Niagara, hundreds of other streams are waiting to produce hundreds of thousands of horsepower.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

To Erect Largest Wireless Station.—The Marconi company is to erect the largest wireless station in the world near Buenos Aires, Argentina. Edward J. Nally, vice-president and general manager of the company, has just closed a contract for the installation.

Toledo Railways & Light Company Joint Section.—The monthly meeting of the joint company section of the Toledo Railways & Light Company and Associates was held in the Zenobia Building on June 28. No business was transacted, the meeting being purely a social one during which a vaudeville performance was given. No meetings of the section are to be held during July and August, but it is anticipated that outside social entertainment will be given in these months.

Regional Industrial Commission for New York.—The regional industrial commission for the New York metropolitan industrial zone, appointed to classify and co-ordinate productive plants under the direction of the War Industries Board, includes: John W. Lieb, New York Edison Company; Ray Palmer, New York & Queens Electric Light & Power Company; Chauncey B. Baldwin, Standard Underground Cable Company; W. D. Baldwin, Otis Elevator Company, and William Hamlin Childs, Barrett Company.

Syracuse Company Gives Publicity to N. E. L. A. Resolution.—The "Carry the war to victory" resolution passed at the National Electric Light Association convention at Atlantic City in June and reported in the ELECTRICAL WORLD in the June 15 issue, page 1252, has been made the basis of a half-page advertisement in the local papers by the Syracuse (N. Y.) Lighting Company. After printing the resolution the company states that it was unanimously adopted at the convention and that the manager of the company "hereby expresses unqualified indorsement of the sentiments contained in this resolution."

Lignite for Fuel in Texas.—Converting lignite coal into a fine powder and feeding the particles under boilers in much the same manner as that in which crude oil is now handled for fuel may be put to practical and extensive use in Texas, according to plans of large industrial interests that have been conducting extensive experiments along this line for the past several months. It is stated that the work of pulverizing lignite and spraying the powder under boilers can be successfully and economically done. It is reported that the Texas Power & Light Company of Dallas has under consideration the construction of one or more large electric power plants at the lignite beds of that section of the state for the purpose of utilizing the new method of using that fuel in the generating of electric energy.

Power Plant Economy Clubs in Toledo.—At the Detroit Avenue station of the Toledo (Ohio) Railways & Light Company a club has been organized among employees which is named the Economy Club. The organization is an educational one, and addresses are given before the meetings on the method of operation and construction of boiler-room apparatus. For the same purpose in another station the Water Street Boiler Room Club has been started. A question box is maintained in this plant, and an extensive circulating library of manufactured catalogs and power-plant literature is being collected.

Unusual Electrical Storms in California.—Two severe electrical storms occurred recently in California, causing considerable damage, chiefly by fire. Weather Bureau records show these to have been the heaviest electrical storms in thirty years. One in northern California in the latter part of June started numerous forest fires and slightly damaged equipment on the lines of the California-Oregon Power Company. On July 1 a more destructive storm in southern California continued for more than twelve hours, causing damage estimated to total $250,000. Two 55,000-gal. oil tanks at El Segundo were destroyed and their contents scattered and ignited. Damage to Los Angeles electric systems was slight, and where interruptions occurred service was quickly restored. At Pasadena the precipitation for the storm was 0.41 in.

Missouri Association Advertises Need for More Revenue.—To appraise people all over the state of the situation which makes higher utility rates necessary the Missouri Association of Public Utilities is sending to its members already-prepared advertisements for insertion in local papers. The advertisements were written as a series by an association committee appointed for the purpose. The first series contained seven advertisements which it is planned to run weekly. Secretary F. D. Beardslee of St. Louis in a letter accompanying one of these advertisements said: "We know you realize the seriousness of the situation pertaining to utilities and the absolute necessity of speedy relief to hold the companies of this class of industry solvent. We trust you realize that for the utilities to procure the relief needed quickly it is necessary that each of us be perfectly frank and plain in laying the facts of our condition before our patrons and the general public, in order to prevent long-drawn-out disputes when our cases are taken up by the Public Utilities Commission. It is likewise of great value to advise our respective communities of relief procured in different communities and states other than our own, as evidenced by the many recent decisions rendered."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Non-Utility Business.—The Illinois Public Utilities Commission, in authorizing increased electric rates for the Saline Electric Company, Du Quoin, remarked that where a public utility operates a non-utility ice plant it will not be permitted to make up losses in the utility business from the revenue of the ice plant nor losses arising in the non-utility business from revenue which is derived from the utility service.

Apportionment of Line Construction Expense.—Deciding a question as to the apportionment of expense for line reconstruction in a case affecting the Richland Light & Power Company and the Richland Telephone Company, the Missouri Public Service Commission holds that under a stipulation to abide by the decision of this commission as to the apportionment of expenses incurred in the reconstruction of electric and telephone lines occasioned by their close proximity the slight expenses incident to the individual alterations are assigned to the utility which could most easily and economically make the change or which would be benefited most thereby, irrespective of any rights of priority.

Re-rendering Bills.—The New York Public Service Commission, First District, has rendered a decision in the matter of the complaint of Charles A. Gould against the New York Edison Company with respect to its alleged refusal to re-render bills on the basis of a combination contract price instead of individual contract prices. The complainant alleged overcharge by the company for energy billed on separate meter readings of the tenants of the complainant which included a period from March 20, 1917, when an application for a master meter was made, to May 7, 1917, the date of the installation of the master meter. The commission held that the respondent is chargeable with undue delay in the installation of the master meter, that in the adjustment of similar complaints the company's own determination of whether there has been neglect or delay may lead to unjust discrimination, and that a general regulation should be adopted so as to provide that upon proper application for a master meter the wholesale rate for energy should apply after a specified number of days from the filing of the application. While the commission is without power to order reparation in the premises, it is suggested that the wholesale rate be applied to energy consumed in the building of the complainant between April 5 and May 7, 1917.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

Charles Sessions has succeeded ex-Senator Joseph H. Bristow on the Kansas Public Utilities Commission.

R. C. Coffy, manager of the Sapulpa Electric Company, Sapulpa, Okla., was chairman of a committee which conducted a Red Cross auction sale and street dance June 22, netting $6,000.

Riece Ridgely has been appointed superintendent of the Arkansas Valley Railway, Light & Power Company at Ordway, succeeding H. H. Lyons, who has entered the government service.

J. M. Atkinson, resident manager for the Big Horn Light & Power Company, Worland, Wyo., has resigned to become manager of the Missouri Valley Light & Power Company at El Dorado Springs, Mo.

M. W. Birkett has been promoted by the Washington Water Power Company, Spokane, Wash., from assistant superintendent of light and power to assistant to the general manager of the company.

George W. Hardy has been appointed superintendent of the distribution department of the Worcester (Mass.) Electric Light Company, with headquarters at 166 Faraday Street, succeeding L. M. Haight, resigned.

C. C. Lovejoy, who was formerly associated with the Illinois Electric Company and the Geyser Electric Company of Chicago, has been appointed new-business manager of the Fort Smith (Ark.) Light & Traction Company.

John Moles, formerly emergency foreman and engineer on the staff of the General Electric Company, with headquarters at Schenectady, N. Y., and Erie, Pa., has succeeded John W. Brassington as chief engineer of the American Writing Paper Company, Holyoke, Mass.

C. L. Jacklett has been transferred from the position of district manager for the Pacific Power & Light Company at Prosser to be district manager at Toppenish, Wash., succeeding G. T. Drenna, who is on leave of absence. Mr. Jacklett has been at Prosser since the fall of 1917.

John W. Hallowell, who has been with Stone & Webster since 1901 and a member of the firm since 1912, has retired from the firm. Since May, 1917, he has been in Washington as a member of the Food Administration, and he expects to continue in that work for the duration of the war.

Walter Wellman has been appointed assistant engineer in the Wisconsin State Engineering Department and assigned to the service department of the Railroad Commission. Mr. Wellman has been in the distribution and engineering department of the Madison (Wis.) Gas & Electric Company for the past seven years.

Herman Gamper of Columbus, Ohio, has been appointed power engineer of the Emergency Fleet Corporation. He has been engaged in making a physical valuation of the light and power properties of the Columbus (Ohio) Railway, Power & Light Company for the city of Columbus. He will be stationed at Philadelphia, but will return occasionally to continue his appraisal work on the Columbus properties.

Paul B. Findley, technical editor in the department of publicity, Westinghouse Electric & Manufacturing Company, has resigned to enter the training school at the University of Pittsburgh, where he will take a special course in radio work with the Signal Corps. Before joining the Westinghouse Electric Company, Mr. Findley was editor of the *Electrical Age*.

J. L. White has resigned as manager of the Albany office of the Oregon Power Company to go into business for himself in Seattle. For several years he was manager of the company's Dallas office. He was transferred to Albany in the spring of 1914. In the fall of 1916 he was appointed manager of the Willamette Valley division.

Dwight P. Robinson has retired from the firm of Stone & Webster, of which he has been a member since 1912. He first became connected with the organization in 1893, and in 1908 he was elected president of the Stone & Webster Engineering Corporation. Mr. Robinson was born in 1869. He was graduated from Harvard with the degree of A. B. in 1890, and two years later with the degree of B. S. from the Massachusetts Institute of Technology.

E. A. Wilcox, formerly manager of the Public Service Company of Oklahoma, Tulsa, Okla., has resigned to accept a position in the power and light division of the Fuel Administration at Washington. Prior to his connection with the Public Service Company of Oklahoma, Mr. Wilcox became well known through his connection with the new-business departments of Pacific Coast companies and through the publication of a book on electric ranges.

Dr. Miller Reese Hutchinson, for a number of years chief engineer for Thomas A. Edison and more recently handling the sale of Edison storage batteries to the government, operating under the name of Miller Reese Hutchinson, Inc., has resigned from the Edison interests to devote his entire time to his duties on the Naval Consulting Board, of which he has been a member since the fall of 1915, and to other government work. Dr. Hutchinson, who is forty-one years old, was graduated from the Alabama Polytechnic Institute in 1897 and during the Spanish-American War was chief engineer of the seventh and eighth districts of the United States Lighthouse Service, engaged in laying submarine cables and mines along the South Atlantic coast.

Carl F. Uhden has resigned as chief engineer of the Washington Water Power Company, Spokane, Wash.

Fred Brown of the Tacoma Gas Company has been appointed to succeed H. A. Joslin as manager of the Eugene office of the Oregon Power Company.

V. H. Greisser, formerly electrical engineer for the Washington Water Power Company, Spokane, Wash., is now consulting engineer for the company.

D. H. Henderson has been advanced from assistant superintendent of distribution to superintendent of distribution of the Washington Water Power Company, Spokane, Wash.

B. M. Merrill has been advanced from assistant superintendent of power to superintendent of power of the Washington Water Power Company, Spokane, Wash.

R. U. Steelquist has been transferred from the post of manager of Dallas, Ore., to be manager at Albany for the Oregon Power Company, succeeding J. L. White. Mr. Steelquist has been manager at Dallas for the past two years, having been manager for two years prior to that at Corvallis.

Clifford S. MacCalla has resigned as vice-president and general manager of the Washington Water Power Company, Spokane, Wash. Mr. MacCalla has been with the company for the last fifteen or sixteen years. He has been general manager for the past seven and a half years. Prior to his connection with this company he was engaged by the General Electric Company in railway work in Australia and later by the Edison Electric Illuminating Company of Brooklyn, N. Y.

Prof. James E. Ives, physicist, research associate and lecturer at Clark University, Worcester, Mass., has been commissioned first lieutenant in the Signal Reserve Corps. Lieutenant Ives was born in London, England, in 1865, and was educated at Harvard, the University of Pennsylvania and Clark University, receiving the degree of Ph. D. from the last-named institution in 1901. In 1904 he was awarded a silver medal at the St. Louis Exposition for his work in radio-telegraphy. He is a fellow of the American Academy of Arts and Sciences and the Institute of Radio Engineers, a member of the Academy of Natural Sciences, American Physical Society and Société Francais de Physique, and has written extensively on scientific subjects. He has been requested to take up special radio investigations for the government.

Obituary

Charles L. Redding, superintendent of the Whitman (Mass.) electric lighting department and of the electrical department of the State Farm, Bridgewater, Mass., died recently at Brockton, Mass., at the age of forty-one.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

RUBBER REQUIREMENTS ALLOCATED ON WAR BASIS

Electrical Industry Will Operate on Seven-sixteenths Usual Consumption for Civilian Orders—Ample Stocks of Crude

Uneasiness is being expressed in certain quarters for fear that a shortage of crude rubber is imminent. On this score anxiety is reported on the part of wire and cable manufacturers. So far as can be ascertained from reliable sources, there is really no need for concern. The importation of crude rubber in 1917 was 196,000 tons. On May 1 the government restricted the importation of crude at first to 25,000 tons for three months. This period expires July 31. It is now learned that the War Trade Board has continued the restriction for a year, and, according to the secretary of the committee on rubber and kindred products, working under the direction of the United States government, it will be continued indefinitely or for the duration of the war. This means the annual importation of 100,000 tons of crude.

It is estimated by the War Trade Board that the government's requirements will be 35,000 tons. The remainder is to be allocated for manufacturing uses of a civilian nature. The electrical industry will have its needs supplied on a basis of seven-sixteenths, or 45 per cent, of its 1917 consumption. On war or government orders the allotment will be 100 per cent.

Free rubber is difficult to obtain in the open market, according to an official statement. Wire and cable manufacturers, on the other hand, say the stock of rubber now in the country is ample for the electrical trade at least and that its wants will not be curtailed. Some industries of the less essential class are to have their demands sharply cut down. As previously quoted the price of standard quality smoked sheets is officially fixed at 62 cents a pound; first latex crêpe, 63 cents; fine up-river Para, 68 cents. On May 14 the board also named prices for forty other grades of rubber, and those in which the insulated-wire trade is most likely to be interested are as follows: Up-river medium, 63 cents a pound; islands fine, 59 cents; prime lighthouse crêpe, 60 cents.

PRIORITY FOR COOKING APPARATUS IN ENGLAND

Necessity for Large Industrial Kitchens Leads Ministry of Munitions to Provide Raw Material for Cooking Apparatus

In England difficulty exists in obtaining delivery of suitable cooking apparatus for public kitchens, regardless of whether the appliances are heated by coal, gas or electricity. Most manufacturers have their hands full in meeting the requirements for equipment needed in factory canteens and large industrial installations aside from the requirements of national kitchens. According to the *Electrical Times*, this situation was recently called to the attention of the Ministry of Foods during a meeting in the House of Commons, and the suggestion was made that a more favorable priority be granted to the manufacturers of cooking apparatus. The reply indicated that such action had already been taken.

In discussing this situation the *Electrical Times* points out that even if sufficient quantities of raw material and skilled labor are provided, considerable time will be required to manufacture the cooking apparatus which is needed immediately. In this connection the paper expresses its regret that assistance from the United States is not asked, pointing out that several electric heating manufacturers in this country would be able to make immediate shipments of cooking apparatus for serving large numbers of people. If a temporary special license were granted for the exploitation of such equipment as this to England, it should be an opportunity for driving an entering wedge that would be useful in after-the-war trade—one that manufacturers of electric heating equipment could not afford to neglect.

EFFECT OF COPPER ADVANCE ON THE ELECTRICAL MARKET

Wire and Brass Increase in Price—Other Articles May Follow According to Relative Amount of Copper Used

Somewhat as a surprise came the increase in official price of copper from 23½ cents to 26 cents. Already its effects are being experienced in the electrical line. Wire, always the first material to feel the fluctuations in the price of copper, advanced accordingly. Rubber-covered wire base advanced from 30 to 34 cents, weatherproof to 32 cents. Lamp cord and annunciator wire have also advanced.

Brass has increased as a result of the rise in copper at least 2 cents a pound where quotations are being made. The settlement of labor disturbances, anticipated shortly, is expected to make for steadier prices in brass.

Copper and brass enter into the make-up of many electrical commodities. The effect, however, will probably be proportionate to the amount of the materials used. Thus where but a small amount is used and the proportion of the expense of this material to the total cost of manufacture is small there is little reason to expect an advance in the price of the finished article, unless this is the culmination of a series of higher costs which on the whole necessitate a wider margin of profit.

A number of items of electrical fittings using both copper and brass in a limited degree have advanced within the past few weeks, and it is rather doubtful if these will go any higher as a result of the government's action. The manufacturers, it is known, are well supplied with 23½-cent copper.

On the other hand, there are a number of articles on which the increased cost of copper and brass will make an appreciably increased cost of production, such as motors, generators, transformers, knife switches, desk portables, controllers, brass connectors, bushings, nipples, brackets and tubes, ceiling and wall fixtures, cable connectors and others.

A number of these items have yet to raise their price to take care of the recent advance in freight rates. It would not be surprising, therefore, to see many more advances in price than have been experienced in the past few weeks.

Furthermore, there are no indications that copper may not go higher, even to 30 cents, in another month. The present price of 26 cents, which it is well known is by no means satisfactory to producers, is made only until Aug. 15. Prior to that time two meetings are scheduled between the War Industries Board and the copper producers.

THE WEEK
IN TRADE

SHARP advances in the cost and in the difficulty of obtaining raw material, the 25 per cent advance in freight rates, the shortage and high price of labor and the increase in the price of copper have had their logical effect on every line of electrical apparatus, staple merchandise and specialties. Higher price levels are now prevalent in every section of the country, and the readjustments in connection therewith are uppermost in all transactions in the purchase or sale of goods. The Department of Labor on Monday issued its regulations governing the employment of unskilled workers in concerns having 100 men, effective Aug. 1.

The change in the official price of copper led to an immediate revision of prices in covered wire, cable and other articles of which the metal is a part. The stock of conduit is low and the supply contracted. In the Pacific Northwest shortages still prevail in certain sizes of wire, larger types of lamps and larger motors. Small motors up to 25-hp.-rating are easier in New England, with orders being filled out of stock. On this class of motors the production is running behind in the Middle West. An advance of 10 per cent on some types of lamps was made July 1, applicable in all sections.

NEW YORK

A close survey of the market inevitably leads to the conclusion that price regulations and readjustments are matters of the most concern to the trade. The manufacturers making the revisions announce the changes with little if any formality or explanation beyond the fact, understood and intelligible to everybody in interest, that material for commercial work is getting more difficult to obtain. In fact, certain items require priority.

Traffic conditions have improved in this territory under governmental management. The rail congestion has been relieved appreciably, according to the heaviest shippers. Water transportation is also greatly improved.

Business is prosperous in a high degree, the volume of trade being greater than in the preceding week, with government orders largely in the ascendant. Collections are held firmly to a thirty-day basis, with efforts to reduce sales as far as possible to the two-off ten-day class. Instances are given where only 1 per cent is allowed.

POLES.—As poles are sold f.o.b. delivered, in accordance with the recent 25 per cent advance in freights, prices will be higher in proportion. White and red cedar are in fair supply. Chestnut in lots of 1000 is not easy to negotiate on the Eastern seaboard. Smaller lots are in a better position.

FARM-LIGHTING OUTFITS.—Higher freight charges and increased cost of material will cause an advance in price by an Eastern manufacturer next month of from 10 to 15 per cent. Two Western manufacturers have already increased the selling cost of their outfits.

ELECTRIC CONTROLLING DEVICES.—An advance of 10 per cent, effective July 1, was made by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis. In making the announcement the company says: "The constant increase in cost of labor and material makes it necessary for us to increase our price by a change in discounts. We will, however, protect for a period of thirty days bona fide outstanding quotations made prior to July 1, and will protect quotations made by us thirty days from date of such quotations." The discount of the company applies only to bulletins dated March, 1916, or later, and all prior bulletins are canceled. A half dozen other manufacturers in the same line have made a like discount available.

POLE HARDWARE.—While there is no change in price, the government steel requirements will restrict the output of pole hardware in the next six months to a marked degree. There is some feeling that this may have a tendency toward higher prices. There is no heavy demand beyond government needs. With the new official policy of expanding Western industrial activities the best market for this line will be shifted from the East.

FRACTIONAL MOTORS.—On sewing-machine direct-current motors of from 1/32-hp. to 5-hp. rating an increase in price of 5 per cent went into effect June 1. In March a 10 per cent advance was made. Deliveries locally are made in ten days.

FANS.—Jobbers' stocks are low. In fact, some concerns are completely sold out, two cars arriving for account of one firm going out at once, with another car to arrive sold in advance. One large manufacturer is said to have been cleaned out a month ago. Both 12-in. and 14-in. alternating-current and direct-current oscillating type are reported as not to be had. There is no reserve stock to draw upon in this section.

BARE AND COVERED WIRE.—All manufacturers of bare and covered wire increased the base price following the higher cost of copper made by the government. On rubber-covered the base was immediately placed at 34 cents, and the price for that class of goods will range from 26 cents to 34 cents a pound, according to the importance of the order. One cable manufacturer withdrew all prices on July 3 and will accept orders only up to Aug. 15 at 26 cents. Previously to that date his prices were for immediate acceptance. A readjustment of copper wire and cable prices is under way or has been sent to the trade. The change came as a surprise. Deliveries are from six to eight weeks on commercial orders. Wire and cable manufacturers, though engaged heavily in the production of government necessities, are also taking care of the requirements of the regular trade to the best of their ability.

CONDUIT.—Manufacturers issued a notice that on June 25 the price of conduit would be raised two points—about 5 per cent. To this the new freight rate of 25 per cent must be added to all points, as conduit is sold f.o.b. mill. Distributers have passed along the differential to the trade, making a 5 per cent increase from local warehouse, with freight additional when shipped by rail. This went into effect on the same date. This is general, although the distributers believe they are entitled to a higher figure to cover the cost of handling. Stocks are low in all sizes, particularly the large sizes. There is no free pipe in the market. The mills are running strong on 3½-in. conduit—the government specifications—as against ½-in. and ¾-in. pipe for commercial uses.

LAMPS.—Miniature and "gem" lamps are advanced 10 per cent on July 1.

CROSS-ARMS.—Stocks in the East are stronger, with the mills working only on a 50 per cent basis. The recent increase in price is between 4 and 5 per cent.

CHICAGO

A partial summary of jobbing conditions in the Chicago territory indicates that the volume of business for the first six months of 1918 has been entirely satisfactory. The expense of doing business, however, has increased to such an extent that profits among the jobbers are not so satisfactory. The jobbers have been doing practically the same volume of business as last year, and the increase in expense of doing business is reported to be 25 per cent in some instances. Another reason why profits have not been up to standard with the jobbers is because a considerable volume of government business has been done, and this has been taken on a very narrow margin.

The price trend, which flattened out somewhat after the recent increase in freight rates, was given another sharp upward tilt by the increase in the government price of copper from 23½ cents to 26 cents. Following this announcement prices of all wire products increased. Price standards were also marked up on other lines in which copper is included. It now appears that the price increases which followed the first advance amount on the average to a little more than 25 per cent of the usual freight cost, the general policy being to mark up the price to an extent which would permit the same margin of profit to be secured as was made formerly. Price changes have been announced by the Benjamin Electric & Manufacturing Company, the Square D Company, the George Cutter Company and by other concerns which make pole-line hardware.

COPPER WIRE.—Lamp cord, magnetic wire, all cable and bare wire have increased in price subsequent to the announcement that the government price of copper had increased from 23½ cents to 26 cents. The Chicago base on weatherproof wire is now 32 cents, and the base on rubber-covered wire is at 33 cents to 34 cents.

SCHEDULE MATERIAL.—There has been some slight readjustment of prices on schedule material in the Chicago market. Some jobbers believed they were selling their stock too cheap and so increased the price a trifle. The tendency on this class of goods is for prices to increase.

DOMESTIC APPLIANCES.—Excellent business is reported in all lines of domestic appliances, including the larger apparatus, such as washing machines.

FANS.—The Chicago jobbers have not yet begun to move their fan stock, owing to the fact that the weather has not been such as to create a demand for fans. In the Southwest it is reported that jobbers have been sold out on fans once and have replenished the stock.

MOTORS.—The Chicago market for motors of ordinary sizes continues to be active. There still is difficulty in building up motor stock.

SMALL MOTORS.—One Middle Western manufacturing concern reports that it is 40,000 small motors behind.

BOSTON

The volume of trade is being maintained at war levels, and the arrival of the vacation period has so far had little effect upon sales. The buying activities of the government continue to dominate the market and it is getting harder and harder to obtain supplies for ordinary commercial use. Deliveries are improving somewhat, but this is apparently due to the intensive production found at the factories, which in some cases is yielding equipment and supplies for stock shipments. Railroad congestion shows little improvement, the shortage of motive power and labor being serious. It looks as though embargoes would be the rule for some time. Prices remain about the same as last week, barring increases in wire, miniature and "gem" lamps as outlined below. Collections vary in quality, some jobbers reporting very good credit conditions and others rather unsatisfactory settlements. Stocks of appliances are large.

MOTORS.—Small motors, up to to 25 hp. rating, are now fairly plentiful, and orders are frequently being filled from stock. The larger sizes are in stock in some cases, but are somewhat irregularly located.

WIRE AND CABLE.—Wire advanced on July 3 from a 30-cent base to a 34-cent base, following the increase in the base price of ingot copper from 23.5 cents to 26 cents per pound. Weatherproof is now quoted at 32 cents, slow-burning at 32.5 cents, rubber-covered at 33 cents, and bare copper wire at 29.5 cents. The market is active for sizes used in shipbuilding, and deliveries are rather slow on the larger cross-sections.

LAMPS.—Stocks are increasing as the result of vigorous factory work. The central stations are now well supplied, the consumption at this season, of course, being a favorable factor to the accumulation of reserves. There is no question that the demand for lamps has decreased because of the daylight-saving program. Miniature lamps are still short, owing to the enormous government demand. On July 1 an advance of about 10 per cent took effect in both miniature and "gem" types.

FUSES.—The demand is very large, especially for industrial uses. Factory stocks are low and insulating materials hard to obtain.

FANS.—The protracted cool weather is beginning to cause anxiety among retailers and jobbers, who are carrying large stocks.

INDUSTRIAL HEATING EQUIPMENT.—A good deal of quiet development work along lines related to war industry service is being done in New England. This should materialize in the near future in applications of wide market interest.

CONDUIT.—Spasmodic arrivals of pipe are a feature of the market. One Rhode Island jobber has just received a carload of conduit ordered fifteen months ago, and long deliveries are no exception in other cases. Stocks are spotty, and priority orders dominate the situation.

FLASHLAMPS.—A moderate sale is reported to American soldiers in France through the Paris purchasing bureaus of merchants in this country. The domestic product continues to be sold in large quantities for cantonment and other service here.

ATLANTA

Business in all lines is well sustained this week. The volume of sales covering staple and schedule material continues heavy. The greater portion of the demand appears to be coming from government and quasi-government quarters. Replies to all inquiries from jobbers indicate that normal commercial channels of trade are being further subordinated to government requirements.

Activity in textile construction and associated lines continues in the Carolinas. The American Process Company of Mount Holly, N. C., contemplates the erection of a mill for bleaching, mercerizing and dyeing.

The Mays Manufacturing Company of Lexington, N. C., has been incorporated for $2,500,000 to manufacture adding machines. Indicative of further progress in shipbuilding is the establishment of a million-dollar steel-ship fabricating plant at Birmingham, Ala.

PANELBOARDS AND CABINETS.—For a time sales have been sagging, but manufacturers state that the outlook this week is much brighter. Deliveries remain about the same. The Emergency Fleet Corporation has placed a substantial order for pilot-house panel control to be used on wooden ships being built at Southeastern coastal cities.

CONDUIT.—Reports from Jacksonville, Fla., Birmingham, Ala., and Nashville, Tenn., are to the effect that conduit stocks have become almost depleted, the only stock of any size being at New Orleans, La., which is about 25 per cent below normal. The government requirements at this point were taken care of by shipments direct from the East. While the call from commercial channels has fallen off, a number of inquiries are being made in the face of present conditions. The demand for flexible and armored cable has increased with a corresponding advance in price.

FANS.—The movement of fans in all sizes has been very satisfactory this week, with the exception of the last few days, which registered much lower temperatures. A few jobbers have been disappointed this season by the non-delivery of their fan quotas.

WIRE.—The withdrawal of prices on all wires makes for considerable uncertainty regarding the future.

HARDWARE.—Except for the sustained government demand, the volume of transactions is off. Deliveries are poor and about twice as long as one month ago.

METERS.—Sales would indicate that the call for the residential type has shown a little improvement.

LABOR-SAVING DEVICES.—Jobbers and retailers are doing a good business in all the popular appliances, especially washing machines. Shipments are good.

HEAT CONTROL.—A practically new device for regulating furnace draft has had a heavy sale this week. One retailer has sold over the counter approximately seventy of these appliances in the last few days. There is a virgin field lying open for this type of appliance, and a big business should be done this year. Shipments are fine.

SEATTLE

Wholesalers report a gratifying volume of sales and inquiries in considerable numbers which presaged satisfactory business for the coming months. During the past week domestic appliances particularly moved rapidly. However, wholesalers report a shortage along these lines which shows no intimation of improvement. A shortage of certain sizes of wire, large size lamps, larger size motors, conduit, etc., still exists with no hope of betterment. The volume of sales of schedule material, including wire and conduit, to shipyards and industrials is heavy. Jobbers are embarrassed by shortages and dilatory freight movements. A slight increase in the price of wire is noted.

The freight situation has not been relieved and is expected to grow much worse when the crop movement begins. Inquiries for a considerable amount of power apparatus have been received. The labor shortage along all lines is increasing, owing to enlistments and draft operations.

The housing division of the Department of Labor will expend $500,000 in Seattle this year in housing employees of the Skinner & Eddy Corporation. The anticipated fall rush of war industrial workers to Seattle has begun, and everything possible is being done to stimulate building activity to care further for the rapidly increasing population.

Contracts for steel, wooden and concrete vessels in the various shipyards in the Puget Sound and Columbia River districts feature the week's industrial news. The Puget Sound navy yard is instructed by the government to proceed with the construction of a two-and-a-half-million-dollar ammunition ship and seven mine sweepers, involving several million dollars. The Seattle wooden shipbuilding plant has secured a contract for five additional 5000-ton wooden ships. The Everett concrete plant has secured contracts of $2,000,000 for concrete ships. The Vancouver (Wash.) yard has been given contracts for four 3500-ton wooden craft, and the yards at Tillamook and Astoria, Ore., have contracts for one wooden vessel each.

AUTOMOBILE LAMPS AND STORAGE BATTERIES.—Sales show a slight increase, particularly on lamps. Stocks on these commodities are low. Prices remain steady.

ELECTRIC WELDING APPARATUS.—Inquiries and sales for shipyard and allied industrial plants are noted. However, the utilization of this equipment in the Northwest is not general.

WIRING DEVICES.—Owing to the increasing amount of small residence construction dealers report good sales. Considering demand and freight conditions, stocks are in fair shape. The fluctuations in prices have been negligible.

LIGHTING FIXTURES.—Sales to home builders are very satisfactory and to industrials considerably heavier than last year and are increasing.

SAN FRANCISCO

In looking over the records of recent building one notes the absence of the factory and industrial work so prevalent since the first of the year and its replacement by dwelling and cottage building. Most of this is for industrial help. This seems to show that from now on electrical industrial work will be more along the lines of maintenance than of new construction. On the other hand, a lot of the new building previously announced is about ready to begin in earnest, so that although future records will not show the great quantity of electrical construction material that is to be used, yet large sales will be the rule for months.

Two irrigation projects of considerable size are under consideration, one providing for the watering of an area of 15,000 acres in the vicinity of Lindsay. The other covers an area of approximately 30,000 acres in the vicinity of Croville and incidentally provides for taking over the South Feather Land & Water Company power system. It is proposed to spend nearly $80,000 in extensions, repairs and replacements to the system of the Hawaiian Telephone Company of Hilo.

The 25 per cent increase in transcontinental freight rates, effective June 25, and the greatly increased traveling rates are responsible for a general change in f.o.b. Pacific Coast prices, varying from 10 to 25 per cent. Some items, such as schedule material, have advanced several times. Besides those items which are treated at greater length below, the following lines have recently changed in price: Fiber and insulating material, connectors, oiled cloth, lamp guards, reflectors and flexible non-metallic conduit.

GLASS INSULATORS.—The great weight of glass insulators and the sharp advance in freight rates makes necessary a 10 per cent increase in selling prices, effective July 1. The demand is poor on account of little extension work, and local stocks are topping.

TAPE.—In addition to a 10 per cent advance in high-grade friction tape a further advance of approximately 20 per cent in commercial friction tape became effective July 1.

METAL MOLDINGS AND FITTINGS.—Metal moldings and fittings have advanced 20 per cent, and further advances are not unlikely in the view of the practical commandeering of the steel industry for government service. Greater familiarity with their possibilities and the efforts of competing lines have intensified their sale.

WEATHERPROOF WIRE.—After a comparatively long period of price inactivity this fickle commodity has just changed, the new price being a decrease of more than 6 cents a pound in maximum quantities over the previous prices.

METAL MARKET SITUATION

War Industries Board Raises the Price of Copper—Lead and Spelter Continue to Advance

Since last week an entire change has occurred in the copper situation. Much to the surprise even of those supposed to have inside information, the War Industries Board through its price-fixing committee allowed an increase of 2½ cents a pound on July 2 to go into effect at once. The President approved the agreement the following day. Instead of 23.50 cents a pound, the official price in carloads or over is now 26 cents, and in less than car lots, or what is known as the jobber's price for smaller consumers, the selling figure will be 27.30 cents a pound. This price is to remain in effect until Aug. 15.

Lead continues to advance, and while 8 cents a pound was reached in last week's quotations, manufacturers are making a base price of 9 cents a pound this week. Tin rules about the same as last week, but the War Industries Board has issued specific instructions for its use in manufacturing which apply to the electrical trade as well as other industries. Spelter is also showing more firmness. Such fluctuations as appear in the old metals are a stiffening in heavy lead and old zinc scrap.

NEW YORK METAL MARKET PRICES

	July 1	July 8
Copper:	£ s d	£ s d
London, standard spot	110 0 0	110 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26 00	Govt. price 26.00
Electrolytic	Govt. price 26 00	Govt. price 26 00
Casting	Govt. price 26 00	Govt. price 26 00
Wire base	28 25	30 00
Lead, trust price	8.00	9 00
Antimony	13 00 to 13.25	13.00 to 13.37½
Nickel, ingot	40 00	40.00
Sheet zinc, f.o.b., smelter	Govt. price 15 00	Govt. price 15 00
Spelter, spot	8 80 to 8 90	8.90 to 9 00
Tin, Chinese*	90	$1.00
Aluminum, 98 to 99 per cent	Govt. price †33.00	Govt. price 33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper wire	21 50 to 22 00	23.00 to 23.50
Brass, heavy	13 50 to 13.75	14.00 to 14 50
Brass, light	10 50 to 11.50	12.00 to 12.25
Lead, heavy	7 12½ to 7 37½	7.12½ to 7 50
Zinc, old scrap	6.50 to 6.75	6.50 to 6.75

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* No Straits offering. † In 50-ton lots or more; carload, 33.10 cents per lb., 1-ton to 14-ton lots, 33.20 cents per lb.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List Per 1000 ft.
No. 14 solid	$61 00
No. 12 solid	71.00
No. 10 solid	90 00
No. 8 solid	106 00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115 00
No. 6 stranded	160 00
No. 4 stranded	205 00
No. 2 stranded	266 00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104 00
No. 12 solid	135.00
No. 10 solid	185 00
No. 8 stranded	235 00
No. 6 stranded	370 00
No. 4 stranded	575 00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List to + 15%
Coil to 1000 ft	10% to 57.25

	No. 12 Solid
Less than coil	List to + 15%
Coil to 1000 ft	10% to 66 75

Twin-Conductor

	No. 14 Solid
Less than coil	List to $120.00
Coil to 1000 ft	$97.75 to $100.00

	No. 12 Solid
Less than coil	List to + 15%
Coil to 1000 ft	10% to 126.80

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	15%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	15%

Twin-Conductor

	No. 14 Solid
Less than coil	+5%
Coil to 1000 ft	5%

	No. 12 Solid
Less than coil	+5%
Coil to 1000 ft	5%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each
Standard packages from 100 to 250

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+ 10% to 12%
1/5 to std. pkg	5% to 20%
Std. pkg	23% to 44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	12%
1/5 to std pkg	20%
Std. pkg	44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 40	$0 40
12 to 50	35	.35
50 to barrel	31	.32
Barrel lots	28 to 2865	.29 to 2965

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 40	$0 40
12 to 50	35	35
50 to barrel	3190	3290
Barrel lots	2890	2990

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5 00
⅜	250	7 50
½	100	10 00
¾	50	13 00
1	50	21 00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45 00
2½	25–50	52.00

NET PER 100 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
⅜-in. s. stp.	$75 00 to $82 50	$67.50 to 69.75
⅜-in d stp.	75 00 to 84.00	69 00 to 72 00
½-in. s. stp.	100.00 to 110 00	90.00 to 93 00
½-in. d. stp.	100.00 to 112 00	92 00 to 96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	List	$63 75
⅜-io. double strip	78 75	71 25
½-in. single strip	List	85 00
½-in. double strip	105 00	95 00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In	List per Foot	Size, In.	List per Foot
7/32	$0 05½	1	$0 25
¼	06	1¼	33
⅜	09	1½	40
½	12	1¾	47
⅝	15	2	55
¾	18	2¼	65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$49 50–$55 00	$24 45–$41 25	$21 50–$33.00
¼-in.—	$54 60–$60 00	$27 00–$45 00	$23 50–$36 00

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$60 00	$30.00	$26 50
¼-in.—	$65 00	$32 50	$29 00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 39

Size, In.	Conduit, List per Foot
¼	$0 08½
⅜	08½
½	08½
¾	11½
1	17
1¼	23
1½	27½
2	37½
2½	58½
3	76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0 05	$0.19
⅜	06	.19
½	07	19
¾	10	25
1	13	37
1¼	17	.45
1½	21	.50
2	28	1.10
2½	40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	+20% to 12%	+20% to 14%
2500 to 5000 lb.	+20% to 15%	+20% to 17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ in	¾ to 3 in.
Less than 2500 lb.	6 8%	9 8% to 10.7%
2500–5000 lb.	8 8%	11 8% to 12 7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5.00 to $6 00
Discount	25% to 30%

CHICAGO

List price	$5 00 to $6 00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	35
65-amp. to 100-amp	50	.90
110-amp. to 200-amp	25	2.00
225-amp. to 400-amp	25	3.60
450-amp to 600-amp	10	5.50
600-Volt		
3-amp. to 30-amp	100	$0 40
35-amp. to 60-amp	100	60
65-amp. to 100-amp	50	1 50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5 50
450-amp. to 600-amp	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10% to 30%
1/5 to std. pkg.	20% to 50%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg.	40%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$5 00 to $7.00
1/5 to std. pkg.	4 50 to 5 95

Standard packages, 500. List, each $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$7 00
1/5 to std. pkg	5.75

Standard packages, 500 List, each, $0.07

LAMPS, MAZDA

105 to 125 Volts

Regular, Clear:	Std Pkg	List, Each
10 to 40-watt—B	100	$0 30
60-watt—B	100	35
100-watt—B ..	24	70
25-watt—C	50	70
100-watt—C	24	1 10
200-watt—C	24	2 20
300-watt—C	24	3 25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25	50	53
25-watt—G 25	50	55
40-watt—G 25	50	55
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30	24	72
Round Bulbs, 4⅜-in., Frosted:		
100-watt—G 35	24	1 10

DISCOUNT—NEW YORK

Less than std. pkg	List
Std pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg.	List
Std. pkg	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft Net
Less than coil (250 ft)	$33 80 to $35 96
Coil to 1000 ft	26 95 to 28 23

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft).	$29 00
Coil to 1000 ft	21 50

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24 00

CHICAGO

Net per 100	$21 25

OUTLET BOXES

Nos.	List, Per 100
101—A, A 1½, 4 S.C., 6200, 320	$30 00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S	30 00
103—C.A., 9, 4R, B 1½	25 00
106—F.A., 7, C.S., 1½, 3 R ..	20 00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10 00 list	25% to 30%	20%
$10.00 to $50.00 list..	35% to 42%	25% to 37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list.	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg ..	5%
1/5 to std pkg	15%
Std pkg.	25%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	10%
1/5 to std. pkg.. ..	20%
Std. pkg ..	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$15 80 to $38 00
1/5 to std. pkg	14 80 to 19 00

Standard package, 2200. List per 1000, $20

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$15 80
1/5 to std. pkg.....	14 80

Standard package, 2200. List per 1000, $20

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std Pkg 3500 5½ N.C.	Std Pkg. 4000 Solid Nail-it—N.C.
Less than 1/5 std. pkg	$11 85 to $20 00	$30 70
1/5 to std pkg.	11 10 to 15 60	24 20

CHICAGO

Per 1000 Net	Std Pkg 3500 5½ N.C	Std. Pkg. 4000 Solid Nail-it—N.C
Less than 1/5 std. pkg.	$11 85	$20 75
1/5 to std. pkg	11 10	24 20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push sockets	500	$0 33
⅛-in. cap keyless socket	500	30
⅛-in. cap pull socket	250	60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+ 10% to 10%
1/5 to std pkg	5% to 8%

NET PER 100 CHICAGO

Less than 1/5 std. pkg	10% to 29 70 to 54 cts.
1/5 std pkg	20% to 26 40 to 48 cts.

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0 80
60-amp. S. P. S. T	1 20
100-amp. S. P. S. T	2 25
200-amp. S. P. S. T	3 48
300-amp. S. P. S. T	5 34
30-amp. D. P. S. T	1 20
60-amp. D. P. S. T	1 78
100-amp. D. P. S. T	3 38
200-amp. D. P. S. T	5 20
300-amp. D. P. S. T	8 00
30-amp. 3 P. S. T	1 80
60-amp. 3 P. S. T	2 68
100 amp. 3 P. S. T	5 08
200-amp. 3 P. S. T	7 80
300-amp. 3 P. S. T	12 00
Low Grade.	
30-amp. S. P. S. T	0 42
60-amp. S. P. S. T	24
100-amp. S. P. S. T	1 50
200-amp. S. P. S. T	2 70
30-amp. D. P. S. T	68
60-amp. D. P. S. T	1.22
100-amp D. P. S. T	2 50
200-amp D. P. S. T	4 50
30-amp 3 P. S. T	1 02
60-amp. 3 P. S. T..	1 84
100-amp 3 P. S. T	3 76
200-amp. 3 P. S. T	6 26

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+10% to +5%
$10 to $25 list	List to 11%
$25 to $50 list.	10% to 14%

	Low Grade
Less than $10 list	List to 5%
$10 to $25 list	10% to 16%
$15 to $50 list	15% to 24%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list.	+ 5%
$10 to $25 list ...	+10%
$25 to $50 list	+14%

	Low Grade
Less than $10 list	5%
$10 to $25 list	16%
$25 to $50 list	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole	250	$0 28
5-amp. single-pole, ind... ..	250	32
10-amp. single-pole.. ..	100	48
10-amp. single pole, ind	100	54
5-amp. three-point	100	54
10-amp. three-point..........	50	76
10-amp., 250-volt, D. P.....	100	66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole.	100	$0 45
10-amp. three-way..........	50	.70
10-amp. double-pole....	50	70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+ 10%
1/5 to std. pkg	5% to 8%
Std. pkg	23% to 25%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	28%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar	List Each
No 155	$0 34
No 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2 00 list	40%	30%
$2 00 to $10.00 list	50%	40%
$10.00 to $50.00 list	64%	52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2 00 list	25%	20%
$2.00 to $10.00 list	25%	20%
$10.00 to $50 00 list.	25%	20%

TOASTERS, UPRIGHT

NEW YORK

List price ...	$5 00 to $6.00
Discount ...	25% to 30%

CHICAGO

List price	$6 00
Discount	25% to 30%

WIRE ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net!
No. 18, less than full spools .. .	$0.43–$0.50
No. 18, full spools ...	38– 45

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0 65
No. 18, full spools	.55

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14..	$15 00–$20 00	$14 00–$15 00	$11 25–$12 25
12.	26.25– 22 10	20 62– 23 20	16 13– 12 05
10...	36.47– 37 80	28 65– 32 40	22.40– 23 75
8...	51 24– 53.35	40 26– 45 70	31.42– 33 55
6..	81 06– 84 40	63 69– 72.35	50.79– 53.05

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft
14..	$19 00	$14 00	$12 50
12..	27 53	23.86	22.02
10..	33.02	30 48	27 44
8.	46.09	42.54	38.99
6..	61 30	61 26	52.18

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb ..	$37 85 to $38.40
25 to 50 lb..	36.40 to 37.85
50 to 100 lb	32 10 to 32.40

CHICAGO

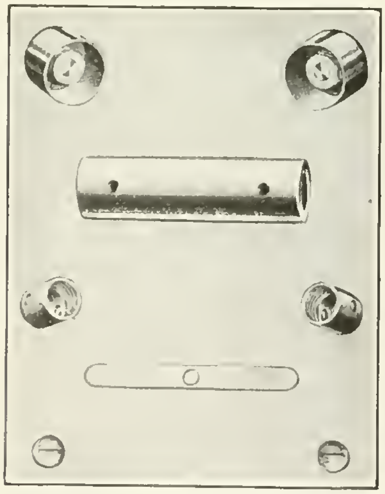
	Per 100 Lb. Net
Less than 25 lb	$37.00
25 to 50 lb.	36 00
50 to 100 lb	35 00

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Improved Renewable Fuse

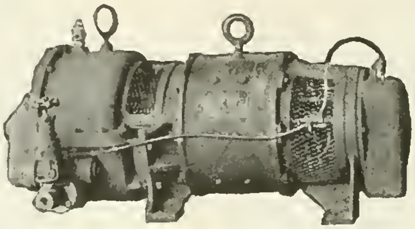
A renewable fuse designed to save on both first cost and maintenance outlay has recently been placed on the market by the D & W Fuse Company, Providence, R. I. The unit consists of a fiber tube having a steel sleeve held in each end by two pins. The inside of each sleeve is threaded to receive a metal plug, which is securely attached inside the brass ferrule, and the sleeve has a seat beyond the threaded portion, on which rests a slotted washer. The link is clamped between this washer and the end of the metal plug, both of which are held in position by the threaded sleeve. This insures permanent electrical contact between the link and the terminal structure, and eliminates any trouble associated with some designs of fuse in which the pressure necessary to maintain the link contact is transmitted through a part of the fiber tube, with resulting difficulties from shrinkage, expansion or warping of the fiber. In the D & W renewable fuse the threaded metal plugs which screw into the sleeves are long enough in proportion to their diameter to be readily started into the receiving thread, which avoids the difficulty of cross-threading, often encountered where thin metal disks threaded on the edge are employed. The steel parts of this fuse are oxidized to prevent "freezing" from molten or vaporized link metal, and consequent sticking after blowing on heavy overload. No tools are required in replacing a link or removing a cap. Re-fusing is effected merely by removing the caps, inserting a new link through the washers, bending one end of the link and replacing the caps. In marketing, one case is furnished for each size of the various ranges, separately supplying the different ratings of renewable fuse links. This insures a very large saving in fuse investment, both for the consumer and jobber, as it eliminates the need of carrying a complete stock of finished fuses of each rating. These fuses are at present being made in 30-amp. and 60-amp. units for 250-600-volt service.



ELECTRICAL CONTACT ASSURED BETWEEN LINK AND TERMINAL STRUCTURE

Small Turbo-Generator Set Directly Connected

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is manufacturing a small turbo-generator set that is adaptable to surface mining, floodlighting, places where night work is essential, for electromagnet work on steam cranes, etc. The unit is made for 10-kw. output, although a temporary load of approximately 12½ kw. may be obtained.



GENERATOR SHAFT EXTENDED IS ONLY REVOLVING UNIT

The machine is fitted with a hand and automatic throttle valve and an emergency overspeed governor. The latter feature is placed on the generator end of the unit and automatically closes the throttle valve of the turbine if the unit overspeeds. It consists of a small weight placed on the shaft of the unit which at a predetermined speed engages a trip lever connected in such a way to the throttle valve that it is automatically closed, thus stopping the turbine.

Fixture with Switch Mounted in Chain

A semi-indirect lighting fixture of the chain suspension type controlled by a pull-chain switch mounted in the suspension chain is being marketed by the Peerless Light Company, 147 West Randolph Street, Chicago. The fixture is made in four general styles, the two suspension-chain styles having 13-in. and 17-in. (33-cm. and 43-cm.) chains respectively and the two ceiling styles also having 13-in. and 17-in. chains. "Peerlite" glass is used in all of the fixtures and is said to produce a daylight effect in an economical fashion. The manufacturer especially recommends these units for commercial and residential lighting. The fixtures can be sold, if the purchaser desires, already wired, and packed in individual cardboard shipping cases.

FIXTURES SHIPPED ALREADY WIRED IF DESIRED

Direct-Current Magnetic Switches

The Allen-Bradley Company, 495 Clinton Street, Milwaukee, Wis., is now making direct-current magnetic switches to be installed in connection with special motor or electric-control applications. They are used to switch the current from a remote point by means of a pilot circuit carrying a comparatively small amount of energy.

MAGNETIC SWITCH WITH ARC CHUTE UP AND MOVABLE MEMBERS DOWN

The contacts of these switches are of the copper-to-copper rolling type with liberal pressure exerted by rugged simple helical springs. The coils are large enough to operate the switch under all reasonable voltage fluctuation without the necessity of introducing protective resistances. The magnetic frame parts are made of sheet or cast steel, thus securing maximum strength and magnetic properties with the least weight, which makes the switch of unusually quick action. The coil frames, the shape of pole pieces and the air gaps are so proportioned that if sufficient current is applied to the coil terminals to start the switch, it will close and seal.

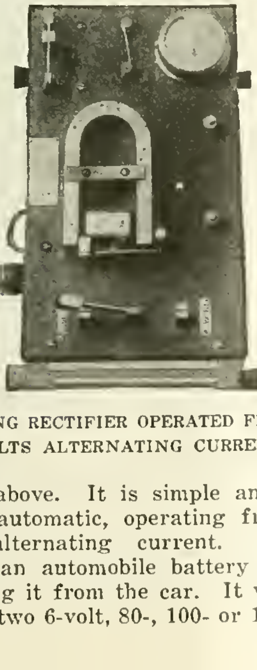
The arc chutes of the magnetic blowout are made with sufficient clearance on each side of the contacts to prevent the arc from burning through the insulation, and they are of open construction so that the air currents set up can assist the magnetic action in breaking the arc. This chute also acts as the stop for the switch in the open position, and when it is pushed up the movable member of the switch will drop down into a position suitable for cleaning and inspection. This also makes the switch inoperative, rendering it impossible to use it unless the arc chute is in place.

Erasing Outfit for Use in Drafting Room

For facilitating the work of draftsmen, the Coates Manufacturing Company, Worcester, Mass., has developed and is marketing an electrical erasing outfit. This consists of a 1/15-hp. electric motor mounted on a stand with a flexible shaft 3 ft. (0.9 m.) in length. The motor is also equipped with a stationary disk for roughing and truing the rubber eraser.

Vibrating Rectifier for Automobile Batteries

For starting all kinds of lighting and storage batteries for automobiles the Fore Manufacturing Company, Inc., 5643 Easton Avenue, St. Louis, is marketing the rectifier (type 2-B) shown above. It is simple and practically automatic, operating from 110 volts alternating current. It will charge an automobile battery without removing it from the car. It will also charge two 6-volt, 80-, 100- or 120-amp. batteries at 6-amp. charging rate at one time. The device weighs only 27 lb. (7.7 kg.). It is operated from a 110-volt lamp socket by attaching a plug.

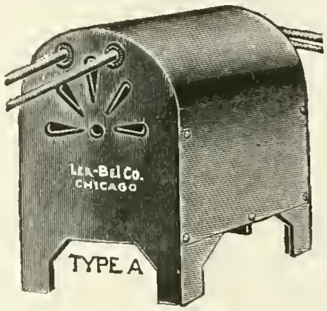


VIBRATING RECTIFIER OPERATED FROM 110 VOLTS ALTERNATING CURRENT

Transformer for Tungsten-Lamp Projection

A transformer that will control the currents applied to incandescent lamps for motion-picture projection accurately at the value specified has been placed upon the market by the Lea-Bel Company, 610 Schiller Building, Chicago. This transformer consists essentially of two—or three—separate parts—the transformer proper and the control panel for each machine. The transformer is so designed that it will supply the energy for the lamps of one machine continuously or of two machines alternately. Both machines may be operated together for some time without causing the transformer to overheat. The panelboard is arranged to be mounted on the wall of the booth convenient to the machine to be operated. A separate panel containing the ammeter and an adjustable rheostat is provided for each machine.

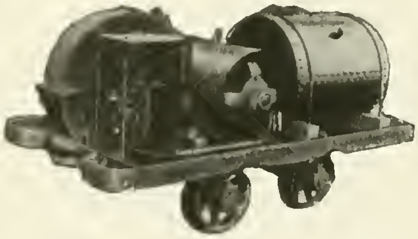
As it is usually desirable to start the second machine before the film of the first one has been quite run off, the lamp can be brought up to full candlepower gradually so that the change-over can be made readily. A low-voltage connection is provided for heating the lamp. This connection also aids focusing the new lamp which is being installed. The current may be varied in steps of 0.2 amp., and the transformer will take care of the ordinary variations in line voltage. Satisfactory adjustment of the lamp may be attained even though the line voltage may vary from 100 volts to 125 volts. The transformer can be supplied for either 600-watt or 750-watt Mazda C. lamps for motion-picture projection.



TRANSFORMER ACCURATELY CONTROLS CURRENT AND VOLTAGE

Portable Motor-Driven Compressor for Mines

For use as an auxiliary to the main compressed-air system or for development work in coal mines without compressed-air service, the Ingersoll Rand Company, 11 Broadway, New York, has developed a small portable motor-driven air compressor. This machine can be used for operating drills, coal cutters and air lifts and for various other purposes. The complete outfit, as shown in the accompanying illustration, is mounted on a truck with flanged wheels of a gage to suit the mine track so that it can be hauled wherever it is needed. This type of compressor is made in ratings up to 415 cu. ft. (35.2 cu. m.) of air per minute and for pressures up to 100 lb. (7 hp. per sq. cm.). The motor, which is built by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is designed to operate on the available energy supply and is furnished in sizes ranging from 12 hp. to 56 hp., depending on the rating of the compressor. A large air receiver forms a part of this outfit. The air can be pumped into this receiver, and the pressure is automatically maintained.



COMPLETE OUTFIT MOUNTED ON A TRUCK

Industrial Truck with Four-Wheel Drive

The Lakewood Engineering Company, Cleveland, Ohio, is now manufacturing a storage-battery-driven industrial truck known as model "BC." The frame dimensions are made as small as possible and take care of two compartments, one over each axle, for twenty-four cells of heavy-duty lead battery or twenty-two cells of Edison battery. These compartments form seats for the operator.

The wheels are steered through a worm and sector arrangement connecting all four wheels. An angle of 6 deg. is obtained by this method of steering, both the inside and outside wheels turning on a radius drawn to a common center. The steering column is placed in the center of the tractor, and at each side of the column is placed a steering wheel connected with the worm by chains.

The controller is placed at the top of the steering column between the steering wheels. A safety contact switch is placed at the bottom of the steering column and operates in conjunction with the controller and brake pedal, making it impossible to operate the tractor unless the controller handle is always brought to the neutral point. When the foot brake is released brakes are applied and current is cut off automatically.

The motor is set midway between axles and drives both fore and aft through worm gear on both axles. Power is transmitted from the cross shaft in the axles by a pair of bevel gears to a vertical shaft carried by the swivel hub.

Trade Notes

Changes in the Western Electric Company's Organization

A. W. BATES has taken the management of the office in New Haven, Conn. He started in at Hawthorne, Ill., in 1909, and for several years was in the A & B service department in New York City.

A. B. VANDERCOOK, who for the last six months has been a company specialist at Los Angeles, Cal., has been made sales manager of the district branch there. His connection with the Western Electric organization dates from 1916.

L. R. BROWNE has been transferred to the International Western Electric Company as credit manager. He entered the service of the company in 1916, beginning as a claim clerk in Chicago. He went to Omaha, Neb., the following year and then to Philadelphia, where he was the credit chief and cashier. Albert E. Case, formerly credit man in Boston, Mass., takes Mr. Browne's place in Philadelphia, with H. P. Litchefield, from New York, succeeding Mr. Case.

M. A. CURRAN, formerly general credit manager of the company in New York City, has taken over the management of the line material department in the general sales organization. E. W. Shepard, in charge of the credit department of the company's Cleveland branch house, succeeds Mr. Curran at headquarters in New York City. F. J. Kelly, connected with the credit end in the Chicago house, succeeds Mr. Shepard in Cleveland. These changes became effective July 8.

TYLER HOLMES, who became connected with the company in 1900, going to the various branches in the East and West and at one time manager at New Haven, Conn., goes to Denver, Col., to assume the management of that house. He succeeds Alexander Brown, whose sudden death from heart disease, while at the wheel of his automobile, occurred June 1. Mr. Brown's death deprived the company of an executive of energy, unusual business attributes and engaging personal qualities. He was the Denver manager for twelve years.

FRANK B. RAE, electrical and mechanical engineer, announces the removal of his office to 219-226 Avenue Building, Cleveland, Ohio.

THE AMERICAN ELECTRICAL WORKS of Phillipsdale, R. I., have given life insurance to all the employees of its plant of more than three months' standing.

THE WAR TRADE BOARD of Washington, D. C., in supplement No. 5, furnishes a cumulative supplement to the enemy trading list, revised, containing additions, removals and connections from March 15 to June 14, 1918.

THE DOLPH MANUFACTURING CORPORATION of Newark, N. J., manufacturer of insulating varnishes and compounds, tape tubing, etc., has placed its selling agency in New York City with John H. Barker, 95 Liberty Street.

H. G. WEDLER, for six years sales representative of the Emil Grossman Manufacturing Corporation of Brooklyn, N. Y., entered the United States military service on June 17. He is now in the mechanical repair shops, Unit 305, Camp Jesup, Atlanta, Ga.

THE JEWELL ELECTRIC INSTRUMENT COMPANY of Chicago announces that the following representatives have been added to the organization: George E. Linton, 10 High Street, Boston; Benjamin B. Baseler, Philadelphia, and the Moore Electric Company, Denver.

THE FAFNIR BEARING COMPANY of New Britain, Conn., manufacturer of ball bearings, in a war saving stamp selling campaign stands second in a long list of other local factories engaged in the same patriotic and laudable work. The per capita sales of the Fafnir company are 18.30, with total sales up to June 8 of 8419.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY is adding two extra stories to its service station at Tenth Avenue and Thirty-sixth street, New York City. This will furnish 15,000 additional square feet to the floor space to accommodate the company's increasing business at the plant. Superintendent Richards entertains hopes that the work will be completed and available by Sept. 1, as provided in the contract.

THE WESTINGHOUSE LAMP COMPANY of New York City has moved its advertising department back from 21 Park Row to the executive office at 165 Broadway.

THE PREMIER RUBBER & INSULATION COMPANY of Dayton, Ohio, is a new concern which has built a complete plant for the manufacture of molded insulation products from bakelite, condensite, etc. K. F. Englerth, the president, is the chief production engineer of the Dayton Engineering Laboratories Company, and A. Huetter, the general manager, was formerly in charge of the Delco molded products departments of the same company.

THE NEW DEPARTURE MANUFACTURING COMPANY of Bristol, Conn., on July 13 will distribute $50,000 in bonuses to its employees, accrued at the close of its business year on June 30. Those who have been in the company's employ from three to six months will be paid an extra half week's wages; six months or more, a full week. In addition the company cordially expresses its appreciation of the loyal co-operation of its employees in every department.

THE WESTERN ELECTRIC COMPANY has created a new addition to its wide activities by forming what is to be known as the government department in New York City. This has been done in order that the resources of the company may be placed at the disposal of the federal authorities to a greater extent than was possible in the past. Harry L. Grant, for many years sales manager of the Chicago house, is the manager, J. C. Enders sales manager, G. A. Sherman assistant manager, and A. L. Perry credit chief. The headquarters of the department are in the company's building at 463 West Street. The company now has dealings with forty and fifty government bureaus, and the new arrangement provides a clearing house for its multifarious transactions.

THE DOEHLER DIE-CASTING COMPANY of Brooklyn, N. Y., has just broken ground for the new addition to its factory on Court and Huntington Streets. This addition will cover 150 ft. on Court Street and 200 ft. on Huntington Street and will be ten stories high, actually doubling the present capacity of the plant. The construction will be of steel and concrete throughout, to confirm to the general character of their present structures, the last addition to which has only been occupied since Sept. 1 last. Newly perfected types of automatic die-casting machinery are now in process of construction, ready to be installed in the new building, which is to be ready for occupancy before the summer is over. While the greater portion of the company's activities are devoted to government and war work, the requirements of the regular trade, which in the main is now also for government consumption, are receiving the usual attention.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY of East Pittsburgh, Pa., at the eighth annual convention of the Tri-State Water and Light Association of the Carolinas and Georgia, held at Atlanta, Ga., was represented by Thomas Fuller. At the session held June 14 Mr. Fuller read a paper, entitled "The Electrical Industry in War Times," which attracted marked attention and was subsequently discussed with interest by the delegates. Among other pertinent things he said: "Our steam-turbine production in normal times averages 500,000 hp. per annum. Our business now to our regular customers totals more than 1,000,000 hp. In addition to this business, we are supplying 2,500,000 hp. for government vessels. Three hundred and fifty-eight vessels now under construction will be equipped with these turbines for main propulsion. In a few months we shall deliver to the government plant at Muscle Shoals a 70,000-kw. turbine, the largest generating unit in the world."

THE KILBOURNE & CLARK MANUFACTURING COMPANY of Seattle, Wash., has recently leased to the Skinner & Eddy Corporation its building and site on West Connecticut Street and has purchased a three-and-a-half acre tract at the northwest corner of Whatcom Avenue and Spokane Street, on which will be erected what will, it is said, be one of the largest wireless manufacturing plants in the world. Plans for the proposed new plant provide for four large buildings, each to be one story, with glass sides and sawtooth roofs. A machine shop, 300 ft. long and 100 ft. wide, and a two-story concrete office building will be part of the new construction. A large concrete testing laboratory will also be built, and all floors in the buildings will be of concrete. Improved methods will be employed in construction, and provide that all materials move one way until they emerge from the testing laboratory in the form of the finished product. The Shipbuilding Corporation's lease provides that the Kilbourne & Clark Company's property shall be vacated by Oct. 1. Plans for the new wireless plant are rapidly taking form. It is announced that the plant, when completed, will cost about $250,000. In the year ended June 30, the Kilbourne & Clark Company manufactured the wireless sets for more than 400 ocean-going ships, including naval and cargo vessels for the government.

Trade Publications

CONDUIT SEAL.—Barnes & Irving, Inc., Syracuse, N. Y., is distributing a circular describing the Misener safety conduit seal.

WIRES.—Advances in price and list prices of bare and tinned copper wire, magnet wire, cotton, silk and enamel have been issued by the Rome Wire Company, Rome, N. Y.

INSULATING TAPE.—The Good Manufacturing Company, 106 North Wells Street, Chicago, has issued a post-card folder showing samples of uncoated tape and of varnished cambric.

ROTARY HACK SAW. — Barnes & Irving, Inc., Syracuse, N. Y., is distributing a circular describing the Misener expanding rotary hack saw for cutting circular holes in metal, wood, slate, marble, etc.

ELECTRIC FANS.—Combination desk and wall type direct-current and alternating-current fans are illustrated and described in a circular that is being distributed by Bodine Electric Company, Chicago. Data and list prices of these fans are given.

BATTERY - CHARGING DEVICES. — Bulletin 318, issued by the Automatic Electrical Devices Company, 12 Opera Place, Cincinnati, Ohio, gives descriptions of charging panels for storage battery stations and also shows the electric "chargometer" for installation on trucks or storage-battery cars.

ELECTRICAL INSTRUMENTS. — The Jewell Electrical Instrument Company, 810 West Lake Street, Chicago, has issued an illustrated catalog showing its line of electrical measuring instruments. Among the instruments included in this bulleting are the laboratory standard portable, general utility portable, inspector's portable, duplex portable, stardard round pattern and automobile meters. The functions of the engineering and repair departments of this company are outlined and the construction features and moving elements of the instruments are described. Price lists are given for all meters except alternating-current instruments lower than 50 volts.

STARTING SWITCH FOR MOTORS.—The Cutler-Hammer Manufacturing Company of Milwaukee, Wis., has issued a pamphlet which shows four typical installations of the C-H 9116 starting switch for squirrel-cage motors. An interior view shows the construction and arrangement of the starting and running contacts, fuses, etc. The manner by which the motor is connected to the line ahead of the fuses and then automatically engages the fuses without opening circuit to the motor in the transition is clearly shown. Attention is called to the fact that the sizes made up to 3 hp., 110 volts, and up to 5 hp., 220 440 and 550 volts, give this alternating-current inclosed starter a wide field of application because of the extensive use of squirrel-cage motors of the ratings specified.

ILLUMINATION.—"The Lighting of Offices and Drafting Rooms" is the title of bulletin No. 35, now being distributed by the engineering department of the National Lamp Works of the General Electric Company. In this bulletin some of the data have been adapted from electrical and technical papers by Ward Harrison, illuminating engineer of the National Lamp Works. The subject of office lighting is discussed under five principal subdivisions—quantity of light, quality, utilization, location and number of lighting units, and illuminating calculations. Illustrations show the effect of different types of lighting units in offices and drafting rooms, and curves are given showing the number of rows of units needed for different lengths or widths of offices or drafting rooms. This chart is designed to simplify the location of lighting units in offices.

New Incorporations

THE FAWN TOWNSHIP LIGHT & POWER COMPANY of New Park, Pa., has been incorporated with a capital stock of $20,000 by H. M. Johnson and others.

THE DUAL WELDING APPARATUS COMPANY of Elizabeth, N. J., has been chartered with a capital stock of $50,000 by M. Lucas, Frederick De Meese and Robert Zuber of Elizabeth. The company proposes to manufacture welding equipment.

THE FEDERAL ELECTRIC & MANUFACTURING COMPANY of McKee's Rocks, Pa., has been incorporated by Miles Bryant and associates. The company is capitalized at $50,000 and proposes to manufacture electrical goods.

THE AHLGREN LIGHT & STORAGE BATTERY COMPANY of Terre Haute, Ind., has been chartered with a capital stock of $25,000 to manufacture batteries and lighting systems. The incorporators are William T. Kincaid, Reilly C. Adams and H. C. Austill.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

BIDDEFORD, ME.—Arrangements are being made by the Peperell Manufacturing Company to secure energy from the Clark Power Company at Union Falls. The cost of developing the plant at Union Falls and erecting of a 11,000-volt transmission line to Biddeford is estimated at $50,000. There is already a waterwheel at the Union Falls Plant, and three others will be installed this summer, for which orders have been placed. It is planned to develop about 700 hp. The Peperell company, it is stated, proposes to equip its entire plant for electrical operation after the war. The York County Power Company is unable to furnish service to the Peperell company at the present time. It is expected to have the plant completed by November so as to provide for the coal shortage this winter.

MONTAGUE, MASS.—The Turners Falls (Mass.) Power & Electric Light Company has purchased a site on Whitney Avenue, which will be used in connection with future developments of its plants.

ORANGE MASS.—Plans are being considered by the New Home Sewing Machine Company, 45 East Seventeenth Street, New York, N. Y., for additions to its plant in Orange, to cost more than $150,000. Work has been started on an addition, to cost about $75,000. Francisco & Jacobus, 511 Fifth Avenue, New York City, are engineers.

WHITMAN, MASS.—The Selectmen have signed the new electric light contract with the Edison Electric Illuminating Company of Brockton under which the company will furnish 36 additional lamps of 60 cp. The contract is for a period of five years. Work will begin at once on the erection of the new lamps.

NORWICH, CONN.—The Shore Line Electric Railway Company, is planning to erect a new high-tension transmission line from Norwich through the Quinebaug Valley to the Massachusetts line in the town of Thompson.

Middle Atlantic States

AKRON, N. Y.—Plans are being prepared by Reidpath & Son, Builders' Exchange, Buffalo, architects and engineers, for the erection of a power house in Akron for the Wheat's Ice Cream Company, 236 Elm Street, Buffalo, N. Y.

ALBANY, N. Y.—The Board of Contract and Supply has awarded contract for the new lighting fixtures for the remodeled city hall to Edward F. Caldwell & Company of New York, at $15,000.

BROOKLYN, N. Y.—The Kenyon Company, 754 Pacific Street, has awarded contract to Charles E. Knox, 10 Park Avenue, New York City, for electrical work in connection with the construction of its new plant. The cost of the entire plant is estimated at about $375,000.

BUFFALO, N. Y.—The engine plant and a number of other buildings at the Erie County Home and Hospital were recently destroyed by fire, causing a loss of more than $150,000.

BUFFALO, N. Y.—Plans are being prepared for the erection of a new plant, 195 ft. by 415 ft., for the General Electric Company, to be situated at East Ferry Street and Fillmore Avenue. The plant will cost about $250,000 and will be used for the manufacture of incandescent lamps.

EAST ROCHESTER, N. Y.—Bids, it is reported, will soon be asked by the Merchants' Dispatch Transportation Company for the construction of a new plant, 150 ft. by 1000 ft., one story, to cost about $500,000. R. Yates is engineer.

ITHACA, N. Y.—Notice has been filed with the Public Service Commission by the Ithaca Gas & Electric Company of a change in its name to the New York State Gas & Electric Corporation.

NEW YORK, N. Y.—A general machine and repair shop, 110 ft. by 200 ft., will be erected in connection with the proposed automobile garage to be established on Second Avenue between Forty-seventh and Forty-eighth Streets, by the Interstate Garages, Inc., of New York.

NEW YORK, N. Y.—The proposed extensions and improvements to be made by the Interborough Rapid Transit Company, for which a bond issue for $37,700,000 is being arranged with the War Finance Corporation, include extensions in power plants electric substations and transmission lines of the company, also improvements in existing electrical apparatus, to cost about $2 391,000; improvements in electric interlocking and other signal apparatus, $3,371,000; electrical machinery and equipment for substations, equipment for electric transmission and distribution systems, $7,886,000.

NIAGARA FALLS, N. Y.—The United States Light & Heat Company, 3215 Highland Avenue, Niagara Falls, is contemplating building a new factory building, 150 ft. by 300 ft., one story, to cost about $75,000. The company manufactures heating specialities. Mill, Rhines, Bellman & Nordoff, Ohio Building, Toledo, Ohio, are architects.

POTSDAM, N. Y.—Bids will be received by Dr. Thomas E. Finnegan, Deputy Commissioner of Education, Education Building Albany, until July 24 for interior telephones, clocks, program bells and fire-alarm system for the State Normal and Training School at Potsdam. Drawings and specifications may be consulted at the above school, Potsdam, at the New York office of the Department of Architecture, Room 1224, Woolworth Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

WATERTOWN, N. Y.—Plans are being prepared by T. L. Tomlines, City Bank Building, Syracuse, for a building, 90 ft. by 120 ft., one story, for an electric plant. The cost is estimated at about $75,000.

BAYONNE, N. J.—Contract has been awarded by the Board of Education to the Dugan-Foerst Engineering Company, 499 Broadway, for electrical work in Public School Building No. 3, at $3,970.

BOONTON, N. J.—Plans are under consideration by the Board of Aldermen for the installation of a new electrical operated pumping unit at the municipal water-works system.

CAMDEN, N. J.—Plans are under consideration by the City Council for extension to the street-lighting system on Mount Ephraim Avenue, beginning at Ferry Avenue.

CAMDEN, N. J.—Plans are being prepared for extensions to the power plant of the New York Shipbuilding Company. Considerable new equipment, including a generating set, condenser, etc., will be installed. Marvin A. Neeland is president.

GLOUCESTER, N. J.—Plans are being considered by the Public Service Railway Company for the construction of a branch traction system to the proposed new town site to be developed by the New York Shipbuilding Corporation.

KEARNEY, N. J.—Preparations are being made by Henry Ford for the erection of a plant in Kearney for the production of patrol boats and submarine chasers, to cost about $2,000,000, for which plans have been approved in Washington. A concrete building, 960 ft. by 200 ft., is already under way. Another building, 1400 ft. by 400 ft., will be erected.

TRENTON, N. J.—An ordinance has been passed by the Board of Aldermen authorizing the Public Service Railway Company to erect new poles and equipment for its traction line in Adeline Street, extending from Liberty to Cass Street.

ALTOONA, PA.—Work has been begun by the Pennsylvania Railroad Company on the installation of a new telephone and telegraph system between Altoona and Marysville on its middle division.

BRAEBURN, PA.—The Marlin-Rockwell Corporation of New York has purchased the property of the Braeburn Steel Company at Braeburn for $1,000,000. It is understood that another plant, equipped with a 6-ton electric furnace, will be erected within 18 months.

FARRELL, PA.—Contracts have been awarded by the County Commissioners for the construction of a new power plant. The new building will cost about $10,000 and the new equipment, including boilers, conduit work, wiring, etc., will cost about $15,000. E. S. Clepper of Sharon is architect.

HARRISBURG, PA.—Work has been begun on the installation of new equipment in the plant of the Harrisburg Light & Power Company, including two double fans, two 150-hp. turbines and auxiliary apparatus. It is also planned to install a new 510-hp boiler in the near future.

MIDDLETOWN, PA.—A large electric substation will be erected by the United States government at the new local supply station now being erected here.

NORTH BESSEMER, PA.—Contract has been awarded by the Newfields By-Product Coal Company for the construction of a new power plant, 40 ft. by 125 ft., at its works to the Nicola Building Company, Dennison and Penn Avenues, Pittsburgh.

PHILADELPHIA, PA.,—A metal-working shop and other mechanical departments will be erected in connection with the proposed occupational school to be established by the School of Occupational Therapy, Philadelphia. Major Tait McKennie and Dean Graves of Philadelphia are interested in the school. Mrs. H. Gordon McCouch is chairman of the committee.

PHILADELPHIA, PA.—Plans are being prepared by the Pennsylvania Railroad Company for extensions and improvements at its various shops, including the construction of new engine plants at South Amboy and at Kearny, N. J., and also extensions to the engine plant at Phillipsburg, N. J., and various other locations. The company will also build new engine plants at its Blairville and York shops.

PITTSBURGH, PA.—Extensive improvements are contemplated by the Duquesne Light Company, involving an expenditure of about $2,000,000, of which contracts for $1,200,000 have already been placed. This does not include the proposal of the United States government to have the company build a new plant to be operated under federal supervision.

SCRANTON, PA.—Notice has been filed with the Public Service Commission by the Barren Light & Power Company of an issue of $50,000 in bonds, the proceeds to be used for extensions and improvements to its system.

SHARON, PA.—Contracts have been awarded by the County Commissioners for the construction of the new power plant at the county farm. The new building will cost about $10,000, and the equipment, including boilers, conduit work, wiring, etc., will cost about $15,000. The general contract was awarded to H. W. Bell of Greenville, and that for boilers to the Union Iron Works of Erie.

WILLIAMSPORT, PA.—Contract has been awarded by the Lycoming Rubber Company for the construction of a new boiler plant, to cost about $50,000, to the McNally Building Company, Framingham, Mass.

CUMBERLAND, MD. — Contract has been awarded by the Baltimore & Ohio Railroad Company to Westinghouse, Church, Kerr & Company, 37 Wall Street, New York, N. Y., for the construction of building, 200 ft. by 800 ft., for rebuilding locomotives, to cost about $1,500,000.

MAGNOLIA, MD.—Plans are being prepared for the erection of ten new buildings, each about 100 ft. by 200 ft., for manufacturing munitions at the Edgewood Arsenal, to cost about $200,000. Captain Hall is in charge.

MERCERS, W. VA.—Contract has been awarded by the Mercers Mining Company to the Charleston Concrete Construction Company, Union Trust Building, Charleston, for building power house and cottages.

MOUNDSVILLE, W. VA.—The United States Smelting Corporation, Frisco Building, Joplin, Mo., is planning to erect a plant for smelting ore in Moundsville, at a cost of about $1,000,000. C. E. Marshall, of Joplin, Mo., is manager.

NEWPORT NEWS, VA.—The Newcomb Life Boat Company is contemplating the installation of additional equipment, involving an expenditure of about $50,000, exclusive of derrick crane and plain crane, to cost $30,000 and $25,000 respectively.

NORFOLK, VA.—Plans are being prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of power house, installation of generating equipment, piping and laundry machinery for hospital reservation at Norfolk.

PETERSBURG, VA. — The American Electric Tool Company, which manufactures electric calking tools, etc., is contemplating an addition to its plant.

ROANOKE, VA.—The Virginia Railway & Power Company has been granted a franchise by the City Council to construct a line on York Street between Boush and Granby Streets.

SHENANDOAH, VA.—Contract has been awarded by the town of Shenandoah for the construction of a hydroelectric power plant, to cost about $55,000. The town now operates a steam plant.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Various, Schedule 1866—70,000 sq. ft. high-pressure insulating blocks, miscellaneous magnesia blocks, 175,000 lb. magnesia plastic cement, miscellaneous magnesia pipe covering, fiber asbestos felting, asbestos millboard, 38,725 lb. wick or rope asbestos packing, 47,750 lb. asbestos paper and 271,000 lb. asbestos plaster. Applications for proposal blanks should designate the schedule desired by number.

North Central States

DETROIT, MICH.—Plans are being prepared by A. Kahn, 58 Lafayette Building, architect, for construction of a garage and storage building for the Detroit Evening News Association to cost about $150,000.

AKRON, OHIO.—Failing to reach an agreement with the Northern Ohio Traction & Light Company, the County Commissioners have announced that they will advertise for bids for the erection of an electric transmission line to connect the wires of the company at Tallmadge with the new County Infirmary.

CLEVELAND, OHIO.—Plans are being prepared by the New York Central Railroad Company, St. Clair Avenue and West Third Street, for the construction of a new locomotive repair shop, 97 ft. by 263 ft., one-story, at 564 East 152d Street, to cost about $150,000.

DENNISON, OHIO.—Extensions and additions to its shops and yards at Dennison are under consideration by the Pennsylvania Lines West. The proposed work will cost from $2,000,000 to 3,000,000, and will include the installation of new equipment at the shops, a new freight yard and enlargement of roundhouse and shops, etc.

GERMANTOWN, OHIO.—At an election held recently the proposal to sell the municipal electric light plant was carried. The Dayton Light & Power Company has submitted a proposal to the Council to furnish electricity for lighting the streets and for domestic purposes in Germantown.

HOLGATE, OHIO.—The local municipal electric light plant has been purchased by W. P. Wallace. Contract has been awarded by the new owner to D. B. Douty of Defiance for the erection of a three-phase transmission line from Definance to Holgate. Electricity will be secured from the plant of the Defiance Gas & Electric Company. Mr. Wallace has been granted a twenty-five-year franchise and a ten-year contract. Later the line may be extended to Hamler to furnish electric service there.

MINGO JUNCTION, OHIO.—The Cleveland & Pittsburgh Railroad, division of the Pennsylvania Railroad Company, it is reported, is contemplating an expenditure of about $6,000,000 for yard and shops at Mingo Junction. T Rodd of Pittsburgh, Pa., is chief engineer.

STRUTHERS, OHIO.—Extensive improvements are contemplated by the Struthers Furnace Company involving an expenditure of about $500,000. The proposed work will include the installation of a complete slag-crushing plant, new engines and new generators. A. B. Stough of Struthers is engineer.

LOUISVILLE, KY.—The installation of a power plant is reported to be under consideration by the Inman Veneer & Panel Company.

LOUISVILLE, KY.—The construction of a powder manufacturing plant is under consideration by the War Department, Washington, D. C., and a site has been purchased. The plans provide for an expenditure of between $10,000,000 and $20,000,000, including land, buildings, machinery, public utilities, etc. The plant will be built by the Du Pont Engineering Company of the E. I. du Pont de Nemours Company, Wilmington, Del.

WEST POINT, KY.—The installation of an electric light plant to supply electricity for both commercial and municipal lighting is under consideration. Crutcher & Starks are reported interested in the project.

INDIANAPOLIS, IND.—Extensive improvements and additions are contemplated to the works of the Mid-West Engine Company, involving an expenditure of more than $1,000,000. The company is a consolidation of the Lyons-Atlas Engine Company of Indianapolis and the Hill Pump Company of Anderson, and will manufacture a large number of turbines for the United States Fleet Corporation.

KOKOMO, IND.—Arrangements, it is said, have been completed for the construction of a large shell plant in Kokomo by the United States government, to cost about $2,700,000. The proposed plant is to be built and operated by the Kokomo Steel & Wire Company, the money being provided by the government. Another open-hearth furnace, in addition to the three already operated by the company, will be installed.

PERU, IND.—Surveys have been completed of the Wabash, Mississinewa and Eel Rivers by W. H. Bassett, hydraulic engineer, Springfield, Ohio, for water-power development for the city of Peru. The City Council is considering the erection of a large power plant on one of the streams. It is estimated that 250 hp. can be developed on the Mississinewa River, 4 miles east of Peru, from water impounded by a 25-ft. dam.

SEYMOUR, IND.—Improvements are being made to the local plant of the Interstate Public Service Company.

CARBONDALE, ILL.—The Illinois Central Railway Company has awarded the general contract for the erection of several buildings in Carbondale, including power house, machine shop, and roundhouse, to cost about $150,000.

MATTOON, ILL.—Application has been filed by the Central Illinois Public Service Company with the Public Utilities Commission for a certificate of convenience and necessity to erect and operate a 16,000-volt transmission line from Milford, Iroquois County, through Iroquois, Kankakee and Vermilion Counties to Hoopeston.

MILWAUKEE, WIS. — The National Brake & Electric Company, Belleview and Cambridge Streets, is planning to erect a new foundry, 40 ft. by 130 ft., to cost about $22,000.

MILWAUKEE, WIS. — The Hercules Steel Casting Company, Free Press Building, has awarded the general contract for the construction of its new electric foundry plant on Robinson Avenue, near Becher Street, in Bay View. The building will be 90 ft. by 300 ft., equipped with a 5-ton electric furnace. The cost of the plant is estimated at about $100,000.

SHEBOYGAN, WIS.—The Eastern Wisconsin Electric Company, it is reported, will build an extension from Black Creek to Appleton this summer.

WEST ALLIS, WIS.—Contract has been awarded by the Gerlinger Steel Casting Company of Milwaukee, which operates an electric steel casting plant, for the erection of a building, 80 ft. by 171 ft. by 200 ft., at its plant, to be equipped with a 3-ton Moore electric furnace and a 5-ton electrically-operated crane. Contracts for most of the equipment have already been placed. Robert L. Reisinger, First National Bank Building, is general contractor.

ST. PAUL, MINN.—The construction of a six-story industry incubator, 125 ft. by 100 ft., and a cold-storage plant, 200 ft. by 200 ft., six stories high, is under consideration by the Central Warehouse Company, Pillsbury and Territorial Road. The cost is estimated at about $750,000. C. P. Bratnobe is president.

ELKHART, IOWA.—The Board of Railroad Commissioners of Iowa has granted the town of Elkhardt a franchise to erect and operate electric transmission lines on certain roads and highways in Polk County for a period of 25 years. Electricity for operating the system will be secured from the transmission line of the Fort Dodge, Des Moines & Southern Railroad Company of Boone, Iowa.

GRINNELL, IOWA.—The Community Hospital Association has awarded general contract for the construction of main building and isolation building to C. W. Ennis, of Toledo, Iowa, at about $47,000. Separate contracts will be let for electric wiring and plumbing. The cost of the buildings is estimated at about $55,000. Proudfoot, Bird & Rawson, Hubhell Building, Des Moines, Iowa, is architect.

HUMBOLDT, IOWA.—The Board of Education has awarded general contract for the construction of a new high school building to the Madison Construction Company of Minneapolis, Minn. The cost of the building is estimated at $110,000. G. L. Lockhart, 391 Endicott Building, St. Paul, Minn., and 539 Youngerman Building, Des Moines, Iowa., is architect.

OTTUMWA JUNCTION, IOWA.—The Chicago, Milwaukee & St. Paul Railway Company is planning extensions and improvements to its terminal facilities at Ottumwa Junction, to cost about $500,000. The work will include a pumping station and filter plant of 70,000 gal. capacity, etc. C. F. Loweth, Railway Exchange Building, Chicago, Ill., is chief engineer.

WEBSTER, IOWA.—The Central Illinois Railway Company is planning to build a 1-story machine shop and power house in Webster, to cost about $75,000.

BEVIER, MO.—The installation of a municipal electric generating plant is reported to be under consideration. Energy to operate the system is now purchased from the city of Macon.

JEFFERSON CITY, MO.—The Hays Wood Product Company is contemplating the construction of a power house, to cost about $20,000 to supply electricity for lighting and heating its factory.

JOPLIN, MO.—The Kirkwood Mining Company is contemplating the construction of a 150-ton concentration plant and will require sludge tables, motors and crushers. The cost is estimated at $40,000. S. A. Smith is general manager.

JOPLIN, MO.—The New Carolyn Metal Company has purchased the property of the Neosho Granby Metal Company and proposes to build a new 300-ton mill and to double the output of the present 150-ton mill. The company will purchase new equipment, including crushers, air compressors, engines and boilers, etc. The cost of the work is estimated at $100,000.

SPRINGFIELD, MO.—Arrangements are being made by the Springfield Gas & Electric Company for the erection of a new power house for the new 10,000-hp. steam turbine and other equipment for the proposed new power plant. The new turbine, it is understood, has been delivered and temporary quarters will be provided at the west shops of the Frisco railroad.

NEW ENGLAND, N. D.—The Asby Light & Power Company, it is reported, will soon ask for bids for construction of a flour mill and an electric lighting plant, to cost about $25,000.

BELVIDERE, NEB.—The contract for the installation of the electric distribution system in Belvidere has been awarded to the Mid-West Electric Company of Omaha, at $5,446. Charles F. Sturtevant is engineer.

DE SOTO, KAN.—The contract for heating, electric wiring and plumbing the rural high school building in De Soto has been awarded to the MacMahon Company, of Kansas City, Mo., at $10,448.

GARNETT, KAN.—Contracts have been awarded by the city of Garnett for improvements to the municipal electric-light plant and water-works system as follows: For construction of dam to the Chanute (Kan.) Construction Company, at $10,850; for a 200-kw. generator and engine, switchboard and boiler to the Merkle Machinery Company of Kansas City, Mo., at $16,104 and $5,275 respectively. Contracts have not yet been awarded for chimney and motor-driven pumps. Black & Veatch, Inter-State Building, Kansas City, Mo., are engineers.

MORAN, KAN.—Negotiations have been closed whereby the municipal electric light plant in Moran will supply electricity to operate the municipal lighting system in Bronson. The town of Bronson will install its own lighting system and erect a transmission line from that town to connect with the local plant.

PALCO, KAN.—In a decision handed down June 8 by the Supreme Court in the suit of J. H. Lee against the city of Palco, it was declared that Kansas towns may vote bonds for a combined light and water plant without a separate bond issue covering each class of municipal utility. Mr. Lee brought suit to prevent the city issuing bonds for a combined water and light plant on the grounds that the bond proposition was a dual matter and that the taxpayers should vote on each proposition separately.

WILLIAMSBURG, KAN.—A tentative contract has been drawn up between the city of Williamsburg and Ottawa whereby the latter will furnish electricity to operate the municipal electric lighting system in Williamsburg. The City Council is considering calling an election to submit the proposal to issue $12,500 in bonds to erect an electric transmission line to Ottawa.

Southern States

SOUTHWEST LA GRANGE, GA.—At an election to be held July 24 the proposal to issue $25,000 in bonds for the installation of an electric lighting system will be submitted to the voters. Post office address, La Grange.

SOUTH JACKSONVILLE, FLA.—The city is considering an issue of $100,000 in bonds for extensions to the electric lighting system and water works.

MOBILE, ALA.—The Navy Department, Washington, D. C., has appropriated $10,000 for ice plant and passenger elevator for the Marine Hospital in Mobile.

SARDIS, MISS.—The Panola Electric Light & Power Company, it is reported, is planning to rebuild its plant, recently destroyed by fire.

MARVEL, ARK.—The Marvel Light & Ice Company, recently incorporated, is contemplating the construction of an electric plant. The company is capitalized at $20,000. H. B. Mayo, L. S. Cook and others are interested in the company.

PARAGOULD, ARK.—The City Council is considering the installation of a municipal electric-light and power plant in Paragould.

KURTHWOOD, LA.—The Vernon Paris Lumber Company, recently incorporated with a capital stock of $500,000 by J. H. Kurth, Jr., and others, proposes to construct a sawmill with steam power plant. It also proposes to establish a town site and install public utilities. Kurthwood has not a post office.

BRISTOW, OKLA.—The Oklahoma Gas & Electric Company has been granted permission by the County Commissioners to use certain highways for the erection of electric transmission lines.

PEORIA, OKLA.—Plans have been prepared by the Nebo Lead & Zinc Company for the construction of a 150-ton concentration plant, to cost about $60,000. The equipment will include air compressors, engines, boilers, tracks, ore cars, belts, conveyors, ore crushers, etc. R. C. Croslen is superintendent.

PICHER, OKLA.—The Commonwealth Zinc & Lead Company of Miami is planning to rebuild its local mill destroyed by fire, at a cost of about $100,000. New equipment, including boilers, engines, conveyors, crushers, belts, etc., will be required. L. N. Dana of Joplin is superintendent.

AUSTIN, TEX.—The Southwestern Telephone & Telegraph Company is planning to build an exchange building at Tenth Street and Congress Avenue.

KILGORE, TEX.—The plant of the Kilgore Electric Light & Power Company was recently destroyed by fire.

Pacific and Mountain States

CLEAR LAKE, WASH.—Preparations are being made by the Clear Lake Lumber Company for the erection of a large sawmill to replace the plant recently destroyed by fire. The new mill will be operated by electricity generated at the mill. A complete power plant will be installed.

HOQUIAM, WASH.—Preparations are being made for equipping the pumping stations of the Hoquiam Water Company for electrical operation. Energy will be supplied by the Gray's Harbor Lumber Company's power plant, 5 miles distant, which will require the erection of 15 miles of copper wire.

NORTHPOINT, WASH.—The Electric Point Mining Company of Northpoint is contemplating the construction of a railway, 10 miles long, to connect its railroad at Leadpoint with the Great Northern Railroad at New Boundary. R. A. Young is manager.

OLMPIA, WASH.—The City Council has awarded the Olympia Light & Power Company a contract to furnish electricity for pumping the water supply for a period of three years.

OLYMPIA, WASH.—All bids for the construction of power house and heating plant at the State School for Girls at Grand Mound have been rejected by the Board of Control and the work will be done by day labor. The lowest bid was submitted by S. G. Morin, of Spokane, at $16,735, which was $8000 more than the appropriation.

SEATTLE, WASH.—Plans are being prepared by Daniel Huntington, city architect, for an addition of another floor to the municipal auxiliary steam-driven electric plant at Eastlake Avenue and Nelson Place. The additional space is to be used as an electrical testing laboratory.

SOUTH BEND, WASH.—The Willapa Power Company has been given permission to condemn property for its proposed large dam, which will make it possible for the company to supply the city with water.

WASHOUGAL, WASH. — The power plant of the Western Light & Power Company was recently destroyed by fire, causing a loss of about $25,000. C. W. Cottrell is president.

WATERVILLE, WASH.—The Douglas County Commissioners have granted the Chelan Falls Power Company a franchise to erect and operate electric transmission lines along certain roads in Columbia County.

EL CENTRO, CAL.—Steps have been taken by the Chamber of Commerce for improvement of the lighting, power and water service in El Centro. A committee has been appointed to make investigations and to interview the Holton Power Company and the officials of the State Railroad Commission relative to inviting competition in the valley.

EUREKA, CAL.—Negotiations are under way between the Humboldt Transit Company and the Western States Gas & Electric Company whereby the latter will furnish electricity to operate the transit system of the former.

FRENCH GULCH, CAL.—The power plant of the Hazel Creek Gold Mining Company on Crystal Creek was recently destroyed by fire, causing a loss of about $30,000. The town of French Gulch is at present without electrical service.

LOS ANGLES, CAL.—Marcus Pluth, 111 West Nineteenth Street, Los Angeles, is contemplating the construction of a hydroelectric power plant on Snow Creek, Riverside County, to supply electricity to operate a Portland cement plant to be established on the Whitewater River and for local service in Riverside County. The cost of the cement plant is estimated at about $500,000.

MARYSVILLE, CAL.—Contract has been awarded by the Marysville-Nevada Light & Power Company to Oscar Ford of Riverside for the construction of a reinforced-concrete dam across the Yuba River at Bullard's Bar, about 40 miles from Marysville.

SAN PEDRO, CAL.—The Union Oil Company is planning a large addition to its local refinery. Contract has been awarded for the erection of a power plant on a site north of the west basin to the Davidson Construction Company, to cost about $25,000.

VISALIA, CAL.—A joint application has been filed with the State Railroad Commission by the Mount Whitney Power & Electric Company, the H. G. Lacey Company and the Southern California Power Company for authority for the Mount Whitney company to purchase all the capital stock of the Lacey company, amounting to $101,999, which is now owned by the Huntington Land & Improvement Company. The Mount Whitney Company asks for authority to issue 2000 shares of its preferred stock in payment of the stock of the Lacey company. The Southern California Power Company proposes to purchase the stock of the Mount Whitney Company. The Lacey Company supplies electricity obtained from the San Joaquin Light & Power Company in Hanford, Kings County.

PORTLAND, ORE.—The Big Bend Transit Company, which proposes to contruct an electric railway from Portland down the Spokane River to its junction with the Columbia River at Miles, is planning to purchase the overflow lands on the south side of the river in connection with the construction of its proposed hydroelectric power plant.

WILSONVILLE, ORE.—The local electric light plant, owned by N. B. Young, has been sold to the Mollalla Electric Company of Canby.

MOUNT PLEASANT, UTAH. — The municipal electric plant and water-works system was damaged recently by a flood caused by a cloudburst.

PRICE, UTAH.—The City Council has entered into a contract with the Utah Power & Light Company, Salt Lake City, to purchase energy to operate the municipal electric system for a period of ten years beginning Aug. 1, 1918.

FORT GRANT, ARIZ.—The Commission of State Institutions has decided to install a central lighting and power plant at the Boys and Girls' Industrial School at Fort Grant, to cost about $12,000. The proposed plant will furnish electricity for lighting twenty-eight buildings on the campus and also power for operating the sawmill, laundry machinery and machinery for the school tailoring shop and shoe shop.

CHULA, MONT.—Arrangements are being made for the installation of an electric-lighting system in Chula. A corporation controlled by the Automatic Electric Light Company of Kansas City, Mo., has been granted a franchise to operate an electric plant here. F. I. Willmont is vice-president of the company.

PIKEVIEW, COL.—The Golden Cycle Mining Company is contemplating the construction of an electric power plant in Pikeview, to cost about $200,000.

GOLDFIELD, NEV.—The Red Hills Florence Company has taken a lease on several claims of the Florence Goldfield group and also on adjacent claims of the Goldfield Consolidated. Arrangements have been made for the erection of an electric transmission line to Gold Mountain and for the establishment of a camp.

PORTALES, N. M.—An election has been called for the City Council to vote on the proposal to issue $$$20,000 in bonds, extensions and improvements to the electric lighting, water-works and sewer systems.

Canada

VANCOUVER, B. C.—The new Point Grey substation of the British Columbia Electric Railway Company at King Edward Avenue and the Lulu Island tracks is nearing completion. The new station will be equipped with two 1000-kw. rotary converters and one 1500-kw. motor-generator; both air-blast and water-cooled transformers will be used.

HAMILTON, ONT.—The construction of a technical school in Hamilton, to cost about $130,000, is under consideration. F. R. Close is chairman of the technical committee.

SANDWICH, ONT.—The H. Walker Company of Walkerville is contemplating the construction of a dye plant in Sandwich, to cost about $1,000,000.

COBALT, ONT.—Preparations are being made for the installation of electrically driven machinery at the mining property of the Ontario Kirkland Gold Mines Company. Right-of-way is now being cleared for the erection of an electric transmission line and additional camp buildings are being erected.

LEVIS, QUE.—The Levis County Railway Company has awarded contract to M. Loneigan, 1254 St. Valier Street, Quebec, for improvements to its electric railway system, at about $125,000.

TEMISKAMING, QUE.—The Riordan Pulp & Paper Company, 355 Beaver Hall Square, Montreal, is contemplating the construction of a sulphite mill and power house in Temiskaming.

REGINA, SASK.—Plans are under consideration by the City Council for extending the municipal street railway system into the North Annex.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until July 24 for sheet copper, street lamps, fuses, batteries, outlet boxes, condulets, reflectors, sockets, switches, fans, copper wire, cable and clips, vulcanizing material, etc. Blanks and information relating to this circular (1222) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

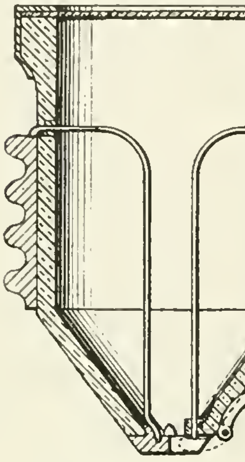
Record of Electrical Patents

Notes on United States Patents

1,266,736. Support for Telegraph Line Wires and the Like; James Wilson, Wichita Falls, Tex. App. filed July 31, 1917. Brackets for holding telephones, telegraph and electric light wires, comprising a cross-bar having vertical and horizontal openings and clamps secured therein.

1,268,574. Motor Controller; Albert J. Horton, White Plains, N. Y. App. filed June 4, 1915. Relates to controllers for motor-driven printing presses.

1,268,777. Transmission Mechanism; George M. Willis, Chicago, Ill. App. filed Feb. 7, 1914. Provides a variable-speed transmission gearing and devices electrically effecting the engagement, with necessary gears to secure any desired speed.


1,268,824—Fuse Plug

1,268,795. Alternating-Current Rectifier; Thomas J. Murphy, Rochester, N. Y. App. filed June 17, 1916. An electricity rectifier wherein current rectified will be substantially constant in potential.

1,268,812. Terminal; Charles W. Beck, Detroit, Mich. App. filed Jan. 4, 1915. An efficient terminal that may be quickly attached to or detached from a binding post.

1,268,824. Fuse Plug; Joseph A. Dugan, Houston, Tex. App. filed Oct. 1, 1917. A fuse plug wherein a plurality of fusible wires are employed.

1,268,849. Process for Making Alloys of Phosphorus; Lewis A. Jefes, Salt Lake City, Utah. App. filed Nov. 13, 1917. Making an alloy of a metal and phosphorus in an electric furnace.

1,268,863. Automobile or Motor-Cycle Horn; Ray H. Manson, Elyria, Ohio. App. filed Oct. 8, 1913. Electric horns in which the sound-producing device is controlled by an electric current.

1,268,890. Sounder for Telegraph Circuits; Fred E. Smith and Le Roy Heflin, Fairfax, Okla. App. filed July 28, 1917. Provides a main-line sounder which obviates the necessity of a local circuit.

1,268,915. Burglar Alarm for Automobiles; Hiram A. Beall, Kansas City, Mo. App. filed March 16, 1917. Burglar or theft alarms for automobiles or like vehicles, controlled in the steering post.

1,268,928. Percolator Heater; Ora A. Colby, Wilkinsburg, Penn. App. filed April 2, 1913. Electrically heated liquid-containing vessels of the percolator type.

1,268,942. Locomotive; George M. Eaton, Pittsburgh, Penn. App. filed Nov. 3, 1916. Electrically propelled locomotives.

1,268,949. Method and Apparatus for Agricultural Engineering; Reginald A. Fessenden, Brookline, Mass. App. filed Feb. 4, 1918. Consists in generating an electrical discharge, controlling same and placing said electrical discharge in operative relation to the plant whose growth is to be influenced.

1,268,971. Locomotive; Rudolph E. Hellmund, Swissvale, Pa. App. filed Oct. 30, 1918. Electric locomotives of the side-rod type.

1,268,972. Insulator Support; Lem E. Hender, Milwaukee, Wis. App. filed Jan. 3, 1918. Provides standard bracket with simple spacing members and fastening means.

1,268,978. Gland; Robert I. Kinnear, Clydebank, Scotland. App. filed June 5, 1917. An improved gland permitting the passage of a number of cables rendered water-tight by one sealing operation.

1,268,990. Mangle; Emil Moeller, Chicago, Ill. App. filed July 23, 1917. A hand-operated mangle and an electrical heating element.

1,269,005. Relay Buzzer; Fred Schoenwolf, Chicago, Ill. App. filed Sept. 8, 1914. Relates to buzzers and the use of an ordinary relay in combination with a dust-proof cover.

1,269,011. Method for Multiplying the Frequency of Electric Currents; Isaac Shoenberg, London, Eng. App. filed Dec 27, 1917. An apparatus for increasing the frequency of a multiphase current comprising coils having iron cores of low reluctance connected into one lead of each phase.

1,269,017. Car; Fred Steffens, St. Joseph, Mo. App. filed March 12, 1917. Relates to motor-driven street cars.

1,269,035. Signaling Means; Peyton H. Workman, Santa Ana, Cal. App. filed Dec. 13, 1916. Relates to electromagnetically operated signaling means adapted to be attached to an automobile body or similar vehicle.

1,269,052. Electric Heater Element; Farley G Clark, Paul Ackerman and Charles E. Cansfield, Toronto, Ontario, Can. App. filed July 5, 1917. An electrical resistant molded in a heat-conducting bed of cement or other plastic material.

1,269,053. Electrically Heated Tank or Reservoir; Farley G. Clark, Paul Ackerman, and Charles E. Cansfield, Toronto, Ontario, Can. App. filed July 5, 1917. A tank or reservoir heated by two or more electric heater elements.

1,269,078. Electrolytic Tank for Electrochemical Reaction; Edward H. Hamilton, Trail, B. C., Canada. App. filed Oct. 4, 1917. An electrolytic tank comprising a set of electrodes constituting reacting couples.

1,269,079. Automatic Switch; George F. Hammond, Montecito, Cal. App. filed Oct. 12, 1917. A mechanical switch having electrically operated controlling means.

1,269,096. Storage-Battery Cover; Edmund Land, Detroit, Mich. App. filed Sept 17, 1917. A storage-battery cover comprising a closure having a filling hole formed with depending inclosing walls.

1,269,112. Automatic Thermostatic Control for Incubators; Adam Ostheimer, Cleveland, Ohio. App. filed Oct. 9, 1916. Means for automatically maintaining constant the temperature in an incubator.

1,269,121. Electric Switch; Joseph H. Rusby, Nutley, N. J. App. filed May 22, 1913. A surface type of electric switch which is operated by push-buttons to snap the blades into positive engagement with the contact devices.

1,269,128. Electrode; Alexander T. Stuart, Toronto, Ontario, Can. App. filed July 5, 1917. Electrodes for electrolytic and other purposes comprising a multiplicity of current-conducting paths.

1,269,141. Producing Crystalline Alumina; Ray H. White, Niagara Falls, N. Y., App. filed Aug. 18, 1917. Electrically fusing a non-uniform charge whereof the lower portion contains an oxiding addition.

1,269,152. Single-Phase Motor; Julius Becker, Racine, Wis. App. filed Aug. 24, 1914. Relates to single phase that will be self-starting and will not draw an undesirably large current from the line.

1,269,156. Circuit Breaker and Switch; George A. Burnham, Saugus, Mass. App. filed April 4, 1916. A circuit breaker having a movable switch member, a latch, a trip coil for the latch and a rotatable latch-engaging element.

1,269,162. Storage Battery; Walter A. Crowdus, Chicago, Ill. App. filed May 22, 1917. Dry storage batteries in which the electrolyte or excitant employed is non-flowing.

1,269,173. Process of Making Battery Depolarizers; Harry F. French and Raymond C. Benner, Fremont, Ohio. App. filed No. 21, 1916. A battery depolarizer which consists in reducing copper oxide with an excess of sulphur and then reoxidizing the reduced mass in the presence of the excess sulphur.

1,269,181. Telephone System; Henry J. Herlink, London, Eng. App. filed Feb. 8, 1916. In a telephone system the combination of a plurality of groups of incoming lines and a plurality of groups of outgoing lines.

1,269,183. Controller; Albert J. Horton, White Plains, N. Y. App. filed May 11, 1916. Controllers adapted for control of sewing-machine motors.

1,269,214. Automobile Signal; Lester E. Prescott and Eugene L. Prescott, South Tacoma, Wash. App. filed July 2, 1917. Provides a signal which may indicate the direction in which the car is to turn.

1,269,222. Preparing Aluminous Abrasives: Lewis E. Saunders and Ray H. White, Niagara Falls, N. Y. App. filed Aug. 18, 1917. In the art of preparing aluminous abrasives by the electric furnace fusion of aluminous materials in presence of carbon, the method of preventing reduction of alumina.

1,269,223. Process of Purifying Aluminous Materials; Lewis E. Saunders, Niagara Falls, N. Y. App. filed Aug. 18, 1917. Purifying aluminous materials, which consists in fusing the same in presence of a sufficient proportion of carbon.

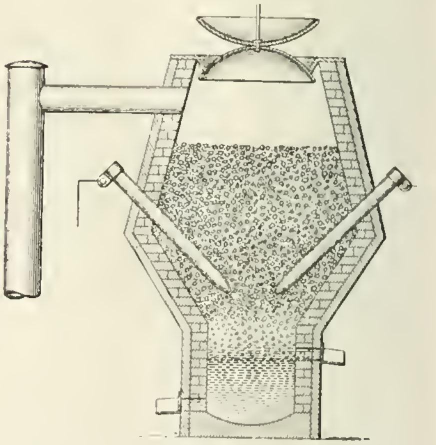
1,269,224. Purifying Aluminous Materials; Lewis E. Saunders, Niagara Falls, N. Y. App. filed Aug. 18, 1917. Purifying aluminous materials and producing crystalline alumina, which consists in fusing the impure aluminous charge with proportion of carbon.

1,269,237. Switch: Frank E. Wilson, London, Eng. App. filed July 1, 1916. Switches for controling the various lamps such as headlamps, side-lamps, tail-lamps and the like.

1,269,245. Automatic Telephone System; Albert Andersen, Chicago, Ill. App. filed June 7, 1916. Systems that employ meters or other measured service devices.

1,269,246. Signal System for Vehicles and the Like; Francesco P. Anello and Giuseppe Pocoroba, Newark, N. J. App. filed Oct. 20, 1916. Comprising an annunciator having a plurality of movable normally invisible visual signals.

1,269,253. Car and Electric Coupling Control; Thomas R. Brown, Sparkill, N. Y. App. filed April 10, 1914. Coupling devices for railway cars for connecting fluid pressure conduits and electric train-line circuits.


1,268,849—Process for Making Alloys of Phosphorus

1,269,278. Electric Switch; Clark T. Henderson, Milwaukee, Wis. App. filed Sept. 14, 1914. Relates to series switches in which a single coil operates the contacts.

1,269,344. Electrical System for Motor Vehicle; George W. Wacker, Rutherford, N. J. App. filed Nov. 2, 1917. Effects ignition in internal-combustion engines and for lighting purposes.

1,269,400. Switch: William W. Dean, Chicago, Ill. App. filed May 11, 1914. Switches designed for use with the steering mechanism of automobiles.

Electrical World

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The Niagara Water-Power Farce

LONG before the United States entered the war at all there was a serious shortage of power at Niagara Falls. The situation that exists therefore at the frontier is not unfamiliar to the operators there, except that the disease, having been allowed to run unchecked for a number of years, has become aggravated. With abundant water plunging over the precipice and with a site unparalleled for rapid and cheap development, the authorities have not turned a hand to remedy conditions. Instead, we have the ludicrous spectacle of power generated in distant steam stations being transmitted to Niagara Falls from time to time to alleviate the shortage. Was there ever a better example of incompetent handling of a serious problem? Canada and the United States agree that there should be greater diversion of the water at Niagara Falls. The power shortage on both sides of the stream has been acute for some time, the Province of Ontario requiring at least 100,000 hp. more and the State of New York 200,000 hp. Had both governments acted to revise the Root-Bryce treaty of 1909 when the need of such revision became apparent, there would now be ample power for war industries in both countries and there would be no necessity for burning precious coal to relieve the shortage. Is it not about time that our foreign affairs committee ended this farce?

Speed the Organization of the Contractors and Dealers

MEMBERS of the National Association of Electrical Contractors and Dealers, who reviewed in annual convention at Cleveland this week the first year under their new form of organization, can feel that they have done much to merit congratulation. What they have accomplished in the country-wide, intensive organization which is their ideal should be weighed with recognition of the adverse circumstances brought by the war. When this factor is given its full heavy weight and the counterbalance of new organization is credited, the net result is encouraging. Other associations in many lines of industry are simply marking time while the war lasts, but the contractors and dealers have managed not only to hold their own but also to move forward in the direction of the greater goal which now inspires them.

Fortunately for the contractors and dealers they had a national organization to serve as foundation for the greater structure which they are rearing. They had also a group of devoted loyal workers who are enthusiastically determined to build up, not tear down. What they lacked, if they lacked anything, was intensive organization to supplement national organization. They need to reach every city where there are contractors and dealers, every town where they can give help. Showing that they render real service to their members, they then have an unanswerable argument for new membership campaigns. The more nearly they approach to 100 per cent enrollment, the better able will they be to make the geographic local associations effective in carrying out the national program. But to get the number of members that are potentially available in this branch of the tremendous electrical industry will take time. It is more important to get a single new member than to talk about getting a thousand new members.

Although many men are timidly reluctant to embark in new enterprises when they think that the outlook is uncertain, it is in fact in just such times that the contractor-dealers' organization can be made of the greatest value to its members. For either war or the end of war carries problems which touch the small contractor-dealer who ought to be a large beneficiary in the new organization. War has been followed by construction which has crowded aside the construction of normal times. With the return of the normal conditions after the war there will be a world-wide demand for construction to meet the needs of peace. With this activity will arise questions affecting materials, questions touching labor, problems which every contractor and dealer will have to answer with the best judgment he has. Or, if the scarcely thinkable alternative of a world economically prostrate be faced for a moment, the contractor-dealer will benefit from organization. What he learns from contact with men in his industry will help him in any event to do his work better for the public.

Research and Prosperity

ONE of the vexed problems which confront the managers of manufacturing and operating companies is to determine the proper amount of time and money that it is profitable to spend at a given time on experimentation, new developments and research. When serious trouble develops in the operation of some electrical device it is usually easy to obtain funds to ascertain and to remedy the fault, but not so with problems of more remote or general character. When times are good and there are plenty of orders ahead the scientific engineer is told that there is no need for research and that he had better don his overalls and help production. When business is slack and a prolonged depression threatens the country the scientific engineer is told that the problem is not to develop new devices but to keep the factory busy on the present types of apparatus. Invention and research cannot, however, proceed sporadically, and the responsible investigators must have at least some assurance of steady jobs and of sufficient funds for experimental apparatus. This fact must not be lost sight of.

One remedy, or at least a stabilizing factor, is the formation of trade associations for research purposes, each member of the association to be assessed a certain tax so that the research workers can look forward with a reasonable degree of confidence year after year. At a meeting on industrial research held during the last convention of the American Society for Testing Materials in Atlantic City the work of some such trade associations was reported. Another remedy lies in the growing interest which our federal government and the state governments take in pure and applied research. It is sufficient to mention here the pending possibility of making the National Research Council a permanent institution and also the splendid work in electrical and other branches of engineering and physics constantly turned out by the Bureau of Standards. But with all these outside helps our large manufacturing and operating companies must take a broader view of their own research work and keep it going "rain or shine."

Steps Toward Coal Saving

THERE is good reason to hope that the campaign for coal saving in industrial plants inaugurated by the Fuel Administration will meet with a substantial measure of success. Whether the savings attainable without radical change in equipment will reach the expected 20,000,000 tons is another matter, depending somewhat on how one would define "radical" changes. Probably the biggest single case of fuel waste in industrial plants and everywhere else is bad firing, especially in the smaller hand-fired plants. How far this condition can be remedied in the present labor situation is extremely uncertain. Whether really skillful firemen are attainable at all in the case of the smaller plants is an open question, for a first-class hand is in great request.

If all the plants concerned could be equipped with mechanical stokers, the average results would certainly be improved, although the highest figures would probably not be raised. Beyond the fire box come the questions of steam pressure, superheat and condensation. In the first two of these matters American practice has until very recently been ultra-conservative. Boiler pressures cannot be materially increased without change of boilers, as any given installation is commonly worked somewhere near its conservative limit, albeit this is generally set too low. Boilers cannot be changed without considerable expense and, what is just now equally important, considerable time, and the same is true of superheaters and condensers. Care in making the best of installations as they stand with small additions is probably the most practicable course for immediate improvement. Sharp looking after details such as proper jacketing of steam pipes, careful setting of engine valves, overhauling condenser pumps and keeping boilers free of scale and condensers clean are items which taken together may result in saving a really large amount of fuel. Inspection of plants and pressure brought on their owners to carry through practical recommendations for saving will certainly be extremely helpful. So far the program can be carried out in time to be effective in the coming season's operations. Meanwhile a general overhauling to improve conditions of economy in the larger way should be started at once in view of the difficulties of manufacturing and delivering necessary added equipment.

Interconnected Super-Stations at Coal Mines

SUGGESTIONS for relieving transportation difficulties and alleviating coal shortage are many and varied. Some have been good and others have been impracticable. Certainly, we cannot have too many minds working on these problems which are pressing for solution. R. J. McClelland has a cure to urge for the present coal and power shortage in the East. It is not a panacea, but it is probably the best and most potent, and at the same time the most readily available, corrective. His arguments, and particularly his conclusions, will bear close reading. In the main his proposition is to locate super-stations at the coal mines, develop available water powers and interconnect these systems into one great network from which existing distribution lines may receive a supplemental supply of electricity.

Plans of this kind, although on a less extensive scale, have been proposed before, because the idea of locating power stations at the mouth of coal mines has always been attractive. The trouble with most of the suggestions heretofore made has been that their proponents have been unduly solicitous about coal and have ignored the question of water supply entirely, little dreaming that it requires an enormous quantity of water for steam and condensing purposes and that as a rule abundant and suitable water is not available at coal mines. There are no such drawbacks in Mr. McClelland's scheme, which is a straight-out engineering proposition based on surveys and acquaintance with conditions.

Of course, there will be those who will object to the proffered solution. It is so easy for us to pursue the even tenor of our way and to add addition to addition rather than to attack the whole problem from an entirely different angle. There is, however, such a thing as making concentration too dominant and too expensive. It requires no argument to convince any one that our coal supply is diminishing. That is a fact. Nor will it be denied that coal must be brought from greater and greater distances. Now it is one thing to bring a few tons of coal from a distance to a consumer, but when the amount required reaches hundreds of thousands of tons the question assumes a different aspect. It then becomes necessary to decide, for purely economical reasons, whether it is better to move the coal or to move the plant. Some of these points are covered by Mr. McClelland in his article.

We have nothing but admiration for the enterprise shown by the author in making the study under consideration and for his boundless faith in the future of the electrical industry. That the electrical industry is destined to go ahead there can be no doubt, and we are face to face with conditions touched on by the author. If now we can get action with the co-operation of the central-station industry, the task of supplying the increasing loads will already be half solved. One feature of the present situation which is hard to understand is the apathy of some central-station executives toward the progressive movement now under way. The war has shown great opportunities for the expansion of the electrical industry and has indeed pushed it far ahead of its time, and yet there are those who, instead of taking advantage of that help to expedite the movement, actually turn to remonstrate with the power that is urging them on. This inertia is hard to overcome, but the industry must go forward despite that handicap. Studies like that of Mr. McClelland help blaze the way.

The Curtailment of Lighting

THE ELECTRICAL WORLD believes in backing the administration to the limit in the effort to bring the war to a successful conclusion. It does not, however, believe it to be a patriotic duty to indorse all the sometimes hysterical and silly suggestions of administration subordinates. Reports are abroad of an impending effort greatly to reduce the consumption of both gas and electricity for domestic purposes, thus throwing the weight of efforts at so-called conservation upon the ultimate public. We trust that such reports may be classified with pro-German propaganda, like the rumors that were carefully circulated regarding the government's intention to raid the householder and commandeer his preserves; but if there is an intention on the part of any one to put the screws on the supply of electricity for domestic uses we wish here and now to file a protest of the most emphatic character, based on the entirely trivial saving which could be thus made compared with the inconvenience put upon the people and the waste of energy still permitted to go on in the prosecution of unnecessary business.

The whole subject of lighting curtailment was gone into early this year, and it was shown in Preston S. Millar's admirable paper and the discussion which followed that all the coal used for domestic lighting amounted to just about one-half of 1 per cent of the country's total coal consumption. This minute amount could, of course, be cut down by rigorous regulation to the possible saving of 0.1 or 0.2 per cent, at an entirely disproportionate amount of public inconvenience. The spontaneous efforts at economy in all things made necessary by the present costs of necessities is quite sufficient to reduce the use of light as far as is generally desirable, without any attempt at regulation. The daylight-saving campaign has already done its bit, and the harassed householder, without the compulsion of efforts at regulation, may be trusted not to waste light. If it is necessary to save energy for war industries, let it be saved at the expense of those unnecessary activities which not only make for waste of the public's money but for the needless employment of labor which might be better utilized in those things which bear directly on the prosecution of the war. One has only to look around in any direction to see industries which, so far as this great purpose is concerned, are simply economic wastes, using up important labor and material in order to create temptation to unnecessary expenditures. Many of these fruitless industries have already been pressed to reduce their coal consumption, but why they should not be suppressed entirely for the period of the war rather than allowed to burden the general public with their wastage it is somewhat difficult to see. Some of the purveyors of hysteria have professed great fear lest the labor which might thus be thrown free should come to some bad end, but any one who knows the labor situation, or even reads the papers and sees the frantic calls for labor which is not forthcoming, realizes the foolishness of this attitude. How about the million men who have gone to the front to fight our battles and the millions who will follow them? They have laid down their work without protest to do a soldier's duty. Is it too much to ask of those whom they have left behind that, for the public good, they should shift their activities from useless to useful occupations and bring the country promptly to that industrial efficiency which must inevitably come if our country is to do its part?

We are making no plea on behalf of the electric lighting companies, which are doing their duty cheerfully and uncomplainingly. They are turning their output to useful ends, and a little more or less domestic lighting is a matter of no great concern to them in the long run; but it is a matter of concern to the man on the street whether he is to be called upon to make sacrifices, not for the common weal, but for the continuation of unimportant business which might better be dispensed with. England has already gone through all the phases of this struggle between the substance and the non-essentials of industry, and by that experience we may well profit. To those who would guide the people in the path of genuine conservation we would commend daily and hourly consideration of the words of the late Lord Rhondda, British Food Controller, when he was about to take office: "I am going over there as the guardian and trustee of the consumer, and particularly the poor consumer." And Lord Rhondda lived up to that righteous resolution and died in harness.

The Coming Issues

A SYNOPSIS of what has appeared on iron-wire transmission, with some further information regarding the electrical and mechanical characteristics of both solid and stranded steel wire, will be presented shortly in the ELECTRICAL WORLD. Another timely article will show how a medium-size station in the Middle West is equipped to store coal for the coming winter. Difficulties encountered in constructing a hydroelectric plant on the Pacific Coast—such as space limitations and changes in plans after ordering equipment—will form the basis of still another discussion. The next installment of the industrial control series will deal with the selection and application of motors and control in the paper and pulp industry

Electric Power Supply for War Industries

Shortage of Power a Major War Problem—Critical Railroad Situation Calls for Generation of Energy Near Mines and Transmission Electrically—Interconnection of Central-Station Systems in War Industries Districts Will Greatly Increase Capacity

BY R J. McCLELLAND

THE extent and the real significance of the enormous industrial expansion brought about by war industries are not at all appreciated by the public, even by the engineering public. The magnitude of the attendant problems, their endless ramifications and their vital influence upon our whole industrial system are just beginning to be realized even by those closely in touch with this great work.

The direct problems of production have received much public attention. Great as these are, however, they are in essential respects less difficult and less critical than the problems presented by congested transportation facilities and shortage in power supply. The railroad transportation situation is at last being recognized as the critical element in our industrial program. Inadequacy of railroad facilities in the Eastern industrial districts is forcing drastic changes in our plans, is going to cause serious disturbance to enterprises already under way and will inevitably occasion widespread public distress during the coming winter. Railroad systems are inelastic and incapable of rapid emergency expansion, and relief in this respect must be largely indirect.

The problem of power supply is intimately connected with the railroad situation, both because it is one of the principal contributaries to the existing and prospective transportation congestion and for the reason that to some extent it may be so handled as to afford considerable relief to this congestion. Power supply is just as essential to our war industries as labor or materials, but with the important difference, that to obtain labor and material for construction purposes, or even to build a shipyard or factory, is usually a question only of months, whereas the construction of large power systems is an undertaking of from one to two years.

In this country, as has been the case in England and France, the problem of power supply is virtually one of providing electrical energy. This war emergency has carried us many years forward in our industrial evolution and is forcing manufacturers, willingly or not, into an era of electrification. As our man power decreases—a considerable actual decrease is inevitable, and relatively to the size of our task a very great decrease is already upon us—the shortage in man power must be made up by the use of automatic machinery and various power-consuming appliances. There is scarcely any characteristic of these extended new enterprises so striking as the extent to which they use and depend upon electrical energy.

SERIOUS POWER SHORTAGE FOR WAR NEEDS

There exists now and will continue to exist a most serious shortage of electric power in all of the war industry districts. Our whole war program will depend largely upon how promptly and how effectively we make good this power shortage. In the industrial district comprised in eastern Pennsylvania, northern Delaware and New Jersey the largest, and probably for an indefinite period the most important, of the centers of new industrial activity, it is estimated that within the time required to develop additional power facilities on a large scale 500,000 kw. of additional capacity will be required for essential war needs. Referring to this district, William Potter, the Pennsylvania Fuel Administrator, in a letter to Dr. Garfield under date of May 13 makes the following statement:

> There is a recognized power shortage in the section mentioned, where are located industries whose products are vital to successful prosecution of the war. Opinion is undivided that, unless immediate action is taken, it probably will develop into a national crisis that in its consequences may not differ from that which would arise were huge orders placed for airplanes without inclusion of the purchase of necessary motors. The power used for turning out a shell is as important as the metal required to make a shell or the wool required to make a uniform. . . .

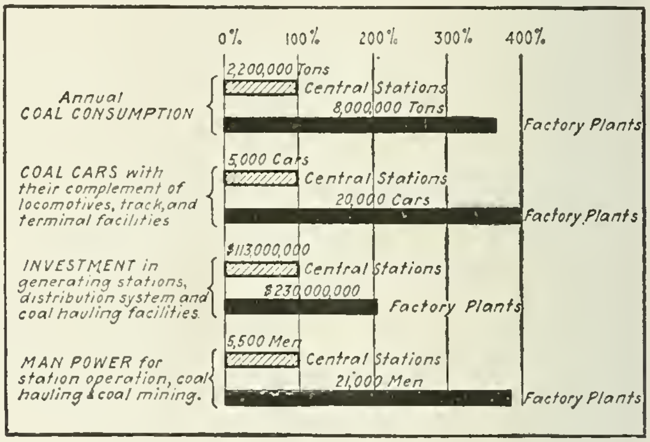

FIG. 1—COMPARISON OF CENTRAL STATIONS AND ISOLATED FACTORY PLANTS FOR SUPPLY OF 500,000 KW. OF WAR INDUSTRIES LOAD IN EASTERN PENNSYLVANIA, NEW JERSEY AND DELAWARE.

> There is grave danger that we will soon find ourselves in a situation similar to that of England two years after her entrance into the war and against which we have been forewarned by her engineers. Industries were constructed, other facilities of existing plants increased, but the power requirements were overlooked, because central stations were looked upon as something indefinitely elastic in nature. This oversight caused England nine to twelve months' delay in her war problem.

Similar shortages exist in New England, very acutely in the Pittsburgh district and the adjacent industrial regions in Ohio, and to a less serious extent in other sections of the country.

This increasingly great use of electric power is not something which will end with the war, so we should not allow any lingering apprehensions of future idle equipment to damp our energies in meeting the emergency demands which are upon us. In Great Britain plans far more comprehensive than anything even talked of here are being laid years ahead for increasing, inter-

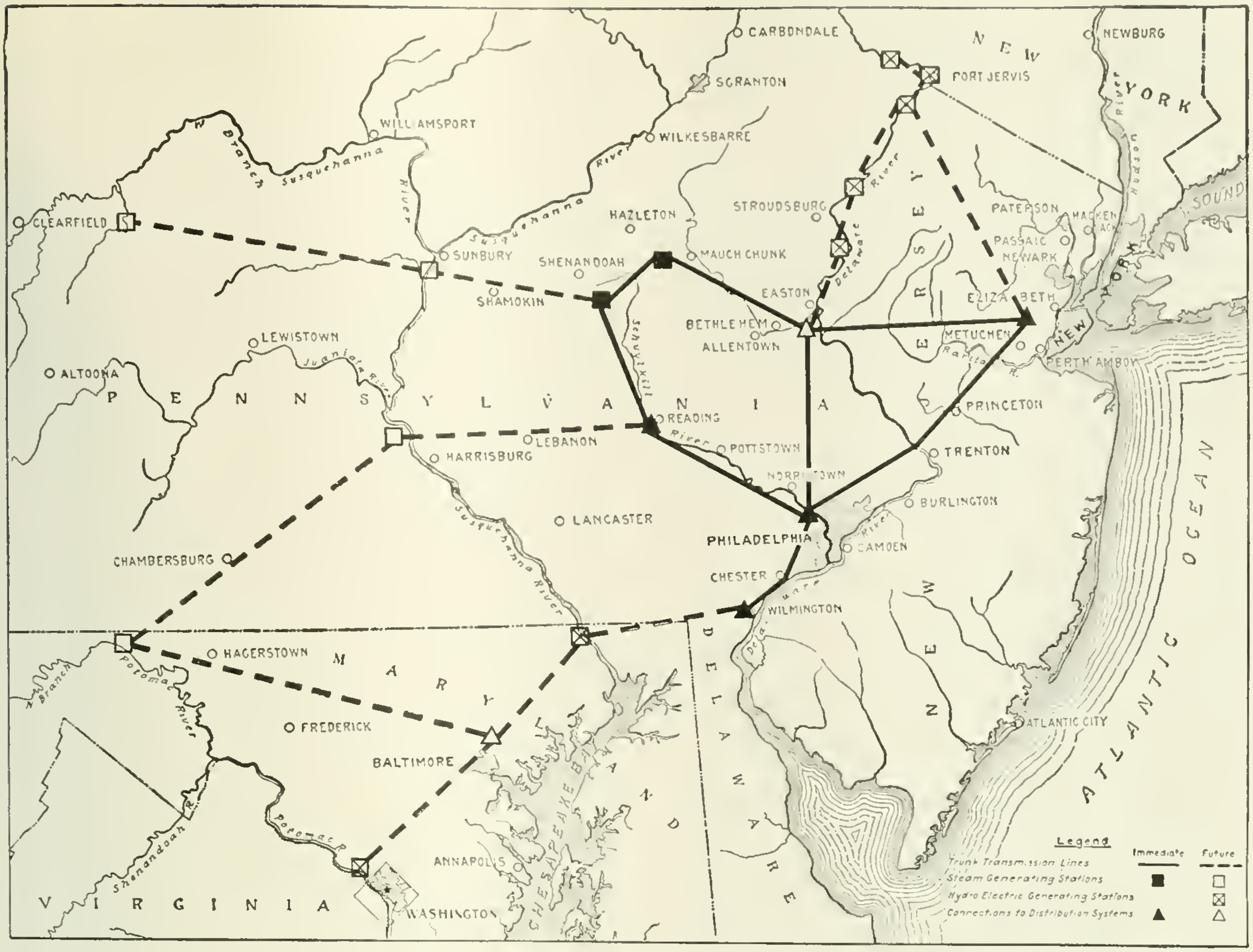

FIG. 2—SYSTEM OF HIGH-VOLTAGE TRUNK TRANSMISSION LINES CONNECTING LARGE EASTERN INDUSTRIAL CENTERS

connecting and centralizing the supply of electrical energy, for making it the very lifeblood of a greater industrial England. This country must keep its place in the industrial world after the war—must increase it if our promised 25,000,000-ton merchant marine is to be given cargoes. If we grant this, we are permanently face to face with this problem of power supply in all of its new-found importance. We must make our present emergency an opportunity, must keep mobilized our war-time spirit of comprehensive organization and efficiency. This is the time to formulate comprehensive plans for our future power supply. It is our good fortune that effective measures to meet immediate vital needs will fit in with such plans.

Isolated Plants on Large Scale Impracticable

The proposition of supplying these increases in power requirements principally from isolated power plants at each factory needs only to be set forth in terms of its demands upon our fuel resources, transportation and manufacturing facilities and man power for its unthinkable wastefulness, and in fact its physical impossibility, to be evident. (See Fig. 1.) Referring merely to one feature of the comparison, isolated plants would require about four times as much coal as central stations, which means four times as many coal cars with their complement of locomotives and track and terminal facilities. With our railroads already insufficient for the emergency demands and facing even more serious inadequacy as our war industries enter the stage of full production, such a demand upon them would be impracticable, even aside from its being needless.

Local Central Stations Not Real Solution

Central stations situated near the load centers do not, however, constitute the final solution of the power problem, either for immediate emergency purposes or for a comprehensive plan of future power supply. For our future needs we must depend, in the East, partly upon development of our larger medium-head and low-head water powers, but principally upon huge super-steam plants burning low-grade fuels and erected in the vicinity of the mines. The fullest possible advantage should be taken of diversity and the other economies which may be gained from interconnection of electrical systems. Plans of broad scope under governmental supervision are being laid along these lines, and indeed are already under way, with our hard-pressed allies in Europe—interconnected water-power developments in France and huge interconnected mine steam plants in England. Our present emergency needs we can meet adequately only by taking the first steps toward such an ultimate system. Steam-electric plants in the mining regions are fortunately within range of emergency needs as to time of construction, and transportation congestion furnishes an unanswerable argument in their favor.

The two fundamental considerations governing our policy as to future power requirements are fuel supply, present and future, and transportation facilities, present and future. A few facts bearing upon these considerations will indicate the reasons for the conclusions just expressed.

COAL SUPPLY OF UNITED STATES

The coal reserves of the United States are widely regarded as so enormous that no present thought need be given to their possible exhaustion. Enormous they unquestionably are, but at the rate at which coal consumption is increasing their life will become a matter of concern within another generation. Coal consumption during the last three years has been increasing at a rate of over 10 per cent per annum. For the past twenty years the increase amounts to 6½ per cent annually. The necessary production for 1918, as estimated by the Fuel Administration, is 710,000,000 tons*, an increase over 1917 of 14.4 per cent. A conservative estimate of our present normal rate of increase is 7 per cent. On this basis, and with a rate of recovery from the mines as high as 67 per cent, the life of our known coal reserves would be as follows:

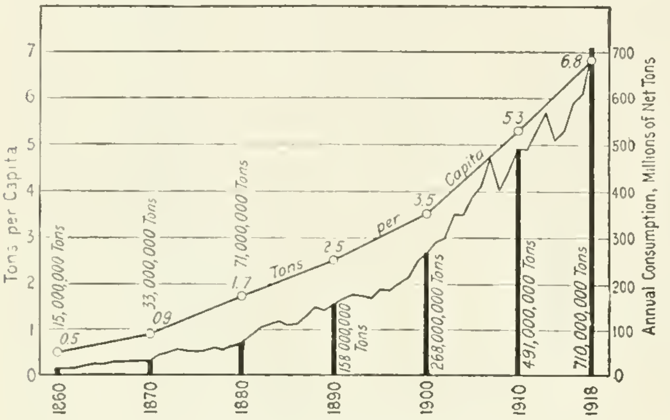

FIG. 3—CHART SHOWING THE INCREASING CONSUMPTION OF COAL IN THE UNITED STATES

	Years
Eastern District, which includes the most accessible and best quality of our fuel	56
Eastern, Central and Southern Districts	64
Entire United States and Alaska, over two-thirds of this being low-grade coals and lignites	83

(These figures are based upon estimates of the United States Geological Survey. They include coal in veins as shallow as 14 in. (35.5 cm.), all coal up to 30 per cent ash and all known deposits within 6000 ft. (1828 m.) of the surface. Obviously, on a corresponding basis the life of the coal reserves minable and usable under present standards would be much shorter. The reserves of fuel oil and natural gas are relatively so insignificant that they would have no appreciable effect on these figures.)

These figures are startling. They do not mean, of course, that our Eastern coal will be exhausted in fifty-six years or our entire fuel supply in eighty-three years. What they do mean is that the time is in sight when we must cut down our rate of increase in coal consumption. They mean also that coal is going to be increasingly expensive.

The figures are even more impressive when we consider that the United States has about 52 per cent of the coal reserves of the entire world, and North America about 69 per cent. Outside of North America, the only really large deposits are in China and are not readily accessible. The next largest are in Germany. This means that in the future we must more and more be called upon to export coal.

Curtailment in our rate of increase in fuel use means either checking of our industrial development or increasing economy in the consumption of our fuel resources. Power supply is going to be the backbone of our future industrial development, and it is going to make increasingly great demands upon our fuel reserves. At the same time power use of coal is the use which is most wasteful of its chemical and thermal value. Accordingly every feasible fuel economy in power generation is called for. The principal economies to be attained are:

1. Centralization of supply of industrial and other power in large generating plants, embodying every practicable measure of efficiency. Large modern central stations have a thermal efficiency of 20 per cent, about four times that of a reasonably good isolated plant.

2. Fullest possible utilization of water powers within economic limits as to cost. The majority of our Eastern water powers can be utilized most effectively only as auxiliaries to large steam-electric systems.

3. Electrification of steam railroads. Steam railroads at present consume more than 25 per cent of our coal output. By electrification this could be reduced to 7 or 8 per cent.

4. Electrification of coal-mining operations, particularly in case of anthracite mines, where a mine usage of 10 per cent could be reduced to 1.5 per cent by electrification, representing a saving, at the present rate of production, of nearly 10,000,000 tons annually.

Although conservation of fuel resources is not *per se* of immediate interest in our war emergency, the question of man power involved in coal mining is an increasingly important war problem. Of the most urgent and vital importance, however, is the question of transportation facilities for fuel.

TRANSPORTATION OF COAL A CRITICAL PROBLEM

Any plan which will reduce the amount of coal which the railroads must haul will be of first importance as a war measure. Fuel transportation, owing to its magnitude and to the utter inadequacy of our supply of coal cars, is the most critical feature of the transportation problem.

In the Central Atlantic seaboard district, where transportation congestion is most serious, material relief may be effected by drawing a portion of the new power requirements from large steam stations situated in the anthracite mining region and transmitting the power over high-voltage lines. No delay in our program would be involved, since new steam stations near the mines and the necessary transmission system could be constructed as rapidly as new steam stations of equal capacity in the seaboard district.

In our immediate emergency transmission systems can readily be built, while adequate increase in transportation facilities is impossible. In spite of every possible effort to increase the capacity of our transportation systems and to add new rolling stock, railroad facilities will for a long time in the future be seriously inadequate. On the other hand the manufacturing facilities which will be called upon to supply transmission material and equipment are not seriously overloaded and are not engaged to any considerable extent upon war work.

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*This figure, as are all other tonnage figures in this article, is based upon net tons of 2000 lb.

INCREASING POWER CAPACITY BY INTERCONNECTION OF SYSTEMS

The necessary increases in electrical generating capacity present a difficult problem. Facilities for manufacturing large generating units are limited, seriously limited, in spite of all the efforts which the government has made to increase production and to limit new installations not contributing to the war program. It is essential that the greatest possible output be had from present installations and from the inadequate amount of new equipment which will be available.

The effective capacity of our generating stations can be increased promptly and very materially by taking now the first step in our inevitable ultimate system, high-voltage interconnection of our larger systems. The advantages, it may even be said the necessary reasons, for such interconnection are numerous:

1. Interconnection would materially increase the load which may be carried on the otherwise separate generating systems as a result of the diversity in peaks. The subject of diversity has been studied considerably of late for several situations, and it appears that even between systems of similar load characteristics a large diversity exists, since even though the peaks of the separate systems may occur at about the same time in the day, the individual maximum peaks do not occur on the same day.

2. Interconnection will make possible the use in regular service of a large portion of the generating capacity otherwise required for reserve, since the transmission lines will make reserve capacity at any one point available for use over the whole interconnected system. It appears a safe estimate that, owing to release of reserve equipment and to diversity, the capacity of a group of large systems would be increased by from 15 per cent to 25 per cent as a result of interconnection. As an instance, studies were recently made of the small systems north and south of Boston (see ELECTRICAL WORLD, June 8) indicating an increase in capacity of 37 per cent as a result of interconnection.

3. Interconnection should result in considerable fuel economy, since it will enable the largest, most efficient and best-located plants to operate at maximum load factors, the less efficient plants being used only when needed.

4. Transmission interconnection will afford the means of utilizing to maximum advantage energy from steam plants in the mining districts as soon as these can be built.

5. Such a transmission system will afford the nucleus of a comprehensive power supply system. It will greatly advance a rational national fuel conservation program and in particular will constitute an important step in the electrification of our Eastern trunk railroads.

Interconnection of large systems is by no means a new expedient, and the advantages to be gained have been thoroughly demonstrated in practice. The great benefits realized in California have received wide publicity. Similar interconnections are now being made in Oregon and Washington and have already been effected in Texas, Illinois and in New England, as well as to a lesser extent in other places. In the South 780,000 kw. in generating stations in four states is interconnected, and another system of 175,000 kw. in another state will probably soon be tied in. In this huge system all available water power at any point is fully utilized before steam is called upon, and the water power itself is operated at an efficiency wholly impossible before the interconnection was effected. For instance, seasonal surplus water power at one plant in North Carolina is now used to fill the storage reservoir of a plant in Georgia 500 miles (804 km.) away by transmission-line distance.

POSSIBILITIES OF INTERCONNECTION IN CENTRAL ATLANTIC SEABOARD

As has been noted, the estimated immediate requirements in eastern Pennsylvania, northern Delaware and New Jersey are about 500,000 kw., which added to the existing loads on the larger central-station systems in this region will make a total load of 1,000,000 kw. A study of the loads in the three largest systems of the district indicates that the present diversity is in excess of 12 per cent, and with other systems included in the interconnected system presumably the diversity would be greater. Accordingly 10 per cent at least may be taken as an eminently conservative estimate for the diversity in the total load of 1,000,000 kw. This would mean that 100,000 kw. in installed generating capacity could be saved through the diversity made available by interconnection.

At the same time, the reduction which would be effected in emergency reserve requirements would probably amount to 75,000 kw., since a minimum of 15 per cent reserve is needed on the present system—ordinary practice provides considerably more—and at least half of this could be saved by interconnection.

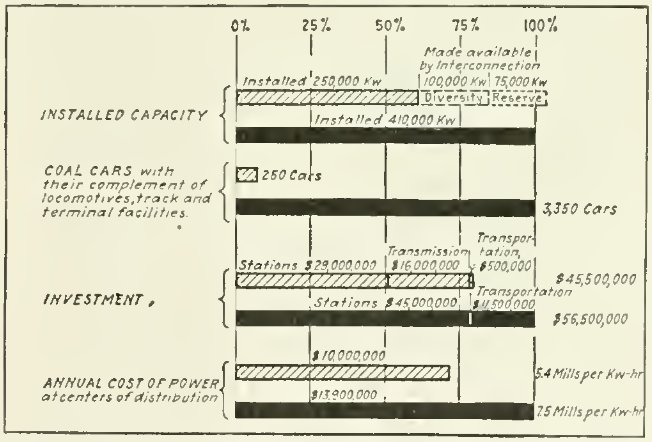

FIG. 4 —COMPARISON OF NEW LOCAL CENTRAL STATIONS VERSUS INTERCONNECTION AND GENERATION NEAR MINES FOR SUPPLY OF WAR INDUSTRIES LOAD

Interconnection of these systems with loads aggregating 1,000,000 kw. would thus result in an effective increase in generating capacity of 175,000 kw., corresponding to a saving in investment of about $20,000,000, which is considerably more than the cost of the necessary transmission system, including step-up stations and step-down substations.

Similar savings would result from interconnection in the Pittsburgh district and in New England. In New England a portion of this advantage has already been realized.

The policy of supplying a large portion of our power requirements from generating stations in the mining regions is not merely a temporary war-time necessity. It is a measure of permanent general economy and will form an important feature of any broad plan for future power supply. There are a number of advantages in locating electric generating capacity in the mining regions, but the fundamental consideration is that, on a sufficiently large scale, it is cheaper to transmit electric power over wires than to haul over railroads the amount of coal required for generation of an equal amount of energy in the district where it is consumed. The investment in the transmission system is not materially greater than the investment in a corresponding amount of railroad facilities, while the railroad operating expense, constituting the greater part of railroad costs, is nearly a clear saving, since the operating expense of the transmission system is relatively negligible.

Mine generation has the further important advantage of utilizing effectively the lowest grades of fuel. This is particularly important in the case of generation in the anthracite district, which saves high-grade bituminous and semi-bituminous coal (our most valuable fuel) by using the smallest sizes and poorest quality of anthracite, most of which is uneconomical to transport and has only a limited field of usefulness.

A number of satisfactory generating station sites are available in or near the anthracite district, and the reliability of modern transmission with duplicate lines is wholly comparable with that of modern central stations. In the immediate emergency it probably would not be advisable to supply all of the 500,000-kw. requirements for the region in question from stations in the anthracite district, since in the first place time can be saved in the installation of a portion of a needed capacity by making extensions to local central stations now in service or under construction, and in the second place an immediate mine installation for the total amount might create a requirement for the smaller sizes of anthracite which would unduly disturb existing arrangements.

An installation of 250,000 kw. in the anthracite district, which is practicable immediately, would supply 235,000 kw. to the load centers, about 100 miles (160 km.) distant. This 235,000 kw., with 100,000 kw. made available by diversity, would leave 165,000 kw. to be installed locally. To supply the whole 500,000 kw. from local central stations would have required, with 15 per cent reserve, the installation of 575,000 kw., so that the 250,000-kw. mine installation with the interconnecting transmission system would correspond to 410,000 kw. of local central-station capacity.

The electrical transmission of the output of the proposed 250,000-kw. mine installation, operated at a high load factor, would save the railroad transportation of over 1,300,000 tons of bituminous coal with an average haul of over 300 miles, releasing for other uses more than 3000 coal cars with their complement of locomotives, track and terminal facilities. It might be pointed out that this represents a saving in railroad operating expense of possibly $2,000,000 annually and in permanent investment in railroad facilities of about $11,000,000 at present price levels. The economic effect cannot, however, adequately be expressed in dollars. The true value of this saving lies in the release of these invaluable transportation facilities for other immediate and vital needs. It means greater output of war materials and more coal for domestic needs. It is measured in terms of the lives of our soldiers and the health of those at home.

Since this same transmission system would serve both to deliver power from mine stations and to interconnect central-station systems, it would fulfill two functions, either one of which independently would be more than sufficient to warrant the required investment or the demand which its installation would place upon our manufacturing resources and our man power.

The plan proposed is fundamentally one of high economy, wholly aside from its emergency advantages. In the following brief comparative analysis, costs are assumed at the present levels. A lower price level would increase the margin of advantage.

COMPARATIVE INVESTMENT AND ENERGY COSTS OF LOCAL CENTRAL STATIONS AND OF AN INTERCONNECTED SYSTEM FED FROM STATIONS NEAR MINES

	—Alternative Plans Giving Equal Capacity—	
	250,000 Kw. at Mines and Interconnection	410,000 Kw. in Local Central Stations
Investment:		
Generating stations	$29,000,000	$45,000,000
Transmission system, including step-up and step-down sub-stations	16,000,000	..
Total	$45,000,000	$45,000,000
Total including railroad facilities	45,500,000	56,500,000
Annual Costs:		
Fixed Charges:		
Stations	$3,500,000	$5,900,000
Transmission	1,700,000	...
Fuel:		
At mines, 2,070,000 net tons at $1.75	3,600,000	....
At seaboard, 1,300,000 net tons at $5		6,500,000
Operation and maintenance stations	1,000,000	1,500,000
Transmission	200,000	
Total	$10,000,000	$13,900,000
Per kilowatt-hour	5.4 mills	7.5 mills
Increase per kilowatt-hour		39 per cent.

Conclusions

The fundamental consideration governing power supply for war industries in the East is the railroad situation. Our whole war industries program depends very largely upon how this problem of power supply is handled in its relations with the railroad situation. The supplying of more power for our major war industries is no longer, has really never been, a choice between power generation at points of use with transported coal versus power generation at mines and the economies of transmission interconnection. The alternatives are supplying these industries over transmission lines and shifting the industries to other parts of the country. As evidence of this, the following is the essential part of an important joint announcement made public a few weeks ago by the War Industries Board and the Fuel and Railroad Administrations:

> A policy has been adopted and made effective for preventing further increase in the volume of war orders and the number of establishments handling them in the area known as the congested manufacturing and transportation district. . . .
>
> Careful analysis of the possible coal movement shows that the increased industrial activity in the Eastern States has created a requirement for coal which exceeds the limit of possible transportation of coal plus necessary materials for manufacture.

Consider what this means in industrial efficiency. The logical location for most war industries is near the ports from which the products will be shipped, since the finished products require greater transportation capacity than raw materials, and since this location obviates reverse direction hauling of raw materials or partly finished products. Referring to the alternative of mine power versus shifting of industries, the Pennsylvania Fuel Administrator in the letter referred to above makes the following statement:

> There is a well-defined report of production embargoes against certain sections of the country as well as removing of industries to the Middle West. There is no doubt that the power division of the Council of National Defense is prepared to show that the cost in time and money of removing industries or building new industries in other centers cannot be compared to the cost of developing necessary power either as a financial proposition or as a physical task. There is no doubt it can be shown that the project to move industries will simply delay the day of reckoning.

A comprehensive and rational policy for future power supply for maintaining our industrial standing after the war and the vital need for effective conduct of our war program, both call for prompt and large expansion of our central-station systems, wide interconnection and substitution of electrical transmission of energy for railroad hauling of coal.

This advance in the art has not been taken up heretofore, because to be effective and economical it must be done on a grand scale, on a scale more comprehensive than our business executives have been accustomed, perhaps have been able, to think and act.

It requires whole-hearted co-operation between the various central-station systems involved. Under present conditions at least it requires government supervision and government assistance. It is beyond the scope of any private enterprise at this time, and the proposition is essentially a national one. The opportunity and necessity for doing things on a grand scale are upon us. This problem of power supply is a thing so big and important, not only for our war program but for the future economic life of the country, that no petty obstacles of inertia or personal prejudice or corporate caution should be permitted to stand in its way. It is believed that full co-operation of private interests will be forthcoming, and the support of the Fuel Administration, the War Industries Board and the Council of National Defense is assured. Preliminary plans were drawn up months ago. The situation awaits appropriations by Congress and action by the administration.

It is a truism which has been frequently stated that war requires the mobilization of the nation's industries and their devotion to essential work. This is especially true in this country. To operate these industries, it has been necessary to mobilize to the fullest extent our available material and labor, but material and labor can only be converted into war work by the application of power. This power, in view of its great economy and flexibility, must be electrical.—*E. W. Rice, Jr., before American Institute of Electrical Engineers.*

THE NEW ENGLAND COAL OUTLOOK IS STILL ACUTE

"Conservation Is the Best and Surest Coal Mine We Have," Declares the Fuel Administrator

Fuel Administrator James J. Storrow of New England returned to Boston a few days ago after a conference with the Washington authorities relative to improving rail shipments of steam coal into the Northeast. Mr. Storrow said that after a re-examination of the New England fuel situation and the war activities of that section, and with a full knowledge of the war needs of other parts of the country, it was decided for the second time that New England must have 30,000,000 tons of steam coal during the twelve months which began April 1. The national Fuel Administration has now issued a series of orders to the various coal-mining regions to get back to this program and maintain the shipments, which are at present about 1,500,000 tons behind. It is expected that the additional coal will begin to arrive in the near future. In May 190,000 tons was gained in shipments of coal by water into the New England States.

Mr. Storrow said that, as nearly as he can estimate, fully 75 per cent of the factories of New England are carrying on war work, and that an adequate supply of coal is essential to the war program laid out by the government.

"Many manufacturers have already begun conservation with a will," said Mr. Storrow in a recent interview, "but some are still lagging. Conservation is the best and surest coal mine we have. We must work it to the limit. Every New England manufacturer, if he will get on the job, can save coal, and it is absolutely up to him to do it."

It is hoped to make a saving of at least 3,000,000 tons in New England fuel-burning plants during the present year. Formal pledges of co-operation have been made to Mr. Storrow by the organizations of engineers and firemen in Massachusetts. Coal dealers within the state have been forbidden to deliver domestic sizes of anthracite to manufacturers, or for use in hotels, business blocks or office buildings, without a special permit from the United State Fuel Administration at Washington. Anthracite screenings, it is understood, can still be used by power plants in connection with bituminous coal.

The larger central stations in New England are at present reasonably well provided with coal for immediate requirements, but the managements are looking forward to the coming fall with considerable anxiety, despite the priority orders which public utilities are entitled to receive.

A recent effort to arrange with the federal government for building vessels in the Boston district for the coal-carrying trade of New England has resulted in failure. The enemy submarine attacks on coastwise shipping sunk a small portion of the fuel supply then in transit to New England, and the shortage of bottoms due to war requirements is bound to be felt materially after the summer is over. Managers are endeavoring to put coal in storage as far as is feasible in anticipation of the peak loads that will confront them in the coming months.

Application of Relays to Industrial Control

Among the Types Considered Are Acceleration Relays, Those for Reducing Motor Speed Under Excessive Load, and Relays of the Fluttering, Phase Failure or Reversal and Transfer Types

BY C. E. CLEWELL
Assistant Professor of Electrical Engineering, University of Pennsylvania

WHILE there are several methods of series-relay control for a motor during acceleration, the underlying principle is to use a relay with a series winding, having a contact disk which is held up and away from the contact fingers as long as the current through the relay coil is above the value for which the relay is set. When the current falls below this set value, the disk drops to the contact fingers, thus completing a circuit to the shunt coil of a magnetic contactor. The disk of the relay is held open mechanically until the current is established at the start.

ACTION OF THE SERIES-RELAY MOTOR STARTER

The action of the series relay as applied to an automatic motor starter can be explained best by a wiring diagram (Fig. 1). A push-button switch is shown at the upper right-hand corner of the diagram. When closed, to start the motor, this push-button allows the current to flow through the shunt coil of the right-hand contactor switch, closing this switch and completing the motor armature circuit through the starting resistance. The contact disk of the series relay is held up mechanically before the push-button is closed, and thereafter as long as the armature current flowing through the series coil of the relay is above a predetermined value. The solid line arrows in Fig. 1 indicate the path of the armature current after the right-hand contactor switch closes.

As the motor speeds up, the current through the armature, and hence through the series coil of the relay, tends to fall off to the value for which the relay is set, and at this point the contact disk of the relay falls and thus completes the circuit through the shunt coil of the left-hand contactor switch, allowing the armature current to take the path shown by the dotted arrows, owing to the closing of the left contactor and the consequent short-circuiting of the starting resistance.

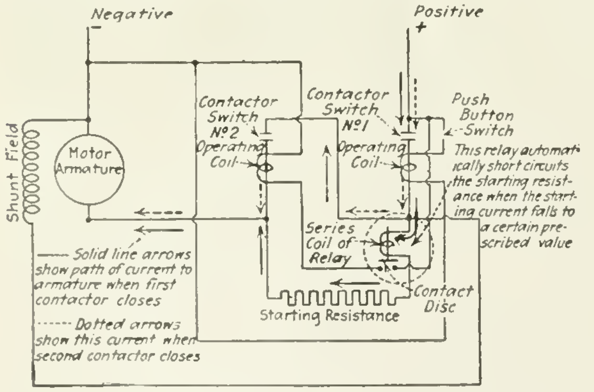
Negative
−
Positive
+
Contactor Switch Nº2
Operating Coil
Contactor Switch Nº1
Operating Coil
Push Button Switch
This relay automatically short circuits the starting resistance when the starting current falls to a certain prescribed value
Shunt Field
Motor Armature
Series Coil of Relay
Contact Disc
Starting Resistance
—— Solid line arrows show path of current to armature when first contactor closes
------ Dotted arrows show this current when second contactor closes

FIG. 1—ONE METHOD OF AUTOMATIC ACCELERATION USING SERIES RELAY

By the scheme outlined the starting resistance is cut out in a manner proportional to the load. It will be apparent that this action is not affected by variations of the line voltage, nor does it depend on the heating of the relay coil, as is the case in some other methods of starting. The fact that the relay will not close until the load current drops to the prescribed value means that it serves as a limit to the load which can be started by the motor. These characteristics may all be advantageous in this method of automatic starting, but, on the other hand, such a device may result in too rapid acceleration at light loads if the relay is adjusted for a heavy load. The fact that the motor will not start on overloads may also be a disadvantage at times. It is obvious that the use of a relay adds equipment to the starter.

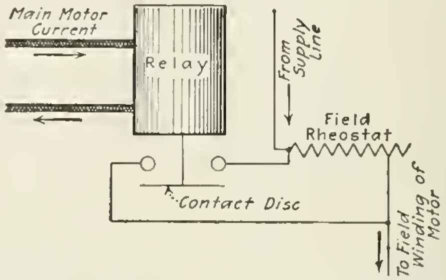

FIG. 2—RELAY FOR REDUCING MOTOR SPEED UNDER EXCESSIVE LOAD

This series-relay method of starting is applicable to both direct-current and alternating-current motors. In designing series-relay starters it is the general practice to employ a relay for each magnetic contactor switch. The diagram of Fig. 1 shows merely one step of starting resistance, whereas for large motors several steps may be necessary.

PROTECTIVE RELAYS

Types of relays designed for protective purposes are named in the accompanying table,* with their uses and functions. The series overload relay is usually employed in conjunction with the under-voltage trip, but may be used singly or in other combinations. For voltages below 2500 and currents less than 200 amp. the elements are generally connected directly in circuit, but above these limits voltage and current transformers are usually employed.

The overload relay illustrated in Fig. 4 (a) is adaptable to use with the ordinary shunt switches of automatic starters in those cases where it is desired to open these switches automatically because of the flow of current in excess of any predetermined value for which the relay is adjusted. The series coil in Fig. 4 (a) is for tripping the relay, the shunt coil at the top being used so as to reset from a master controller.

Other types of overload relays which may be mentioned include a time-element device like that in Fig. 4 (b), which in this case is arranged for resetting by hand. Fig. 4 (c) shows a direct-current series relay for use with shunt switches to regulate the acceleration rate through current control. (See also Fig. 1.) The ability of all motors to stand large currents for a short interval without injury to the motor or controller makes the time element of industrial motor overload protection devices of all kinds an important item.

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*Abridged and slightly rearranged from a tabulation by S. Q. Hayes in "American Handbook for Electrical Engineers," p. 1216, Several references have been made to this handbook section in the preparation of this article.

The advantage of the overload relay in comparison with the fuse is due to the convenience of restoring a relay to its original position quickly, whereas a fuse must be replaced when burned out. Sometimes a relay is used on one side of the line only, and here a fuse is required in the other side of the line. In such cases the rating of the fuse is commonly higher than the setting of the relay, thus causing the relay to open first and saving the fuse in ordinary cases.

The usual custom of setting overload protective devices to handle short interval peaks means, of course, minimizing or completely removing the protection against continuous overloads, which may not be so high as the short internal peaks but may ultimately hurt the motor on account of this duration. The wide variations of loads on the typical industrial motor, coupled with the feature just mentioned, mean that complete protection for such motors is difficult to realize, and indicate, moreover, the need for further development of overload devices.

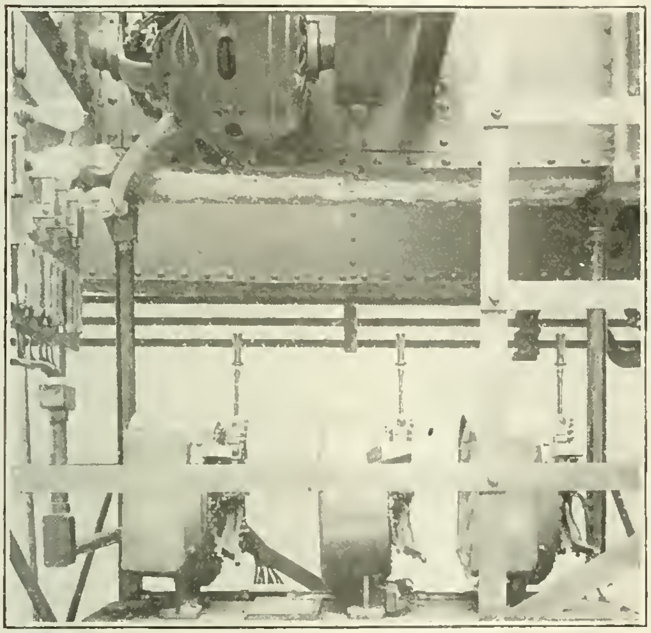

FIG. 3—PORTION OF POLYPHASE-OPERATED CRANE SHOWING CONTROL

THE FIELD-RHEOSTAT RELAY

One relay that has an interesting application to starting and operating conditions is the field-rheostat type shown in Fig. 4b. This relay is connected in such a way (in general as in Fig. 2) that the field rheostat is automatically short-circuited at such times as the armature current is above a prescribed value. With motors of the adjustable-speed type where speed control is accomplished through the adjustment of a field rheostat, it is obviously important to have full-field strength—that is, zero-field rheostat resistance—at starting, to insure a good starting torque and to protect the motor against excessive currents during the starting interval.

A reference to Fig. 2 shows that when the contact disk of the relay is raised by the action of a heavy armature current through the relay coil the resistance of the shunt-field rheostat is short-circuited. This action is especially important at starting if the field rheostat has been left set with its resistance in the field circuit. It is also useful if the motor happens to become heavily overloaded during its normal operation, since under such conditions the field rheostat is short-circuited as long as the overload lasts, causing the motor to operate at reduced speed, but automatically bringing it up to its set speed again when the overload is removed.

One of the principal advantages of the field-rheostat relay is the freedom it gives to the operator to set the field rheostat so as to produce the most economical speed for his machine tool, and then to leave it untouched during successive starting intervals. Fig. 4b shows a panel containing the field rheostat relay only.

CLASSIFIED LIST OF PROTECTIVE RELAYS

Application	Relay Type	Operation
For storage batteries and direct-current apparatus	Direct-current overvoltage	Prevents overcharging and damage from excessive voltage
For storage batteries and rotary converters	Direct-current reverse-current	Prevents discharge into charging source and protects against reversal of energy flow
For direct-current motors	Low-voltage release	Operates if voltage falls below a given value
For storage batteries	Direct-current overload	Disconnects when charge is completed
For feeders, motors, rotary converters and transformers	Alternating-current overload	Protects against overload
For feeders and generators	Alternating-current overload and reverse load	Protects against overload and reversal of energy flow
For induction motors	Alternating-current low voltage	Protects against fall in line voltage
For synchronous apparatus	Alternating-current reverse phase	Protects against reversal of phase progression

THE FLUTTERING RELAY

Automatic controllers for direct-current planer equipment involve an application of the relay somewhat like the one just described. The motor for the planer, whether for reversing or for non-reversing operation, may have two field rheostats, one being placed in circuit by the forward action of the master switch and the other becoming operative with the master switch in the reverse direction. The fact that the cutting stroke is usually made at a moderate speed and the reverse stroke at a considerably higher speed means that the motor operates with a strong field; that is, with little or no field rheostat resistance in the field circuit during the cutting stroke. At the end of the cutting stroke the field rheostat is automatically cut into the field circuit for producing the higher return-stroke speed.

The sudden change from a strong to a weak field is likely to produce excessive armature currents at the point of the planer reversal and during its acceleration for the reverse stroke. The addition of a field relay automatically furnishes the means for a gradual reduction of the field strength with each reversal of the master switch, as follows: A rise of current above any prescribed value for which the relay is set causes the relay to close and thus short-circuits the field rheostat and tends to produce the full field strength for a brief interval. As soon as the armature current again falls below the given set value the relay opens the short-circuit across the field rheostat, thus inserting full-field rheostat resistance in the field circuit again. The back-and-forth action of the relay causes the field to fall to its lowest value without unduly high armature currents and is equivalent to a gradual increase of the resistance inserted in the field circuit, the usual name for this type being the "vibrating" or "fluttering" relay.

USE OF TRANSFER RELAY WITH ADJUSTABLE-SPEED MOTORS

The fluttering relay is equally applicable to the operation of any adjustable speed motor, its action being desirable in passing from the minimum to the higher speeds in such motors. The action of the relay is similar to that of a voltage regulator.† Tests on the smaller motors seem to indicate, however, that the action of such a relay is not very smooth. A second objection to its use lies in the fact that if the speed of an adjustable-speed motor is suddenly reduced from a high to a low speed, the temporary generator action of the motor may cause a large reverse current, thus lifting the relay, increasing the strength of the motor field and still further increasing the armature current. Thus the effect of the relay is essentially opposite to that experienced in the acceleration of the motor.

One way of overcoming the difficulty outlined with the fluttering relay is to employ a second relay with a winding so arranged as to reverse the connections leading to the fluttering relay in case the motor regenerates at any time. The second or auxiliary relay is known as a transfer relay and is required only in those cases where the change of field-rheostat resistance is rapid. Some interesting discussion on the fluttering relay may be found following the Institute paper referred to in the footnote on this page.

OTHER USES OF RELAYS

Among other uses of relays for industrial motors is that of the transition relay in automatic compensators for starting induction motors. Two coils are used in one type of transition relay, one in shunt and the other in series with the motor. The action of the relay in such a case is to disconnect the motor automatically from the transformer and to place it directly on the supply mains as soon as the motor-starting current falls to some given value which causes the action of the shunt coil to exceed that of the series coil in the relay.

Overload relays, sometimes termed "jamming" relays, may also be used in special cases for automatically placing the starting resistance in the motor armature circuit in case of overload, for the purpose of avoiding a reduction of the torque to zero even under excessive overloads.

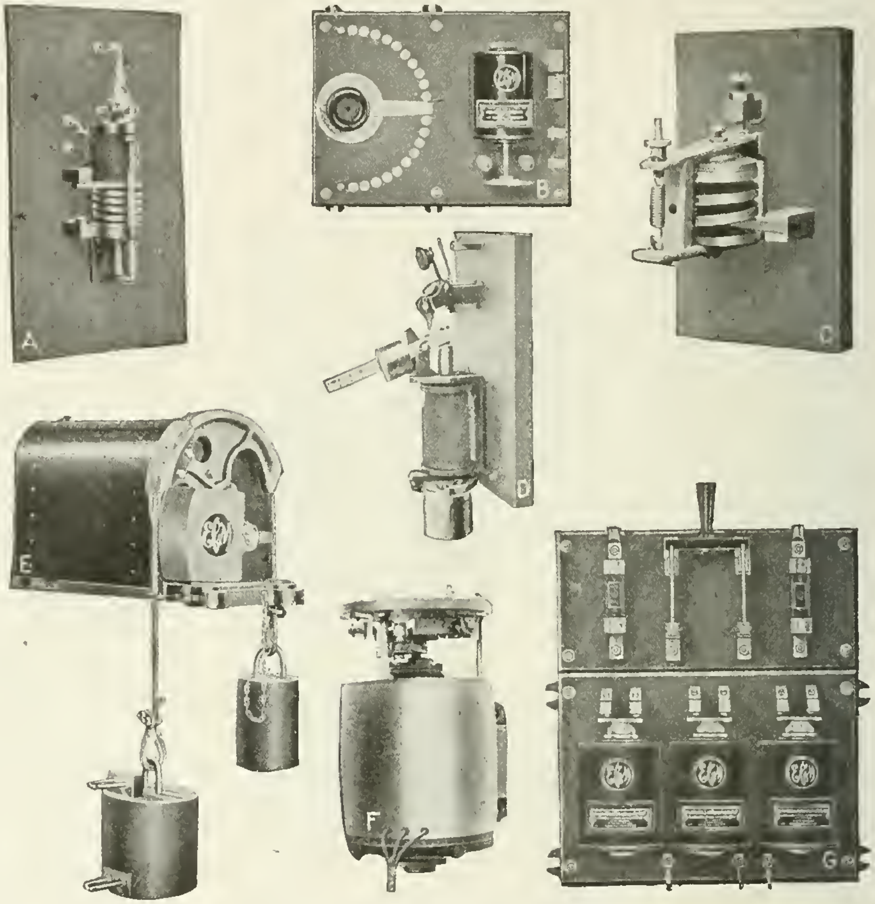

FIG. 4—OTHER APPLICATIONS OF RELAYS

A—Double-coil overload relay; B—Field-rheostat relay; C—Direct-current series relay for current control during acceleration; D—Time-element type of overload relay with hand-operated reset; E—Safety-limit stop for crane overtravel; F—Phase-failure and phase-reversal protective device; G—Series-wound relays for motor starting.

There are a number of other protective devices adapted to the operation of motor-driven apparatus, such as the phase-failure and phase-reversal protective equipment illustrated above, which is to safeguard the operation of polyphase motors in case of failure of any one of the phases, phase reversal, or excessive drop in line voltage. The cut shows a type of mechanically operated safety device, this case referring to a safety limit stop to prevent overtravel of the hook block in crane operation. Many safety devices of this general form have been developed for avoiding difficulties which are likely when the personal judgment of the operator is relied upon as the sole protection of the apparatus.

BIBLIOGRAPHY.—*Electric Journal*, January, 1917, p. 35; March, 1917, p. 103; May, 1917, p. 196; data of the Westinghouse Electric & Manufacturing Company, and bulletins or data of the Cutler-Hammer Manufacturing Company, the Electric Controller & Manufacturing Company, the Condit Electric Manufacturing Company and the Wagner Electric Manufacturing Company.

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†See paper by H. D. James, *Transactions A. I. E. E.*, Vol. 36, p. 265.

Niagara Power in War Industries

HOW valuable a service is rendered to war industries by central stations in the Niagara district is told concretely and convincingly in a report to Secretary of War Baker just made public. The report is signed by Robert J. Bulkley and Brig. Gen. Charles Keller of the Corps of Engineers. Acting under orders from the Secretary of War, they have been exercising supervision over the supply of electrical power since November, 1917, in the portion of western New York in which Niagara Falls hydroelectric power is used.

On Dec. 8, 1917, Mr. Bulkley and General Keller submitted to the Secretary of War a preliminary report outlining a general plan under which they proposed to proceed, its underlying principle being the distribution of the hydroelectric power generated on the American side at Niagara Falls and that imported from Canada as completely as possible to war industries, giving them preference in the order of their importance as communicated by the War Industries Board.

SECRETARY OF WAR APPROVES PLAN

Approving the general plan, Secretary Baker on Dec. 28, 1917, signed requisition orders directed to the Hydraulic Power Company and the Niagara Falls Power Company, under the terms of which all power generated or imported by these two companies was requisitioned by the United States and directed to be distributed to consumers named. "Both companies," says the report of Mr. Bulkley and General Keller, "obeyed these orders loyally and have since then been disposing of all the electric power under their control in exact accordance with the instructions of your representatives."

Owing to certain practical difficulties of operation and distribution and to some misapprehension on the part of all concerned, it has been necessary from time to time to modify the schedules first issued. The Defiance Paper Company, taking power from the Hydraulic Power Company, and the International Paper Company, diverting water from the intake canal of the Niagara Falls Power Company, were deprived of all power, under the original orders. Arrangements were sanctioned for the installation by these companies of furnaces for the production of ferro-silicon. Both companies have completed their installations, their power has been restored to them, and they are now producing ferro-silicon.

The power imported from Canada by the Niagara, Lockport & Ontario Power Company and that which it generates at its steam station at Lyons, N. Y., and its hydroelectric stations at Salmon River and Minetto, N. Y., were not requisitioned by the United States. Explaining this arrangement, the report says:

"As the company had few large industrial users on its lines, a complete rearrangement of the allotment of this power did not appear necessary, and owing to the willingness of the company to co-operate in our plans, it seemed preferable to treat this company with less formality and to secure such adjustments as were needed by means of frequent and friendly conferences with its officials, whose advice we have found to be helpful and disinterested.

"This company operates over an extended territory, from Syracuse on the east to Erie on the west. Many public utilities are on its lines, the largest being the Rochester Railway & Light Company and the Syracuse Lighting Company. The former has a steam station at Rochester and a hydro station on the Genesee River, and the latter has a steam plant at Syracuse. Under arrangements suggested by the Niagara, Lockport & Ontario Power Company, at times of most pressing need additional steam power has been produced at Rochester and Syracuse and made available for use at Niagara Falls. The result of our arrangements with the Niagara, Lockport & Ontario Power Company was to curtail many minor and non-essential industries and to assign the power so saved to the Union Carbide Company for the production of ferro-silicon."

CONDITIONS IN CITY OF BUFFALO

Conditions in Buffalo are also discussed by Mr. Bulkley and General Keller in the report. The Buffalo General Electric Company, with a steam station of 30,000-hp. rating, receives normally also 51,000 hp. of Niagara Falls power and distributes it to the varied industries of the city of Buffalo. Except so far as this company was involved in the requisition order upon the Niagara Falls Power Company, no attempt was made to commandeer its output, but, as in the case of the Niagara, Lockport & Ontario Power Company, it was deemed best to take advantage of the company's intimate knowledge of the local situation and through its co-operation to secure such a reassignment of its output as, while affording the maximum gain of power for war industries, would at the same time to the slightest degree damage the diverse and usually small local industries dependent on this company.

"In a general way the policy suggested by the company and applied by us," write the representatives of the Secretary of War, "has been to remove from the peak hours all load possible, thereby freeing a corresponding amount of continuous power, part steam, part hydroelectric, for use at Niagara Falls. In the case of some industries, such as brewing and malting, the denial of peak power has had the effect of compelling all operations to cease save as independent steam plants may have been available with fuel on hand."

Accompanying tables, which are taken from the report, refer to normal operating conditions, when the full output of the companies named is available. During the past winter the excessive and long-continued cold weather caused the hydroelectric companies great difficulties because of the formation of ice in their intakes, thereby reducing the flow of water and correspondingly the output of power. These difficulties were of unprecedented magnitude at Niagara. A typical diagram, reproduced on page 111, illustrates the extent to which the output of all the companies was reduced. At the same time correspondingly increased demands were necessarily made on the steam stations everywhere in the territory between Syracuse and Erie, while fuel supplies, which had been at a low ebb because of abnormal war activities, grew lower and lower. "At one time, indeed," says the report, "the Buffalo General Electric Company had less than a day's supply in reserve. By means of constant application to the Fuel Administration, practically daily in fact, we were enabled to keep the steam stations at Buffalo, Rochester, Lyons and Syracuse in uninterrupted operation, and to this extent the exercise of the authority confided by you in us helped to avert a public calamity."

TABLE I—USE OF ELECTRIC ENERGY AS PRODUCED DURING TYPICAL PERIOD IN WINTER OF 1917-1918 (IN PER CENT OF TOTAL OUTPUT)

	Niagara Falls Power Co.	Hydraulic Power Co.	Niagara, Lockport & Ontario Power Co. Niagara & Erie Power Company	Buffalo General Electric Co.
Direct war industries...	73.53	97.05	58.31	50.27
Transportation purposes......	11.55		21.21	21.47
Street, commercial and residence lighting, water supply.	7.81	1.95	7.61	13.99
Commercial power consumers over 100 hp...	1.52	0.13	5.94	2.82
Small commercial power....	3.61	0.78	6.80	7.49
Non-essential purposes.	1.98	0.09	0.13	3.96

Coal is criticised now as being of very poor quality, full of stone and foreign matter. It produces less steam per unit used, more ash and refuse, requires more labor in firing and more cars, engines and railroad men for its transportation, while at the same time generating less power than is the case under reasonably normal conditions. Mr. Bulkley and General Keller comment:

"It would seem possible, without very great effort, to better the quality of the coal output. The benefit of so doing would be very great."

Difficulties caused by ice or shortage of coal were met by cutting off all but the essential industries and by supplying the latter with power in order of preference indicated in the schedules approved by Secretary Baker. The period of acute shortage caused by ice ceased about March 1. Since then the beneficial results of regulation and controlling the distribution of power have become apparent.

As a result of the intervention of the national authorities accurate knowledge was obtained of the uses of power generated in this country in the Niagara

TABLE II—DISTRIBUTION OF ELECTRIC POWER OF THE HYDRAULIC POWER COMPANY AND NIAGARA FALLS POWER COMPANY BEFORE AND AFTER APPLICATION OF ORDER OF SECRETARY OF WAR, DEC. 28

Company Taking Power	Use of Power (Hp.), November, 1917	Reapportionment of Power (Hp.), Increase	Reapportionment of Power (Hp.), Decrease	Distribution of Power (Hp.), March, 1918
HYDRAULIC POWER COMPANY:				
Aluminum Company of America	65,866		6,000	59,866
Ice companies....	473		223	250
Cliff Paper Company.	3,291		3,291	0
Defiance Paper Company..	2,034		2,034*	0
Frontier Brick Company..	36		36	0
General Abrasive Company...	1,706		...	1,706
National Electrolytic Company	2,892		......	2,892
Union Carbide Company.	37,000	5,500	...	42,500
Hooker Electrochemical Company........	6,534		....	6,534
Isco Chemical Company.....	591	600		1,191
National Carbon Company...	2,477	2,184	...	4,761
Niagara Alkali Company.	5,714	300	..	6,014
Oldbury Electrochemical Company.......	3,000	3,000	...	6,000
United States Light & Heat Corporation.	1,319		.....	1,319
Titanium Alloy Manufacturing Company.......	7,074			7,074
Other smaller companies	4,514			4,514
	144,621	11,584	11,584	144,621
NIAGARA FALLS POWER COMPANY:				
Buffalo General Electric Company	35,282	.....	9,100	26,182
Niagara River Manufacturing Company........	880	...	880	0
International Paper Company	3,000		3,000*	0
Acheson Graphite Company..	5,408	2,500		7,908
Hooker Electrochemical Company	9,165			9,165
Isco Chemical Company.	709		..	709
Mathieson Alkali Company...	10,343	1,407		11,750
Niagara Electrochemical Company.....	9,506	4,000		13,506
Niagara Alkali Company.	1,363		......	1,363
Oldbury Electrochemical Company...	2,654		.....	2,654
Star Electrode Works....	4,083	1,600	......	5,683
Carborundum Company........	10,483	2,217	.....	12,700
Union Carbide Company.	16,533	1,256	....	17,789
Other smaller companies.	23,935		.....	23,935
	133,344	12,980	12,980	133,344

*Later returned to paper company when it began manufacture of ferro-silicon

TABLE III—NIAGARA FALLS-BUFFALO DISTRICT—INCREASED ALLOTMENTS OF POWER (HP.) TO ELECTROCHEMICAL INDUSTRIES IN APRIL, 1918, AS COMPARED WITH POWER USED IN NOVEMBER, 1917, UNDER NORMAL CONDITIONS.

Manufacturers and Power Companies	Product: Ferro-Silicon Nov., '17	Product: Ferro-Silicon Apr., '18	Product: Electrodes Nov., '17	Product: Electrodes Apr., '18
Union Carbide Co.—Hydraulic Power Co., Niagara Falls Power Co., Niagara, Lockport & Ontario Power Co	66,867	78,964	......	...
Defiance Paper Co.—Hydraulic Power Co	0	2,034	......	...
International Paper Co.—Niagara Falls Power Co........	0	*3,000	.....	...
U. S. Alloys Co.—Buffalo General Electric Co.......	6,720	9,176	...	.
	73,587	93,174	...	..
Increase......		19,587		
National Carbon Co.			2,577	4,761
International Ach. Graphite Co..		...	5,408	7,908
Star Electrode Works..			4,083	5,683
			12,068	18,352
Increase.......		... ..		6,284

	Product: Silicon Nov., '17	Product: Silicon Apr., '18	Product: Phosphorus, Etc. Sodium-Cyanide Nov., '17	Product: Phosphorus, Etc. Sodium-Cyanide Apr., '18	Product: Chlorine, etc. Nov., '17	Product: Chlorine, etc. Apr., '18
Carborundum Co. of America..	10,483	12,700		.	..	......
Increase............	.	2,217	....	....	......	.....
Oldbury Electrochem. Co.			5,654	8,654	....	....
Increase..............	.....	.	.	3,000	......	....
Niagara Electrochemical Co..................	....		9,506	13,506	......	......
Increase............				4,000		
Mathieson Alkali Co......	......	...	.....		10,343	11,750
Isco Chemical Co.	. .	.	..		1,300	1,900
Niagara Alkali Co.	....	....	......	. . .	7,077	7,377
Niagara Smelting Co......	......	.....	......	..	1,125	†11,319
					19,845	22,346
Increase..........	.....	.....	......	......	..	2,501
Total increase........	......	.....	......	......	.. .	37,589

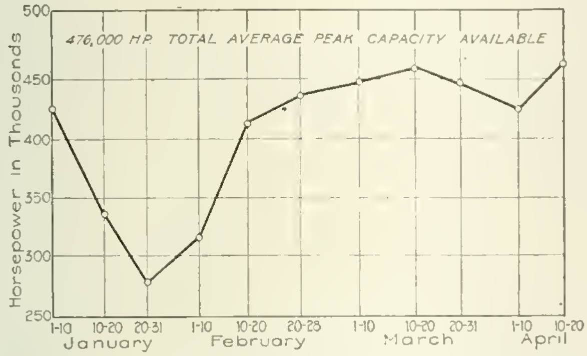
*Used by Union Carbide Company until April, when paper company began ferro-silicon manufacture.

†Power supplied by Niagara, Lockport & Ontario Power Company.

Falls district and that imported from Canada. This information shows that practically all the power available is used to the advantage of the prosecution of the war, as appears in an accompanying table.

In discussing the need of more power in the district the report says:

> Disregarding the abnormal shortage of power in the Niagara and Buffalo district during the past winter, under war conditions the power supply falls short of the demand by about 200,000 hp. This estimate is not based on new industries coming into the district, but is determined as the amount of power which could be absorbed by the industries now operating were such a supply available. A large part of this amount would be absorbed without the addition of new industrial equipment by the users.
>
> Some of this shortage will be relieved next fall by the proposed enlargements of the steam plants of the Buffalo General Electric Company and the Niagara, Lockport & Ontario Power Company. These two companies are now making additions to their plants aggregating 62,000 hp.



REDUCTION IN NIAGARA COMPANIES' OUTPUT CAUSED BY ABNORMAL WINTER

> By means of a further development by the American hydro-power companies at Niagara Falls their existing supply of power, amounting to about 250,000 hp., will be increased by about 160,000 hp.
>
> To enable us to administer this power situation efficiently, we have caused to be permanently assigned to duty at Buffalo Capt. R. S. Hardy, Engineers R. C. He is in close touch with the managers of the various companies concerned, and his services have been most helpful in arriving at correct solutions of the difficulties frequently arising. His assignment to this duty should be continued as one of the most helpful measures in keeping the matter under satisfactory control.
>
> It further seems necessary to arrive at the greatest possible degree of certainty that the fuel supply of the important steam power plants in this territory will be maintained. We have already approached the Fuel Administration and hope to secure its early co-operation to this end.

False Economy

The Wall Street *Journal* editorially refers to the plan of saving coal by reducing domestic consumption of gas and electricity as follows: "A plan to save coal by reducing domestic consumption of gas and electricity one-half assures a minimum of result at a maximum of discomfort. It has this additional feature, not at all pleasant to contemplate: It will bear hardest upon those least able to bear hardship. People of small means who cook by gas and light their rooms with it or electricity are not apt to burn more than is absolutely necessary. On May 31 Bradstreet's price index of foods, based on thirty-one articles, was 4.24 compared with 4 a year ago. Some articles are double their 1913 price, and it is these that families of limited means must purchase."

EFFECTS OF PRESENT CONDITIONS ON COST OF LINE CONSTRUCTION

Poles, Wire and Labor Advance 10 to 90 per Cent in Four Years—Good Management Has Kept Construction Costs from Rising so Fast

BY A. G. HURD

TO DETERMINE the effect which the constantly increasing cost of material and labor has had on the total cost of line construction, the records of a public utility company were analyzed recently, the observations being given in the accompanying tables. That these costs of construction did not keep pace with the prevailing market price of material is due to several factors, among them good judgment and scientific management. For the sake of comparison Table I gives the average market price which this company paid for material and labor from 1915 to May, 1918, and shows the increase in percentage of the 1915 figures.

TABLE I—INCREASE IN COST OF MATERIAL AND LABOR

Year	Wire, Per Cent.	Poles and Equipment, Per Cent.	Labor, Per Cent
1915	100	100	100
1916	125	105	120
1917	174	110	150
1918	170	110	190

If all purchases were made at the time of construction and the jobs were similar—i.e., the poles erected in the same kind of earth, etc.—the cost of construction in the various years would follow the increase shown in Table I. In actual practice, however, all one-pole line extensions are not alike in length, difficulty of erection and other labor items. Data indicating the actual cost of one-pole, two-pole and three-pole line extensions, from 1915 to May, 1918, are given in Table II. A one-pole line extension would consist, under this definition, of one two-wire span of approximately 100-ft. (30.5 m.) and one 35-ft. (10.7-m.) pole with cross-arm, braces, bolts, pins and insulators.. Practical conditions will cause a variation from this standard in length of wire, number of cross-arms (one or two), bolts, etc. However, if sufficient examples of approximately the same class of construction are grouped a very fair average of the actual cost of the work over any time may be obtained.

TABLE II—ACTUAL EXTENSION COSTS AND RELATION TO 1915 VALUES OF THREE POLE-LINE EXTENSIONS

	Wire		Poles and Equipment		Labor	
Year	Cost	Per Cent.	Cost	Per Cent.	Cost	Per Cent
1915	8.15	100	10 36	100	3.39	100
1916	9 07	111	10 91	105	5.11	150
1917	9.19	113	10 90	105	5 70	168
1918	11.39	140	10.80	104	6.58	194
1915	13 20	100	20.77	100	7 50	100
1916	15.76	119	19.68	95	7 89	105
1917	17 60	133	20 92	100.5	9 19	123
1918	16.97	129	20.97	101	9.34	125
1915	19 18	100	29.82	100	11.33	100
1916	22 25	116	30.07	101	13.51	116
1917	23 30	121	30.40	102	13 51	120
1918	23.45	122 4	31.50	106	14 28	126

An inspection of the table shows that the increasing cost of extension materials has lagged behind the market increase in these commodities owing to advantageous purchasing and the use of stock on hand. Eventually these costs would meet the percentage of increase as shown by the market quotations. Likewise when prices begin to fall the percentage of decrease in cost of construction will lag behind the market prices unless this is offset by careful purchasing and by not carrying too large a stock.

The fact that labor costs have increased less than the market price of labor may be chiefly accounted for in two ways:

1. By the element of luck in the order in which extension came in. In this system there are several localities where layers of limestone or hard Utica shale are encountered one foot beneath the ground line. Blasting is not possible, and there have been cases where it cost more than $5 to dig the hole for a 35-ft. (10.6-m.) pole. Not much difficult ground has been encountered lately.

2. The other reason for lower actual costs was that the mounting cost of labor was met by more scientific planning of the work, jobs being grouped so that as little time as possible was wasted in getting from place to place and starting the actual work.

That the increasing cost of construction has forced the more scientific treatment of what were formerly considered small things is a compensation which should not be lost when prices again recede to more reasonable figures.

MANY WAR PROBLEMS WERE DISCUSSED BY THE A. S. M. E.

Worcester Convention Also Considered Fire Protection, Safety Engineering, Vocational Traning and other Timely Topics

Besides the papers and addresses noticed in the Electrical World for June 15 as among those characterizing the Worcester (Mass.) convention of the American Society of Mechanical Engineers, many others filled the three-day session with interest.

A paper on "Some Economic Aspects of Fire Protection Problems and Hazards in War Times," by J. D. Pryor and F. V. Sackett, Providence, R. I., was read by title. The authors discussed the engineering principles of protection in metal-working establishments, textile plants, shipyards, piers, flour mills and grain elevators.

At a general session W. W. Bird read a paper describing the foundry cost and accounting system of the Worcester Polytechnic Institute commercial foundry; Lieut. J. L. Alden presented a paper on "A High-Speed Air and Gas Washer," and I. H. Cowdrey discussed the effect of moisture re-absorption on air-dried fir and hard pine. J. C. Smallwood read a paper on "The Uses of Steam in the Canning Factory," and Morris L. Cooke contributed a paper on "The Public Interests as the Bed Rock of Professional Practice."

One of the parallel sessions was devoted to safety engineering. L. A. De Blois of E. I. du Pont de Nemours & Company, Wilmington, Del., pointed out that over 80 per cent of industrial plant accidents are preventable and urged that the safety problem be treated from a thoroughly comprehensive engineering standpoint and that precautionary measures should not cease with the appointment of a safety inspector or committee. A remarkable point brought out is that about the same assignment for industrial accidents is found in the du Pont plant (manufacturing the most dangerous materials used in industry and war) as in the cement industry. It appears that neither the nature of the industry nor the character of materials produced or handled has as much effect on the cause, frequency and severity of accidents as the safe design of plants, proper organization, supervision and education.

A twenty-one-page memorandum was also presented at this session by the National Safety Council, covering the teaching of safety engineering.

On one of the evenings a general war session was held at the Hotel Bancroft, President Main being the first speaker. He emphasized the present opportunities for engineers to engage in government service, after which Prof. L. P. Breckenridge of Yale University took the chair and pointed out the vital importance of carrying forward technical education, even under war conditions. He urged that everything possible be done to maintain the supply of students for technical schools in the interest of the country's welfare. Dr. W. Irving Clark of Worcester told of recent experiences in France, and Paymaster C. E. Parsons, U. S. N., gave a brief address upon the work of the navy purchasing bureau staff.

At a morning session there was a general conference on fuel economy, the presiding officers being Professor Breckenridge and F. R. Low, editor of *Power*. The latest problems in boiler-plant practice were discussed at length.

Papers were presented by C. M. Allen and F. W. Roys on "The Efficiency of Gear Drives"; by H. G. Reist, on "A Self-Adjusting Spring Thrust Bearing"; by C. A. Briggs, W. C. Chapin and H. G. Heil, on "The Elastic Indentation of Steel Balls Under Pressure"; by F. Hymans, on "Stresses in Machines When Starting or Stopping"; by Morgan Brooks, on "Air Propulsion," and by Harold E. White, on "The Electric Heating of Molds." Messrs. Allen and Roys described a motor-driven apparatus for measuring gear losses directly by balancing the motor field against an Alden absorption dynamometer.

Mr. White gave the results of electric mold heating in a specially designed equipment in which the molds are magnetized with 60-cycle current, the molds being of steel and heated by the eddy currents and hysteretic losses. It is expected that the new method can be utilized in the production of die castings of readily fusible metal and also in drawing the temper of hardened-steel parts. The method was developed on account of the slow and frequently interrupted production obtained in manufacturing phenolic condensation products. The first coil was made of 100 turns of No. 6 wire (asbestos-covered) wired to a 220-volt supply line. With molds weighing 10 lb. to 15 lb. (4.5 kg. to 6.8 kg.) a curing temperature, starting cold, was reached in from three to five minutes. In the latest equipment the coils are arranged both above and below the mold. By the induction method it is possible to pile several thin molds on top of each other and heat them all at once, something out of the question with any other method.

The vocational training session was marked by addresses by Major Cassidy, U. S. N. A., Camp Devens, Mass., on "The Training of Officers for Service at and Behind the Front"; Arthur L. Williston of Boston, educational director of the New England committee on education and special training, War Department; Lieut. André of the French Military Mission, Northern District, Harvard University, and C. L. Homer, Fore River Shipbuilding Company, Quincy, Mass.

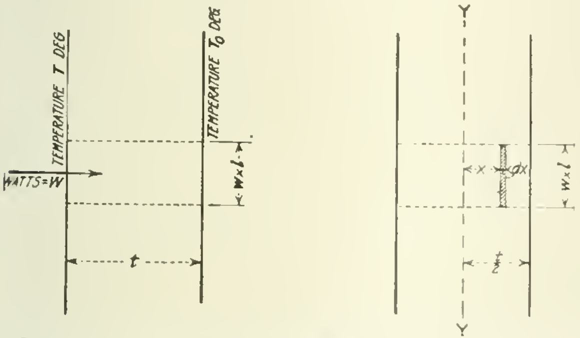
“Hottest Spot” Temperature in Transformers

Formula Developed for Calculating Maximum Temperature—Correction for Space Factor and Conduction Through Conductors Included—Application of Formula to Specific Case Illustrated

BY ALFRED STILL
Professor of Electrical Design, Purdue University

THE tendency on the part of designers of every kind of electrical machinery and apparatus is to make use of accumulated test data relating to similar apparatus when making calculations on new designs, which are usually but slight modifications of existing types and sizes. This procedure may be followed with comparative safety by the experienced engineer, who is usually a good guesser; but nevertheless occasions arise when calculations based on the fundamental principles of physics should be used, if only as a check on the designer's judgment and divination.

When testing transformers to ascertain whether the temperature is or is not excessively high, a thermometer placed at the hottest accessible part indicates approximately the temperature of the outside surface of the coils. It is customary to add 15 deg. C. to this recorded temperature and assume that the result will be the temperature of the hottest spot in the windings. This may or may not be the case, although in modern transformers it is probable that this figure is not often exceeded.



FIGS. 1 AND 2—SECTION THROUGH WHICH HEAT IS CONSIDERED AS BEING TRANSMITTED, AND A SIMILAR SECTION BUT WITH THE HEAT GENERATED WITHIN

Although the internal temperatures of coils are not easily calculated, it is possible to develop approximate formulas which are easily applied and which, with slight modifications, may be used with advantage in predetermining the internal temperatures of many types of electrical windings. Before developing a practical formula for use in transformer design, it will be advisable to consider briefly the relation between fall of temperature and flow of heat through heat-conducting materials.

Fig. 1 is intended to represent a section through a very large flat plate, of thickness t, consisting of any homogeneous material. Assuming that a temperature difference, $T_d = T - T_0$ deg. C., is maintained between the two sides of the plate, the heat flow (expressed in watts) through a portion of the plate of area $w \times l$ can be calculated as follows: The resistance offered by the material of the plate to the passage of heat may be expressed in *thermal ohms*, the thermal ohm being defined as the thermal resistance which causes a drop of 1 deg. C. per watt of heat flow. In other words, if R_h is the thermal resistance of the heat path under consideration,

$$R_h = T_d/W \tag{1}$$

which permits of heat conduction problems being solved by methods of calculation similar to those used in connection with the electric circuit.

Let k be the heat conductivity of the material, expressed in watts per inch cube per degree Centigrade difference of temperature between opposite sides of the cube, then the watts of heat flow crossing the area $(w \times l)$, indicated in Fig. 1, is

$$W = [(wlk)/t]\ T_d \tag{2}$$

A similar case is illustrated in Fig. 2, but the heat is now supposed to be generated in the mass of the material itself. The plate is still considered to be very large relative to its thickness, so that the heat flow from the center outward will be in the direction of the horizontal dotted lines. A uniformly distributed electric current of density Δ amp. per square inch is supposed to be flowing to or from the observer, and the highest temperature will be on the plane YY' passing through the center of the plate. Assuming this plate to be of copper with a resistivity of 0.84×10^{-6} ohms per inch cube at a temperature of about 80 deg. C., the watts lost in a section of area $x \times w$ sq. in. and length l in. will be

$$\begin{aligned} W_x &= (\Delta xw)^2 \times 0.84 \times 10^{-6} \times (l/xw) \\ &= 0.84 \times 10^{-6} \Delta^2\, wlx \end{aligned} \tag{3}$$

By adapting formula (2) to this particular case, the difference of temperature between the two sides of a section dx in. thick is seen to be

$$dT_d = W_x \times dx/(wl \times k),$$

whence

$$\begin{aligned} T_d &= \frac{0.84 \times \Delta^2}{10^6 k} \int_0^{\frac{t}{2}} x\,dx \\ &= (0.84\,\Delta^2 t^2)/(8 \times 10^6 k) \text{ deg. C.} \end{aligned} \tag{4}$$

The value of k for copper is about 10 watts per inch cube per degree Centigrade.

PRACTICAL APPLICATION OF FORMULA

The problem of applying these principles to the practical case of a transformer coil is complicated by the fact that the heat does not travel along parallel paths as in the preceding examples, and, further, that the thermal conductivity of the built-up coil depends upon the relative thickness of copper and insulating materials, a relation which is usually different across the layers of winding from what it is in a direction parallel to the layers.

A section through a transformer coil wound with layers of wire in the direction OA is represented in Fig. 3, the number of layers being such as to produce a total depth of winding equal to twice OB. The whole of the outside surface of this coil is supposed to be maintained at a constant temperature by the surrounding oil or air. In other words, it is assumed that there is a constant difference of temperature of T_d degrees between the hottest spot (supposed to be at the center O) and any point on the surface of the coil.

The heat generated in the mass of material represented by Fig. 3 is thought of as traveling outward through the walls of successive imaginary spaces of rectangular section and length l perpendicularly to the plane of the section. $CDEF$ is the boundary of one of the imaginary spaces the walls of which have a thickness dx in the direction OA, and a thickness $dx\ (OB/OA)$ in the direction OB. According to formula (1), it can be stated that the difference of temperature between the inner and outer boundaries of this imaginary wall is dT_d = heat loss in watts occurring in the space $CDEF$ multiplied by the thermal resistance of the boundary walls.

Considering the heat flow through the portion of the boundary surface of which the area is $CDEF \times l$, and letting W_x stand for the watts passing through this area

$$dT_d = W_x \frac{1}{(2DElk_a/dx) + (2CDlk_b)/(dxOB \div OA)}$$

This simplifies into

$$dT_d = W_x \frac{dx(OB/OA)}{2lx[k_a(OB/OA)^2 + k_b]} \qquad (5)$$

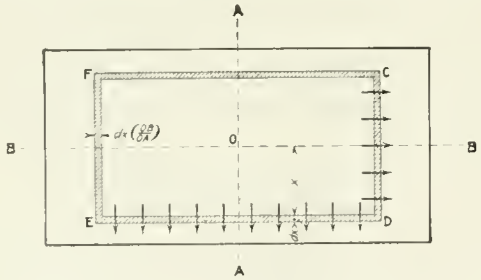


FIG. 3—HEAT GENERATED WITHIN A MASS CONSIDERED AS TRAVELING OUTWARD IN DIRECTION OF ARROWS

In order to calculate W_x it is necessary to know not only the current density, Δ, but also the space factor, or ratio of copper cross-section to total cross-section. Let a stand for the thickness of copper per inch of total thickness of coil measured in the direction OA; and let b stand for a similar quantity measured in the direction OB; the space factor is then $(a \times b)$, and

$$W_x = [\Delta \times 2x \times 2x(OB/OA) \times ab]^2 0.84$$
$$\times\ 10^{-6} l / [2x \times 2x(OB/OA)ab]$$

Inserting this value of W_x in (5), and making the necessary simplifications,

$$dT_d = \frac{0.84\Delta^2 ab}{10^6[k_a + k_b(OA/OB)^2]} x dx$$

whence, by integration between the limits $x = O$ and $x = OA$,

$$T_d = \frac{0.84\Delta^2 ab(OA)^2}{2 \times 10^6[k_a + k_b(OA/OB)^2]} \text{ deg. C.} \qquad (6)$$

Except for the obvious correction due to the introduction of the space factor ab, the only difference between this formula and formula (4) is that the thermal conductivity, instead of being k_a as it would be if the heat flow were in the direction OA only, is replaced by the quantity in brackets in the denominator of formula (6). This quantity may be thought of as a fictitious thermal conductivity in the direction OA, which, being greater than k_a, provides the necessary correction due to the fact that heat is being conducted away in the direction OB, thus reducing the difference of temperature between the points O and A.

CALCULATION OF k_a AND k_b

Let k_c and k_i respectively stand for the thermal conductivity of copper and insulating materials as used in transformer construction. The numerical values of these quantities, expressed in watts per inch cube per degree Centigrade, are $k_c = 10$ and $k_i = 0.0033$. It follows that

$$k_a = \frac{1}{(a/k_c) + [(1 - a)/k_i]} = \frac{10}{a + 3000(1 - a)} \qquad (7)$$

and similarly,

$$k_b = 10/[b + 3000(1 - b)] \qquad (8)$$

where a and b are the thickness of copper per inch of coil in the directions OA and OB respectively, as previously defined.

Example.—To illustrate the use of the formula, suppose that a transformer coil is wound with 0.25 in. by 0.25 in. (6.4-mm. by 6.4-mm.) square copper wire insulated with cotton 0.01 in. (0.254 mm.) thick and provided with extra insulation of 0.008 in. (0.2 mm.) fuller board between layers. There are twelve layers of wire and seven wires per layer. Assume the current density to be 1400 amp. per square inch, and calculate the hottest spot temperature if the outside surface of the coil is maintained at 75 deg. C.

$a = 0.25/0.27 = 0.926$; $b = 0.25/0.278 = 0.9$; whence space factor $ab = 0.833$. By formulas (7) and (8), $k_a = 0.0448$, and $k_b = 0.0332$. $OA = 3.5 \times 0.27 = 0.945$, and $OB = 6 \times 0.278 = 1.67$ in. By formula (6),

$$T_d = \frac{0.84(1400)^2 \times 0.833(0.945)^2}{2 \times 10^6[0.0448 + 0.0332(0.945/1.67)^2]} = 11 \text{ deg. C.}$$

and the hottest spot temperature $= 75 + 11 = 86$ deg. C.

It is not possible to single out any one industry or product and say of it, this is the most important for the winning of the war. We may truly say that the most important element is the spirit of the soul of the people—the morale of the nation—but in dealing with our industrial life we have absolute need of many things. Food we must have or perish; steel, copper, chemicals, machinery, coal—we have need for all of these and more, or we must suffer defeat. Ranked with these and just as important a factor must be placed the electrical industry in its many phases of usefulness. What is there that man is making or doing for the cause of democracy and freedom "over there," or over here, which does not in some measure depend upon light, heat or the power of electricity?—*Thomas Fuller, Westinghouse Electric & Manufacturing Company, before Tri-State Water and Light Association.*

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

METER READINGS FACILITATED BY USE OF PORTABLE TABLE

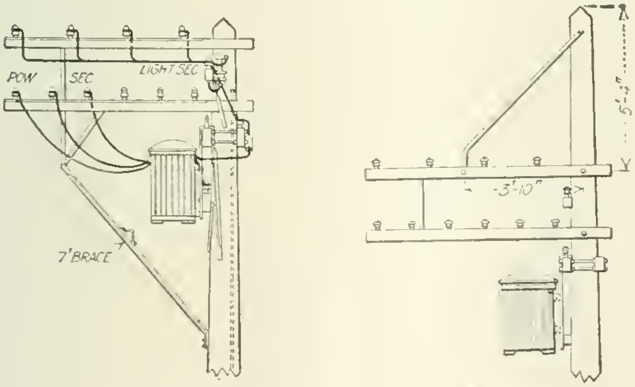
Holds Daily Report and Can Be Moved in Front of Switchboard on Which Meter Is Placed, Reducing Chances of Error

In many power plants that are equipped with benchboard control for operating switches considerable trouble is entailed in recording the readings of meters installed on a long switchboard. The switchboard operator usually writes the readings on a piece of scrap paper and then some time during the interval of readings he copies the figures on the standard daily report. To eliminate the time wasted in copying the readings and to reduce the possibility of error in handling the figures twice, a company in the Southwest constructed a light table supported on wheels so that it can be easily moved. The top of this table holds the daily report sheet. The operator starts at one end of the line of instruments and records the indications of the meter, at the same time moving the table along so that it is directly opposite the meter whose reading is being recorded.

MORE TRANSFORMER SPACE ON DISTRIBUTION POLE

Overhead Bracing Method Permits Transformers of Any Size up to 100 Kw. to Be Hung on Poles—First Cost Lowered by This Method

As loads on distribution lines increase, transformers that were considered sufficiently large at first often turn out to be far short of present requirements. If transformers of larger size are required, it may happen that there is not room on the pole between the cross-arm and the brace. In order to eliminate this difficulty, a company in the Middle West is considering the advisability of changing its standard, which is shown in Fig. 1, to that shown in Fig. 2.



FIGS. 1 AND 2—PRESENT METHOD OF HANGING TRANSFORMERS AND PROPOSED METHOD OF BRACING CROSS-ARMS

As may be observed, the proposed change consists of eliminating the arm brace under the cross-arms and installing a lighter brace above the arms. Of course, if the former clearance is to be maintained longer poles must be used, but it is thought by the company that the cost will not be increased because the pole top will not have to be as large as formerly. Besides, the size of the pole at the gains will be the same. Furthermore, the brace can be made from smaller stock because it will be in tension instead of compression.

The result will probably be that the first cost will be lowered, although this is not the main consideration. One feature is that it will be easier to hoist transformers on the poles on account of the increased height of the pole. Transformers as large as 100-kw. rating can be installed on these poles, whereas with the old construction the extreme maximum is 50 kw.

AUTOMATIC APPARATUS TO LIMIT PEAK LOADS

Power Indicating and Limiting Apparatus on St. Paul Electrified Railroad Assists in Securing Minimum Rate

The contract under which the Chicago, Milwaukee & St. Paul Railway is supplied with power for the operation of its electrified division is based on a 60 per cent load factor, with the provision that the load is not to exceed an average value of 12,000 kw. in any five-minute period. Under these conditions it is very desirable to maintain a high load factor, and to this end a unique scheme has been devised and special instruments developed which have increased the load factor from 40 to 60 per cent.

The power indicating and limiting system for securing this result consists of a 1200-volt circuit running from the first to the last substation and fed from a very small motor-generator in the load dispatcher's office. In each substation where there is a power-company feed tap there is installed a contact-making wattmeter, which introduces into the power indicating and limiting circuit an additional ohmic resistance whose amount varies with the load supplied at the feeder tap. In each substation there is also automatic apparatus which, when the total kilowatts used in the system reaches the amount contracted for and consequently when the current in the power indicating and limiting circuit reaches a certain value, causes resistance to be inserted in the fields of the substation generators of the motor-generator sets.

This reduces the voltage on the trolley system, causing the speed of all trains to be decreased. The maximum reduction in load thus obtained is about 30 per cent of that which would be used in case the power indicating and limiting system were not provided. The apparatus is so arranged as to reduce the voltage of the most heavily loaded substations first, and also to reduce the voltage of any individual substation so as to throw the load on the other substations when the load on such substation reaches the particular amount for which the apparatus may have been adjusted.

In the dispatcher's office there is a switchboard on which is mounted apparatus for controlling the small motor-generator set supplying the system, and also indicating and curve-drawing wattmeters which show for any instant the total kilowatts supplied by the power company. This work, like other electrical features of the St. Paul electrification, is in immediate charge of R. Beeuwkes, electrical engineer.

EXTINGUISHING FIRES IN TURBO-GENERATORS

Water Directed to Windings from Pipes in Rotor End Bell Serves as Emergency Extinguisher Until Cover Can Be Removed

BY J. T. FOSTER

The enormous demands for industrial load now being imposed on electric power companies have brought about the policy of keeping at a maximum the output of every available piece of apparatus, which necessitates that the operating engineer shall be prepared for occasional burn-outs by making plans for such emergencies.

The burn-out of a turbo-generator is extremely serious under present conditions and may mean that a generator will be out of service for several months for rewinding. If the fire is detected and promptly put out, the damage may be limited to one or two coils, which may be quickly replaced. The tendency of fire to spread rapidly through the generator windings is great because of the velocity of the cooling air.

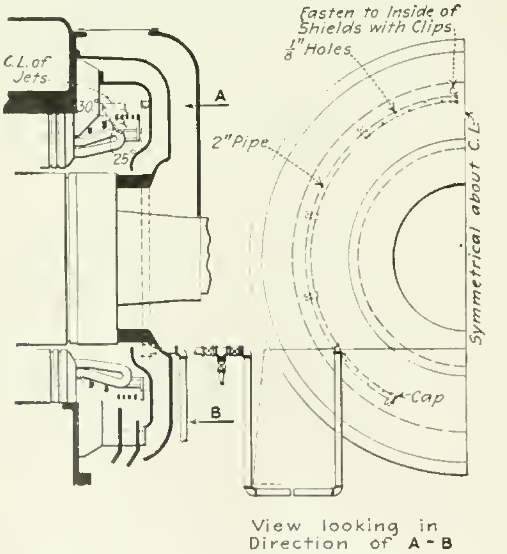

Fasten to Inside of Shields with Clips.
1/8" Holes
C.L. of Jets
30°
25°
A
2" Pipe
Symmetrical about C.L.
Cap
B
View looking in Direction of A-B

FIG. 1—FIRE-EXTINGUISHING PIPES FASTENED WITH CLIPS TO GENERATOR END BELLS

Among the extinguishing agents proposed for the rapid extinguishing of fires have been carbon tetrachloride, carbon dioxide, steam and water.

The first three are all more or less effective if used in sufficient quantities, but they offer some objections because carbon tetrachloride and carbon dioxide are injurious when breathed by the station attendants, because carbon tetrachloride may react chemically and disintegrate the coil insulation, and because live steam may bake out the coil insulation and permanently weaken it. The foregoing disadvantages have led operating engineers to use water as the extinguishing agent because there are no objections to its use except when it is used in excessive quantities.

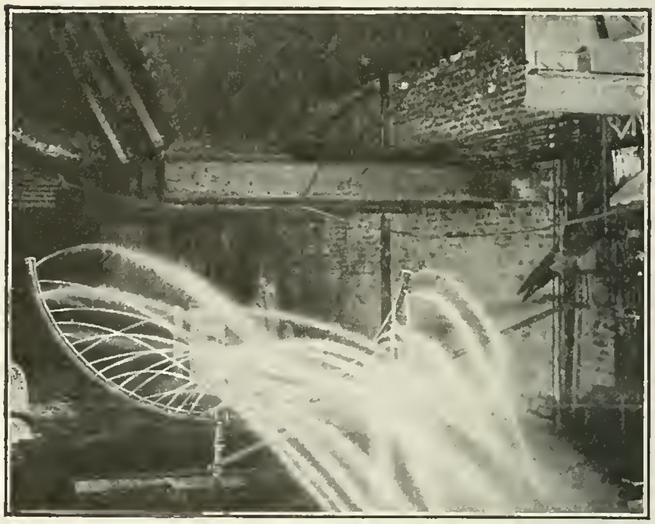


FIG. 2—SPRAY PIPES BEING TESTED BEFORE INSTALLATION IN GENERATOR

Where a machine is so designed that the end bells can be readily removed, the fire does not usually progress to a point where the destruction of the coils becomes general, because the machine can be quickly uncovered and water applied. When the design does not permit of the ready removal of end bells, or the casing does not have handholes, however, it may happen that before the attendants can use any means of fire extinguishing the stator or rotor will be completely burned out.

The attempt to smother the fire by closing the inlet and outlet dampers, while helpful, is not entirely effective, and for this reason automatic dampers should not be installed, because they would not remedy conditions materially and would introduce a serious element of danger. Cutting off the machine excitation, while a necessary step, is of minor importance, and the benefits which would be obtained from automatic relays would not compensate for the attendant danger. Time is the most important factor entering the problem.

Of course it is necessary to disconnect the machine from the bus, cut off the excitation and shut down the steam end when a fire starts, but it is also necessary to use some more positive means of smothering the fire. One form of apparatus for doing this consists of a ring of 2-in. (5-cm.) pipe fastened with clips to the inner surface of the generator end bells, as shown in Fig. 1. This pipe is drilled, the holes being $\frac{1}{8}$ in. (0.3 cm.) in diameter and staggered to obtain a proper distribution of water from the jets. Water under 5 lb. pressure (351 gm. per sq. cm.) is piped to the ring, and admission thereto is controlled by a hand-operated valve which is readily accessible in an emergency. This apparatus serves only for the emergency purpose of preventing the fire from spreading. However effective it may be from this point of view, it will still be necessary in any event to uncover the machine and use a hose to extinguish the fire.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

INTERESTING RANGE POLICY OF COMPANY IN SOUTHWEST

Figures That All Extensions Made at the Present Time Can Be Made to Pay if Man Who Wires House Buys Electric Range

A central-station company in the Southwest, operating in a city which is enjoying considerable building activity at the present owing to the oil boom, has adopted an interesting policy in regard to electric range sales. While this company's sales department on the whole is somewhat depleted, it has continued to let one man devote his time entirely to selling electric ranges. He spends his efforts principally in working on the builders of new homes. The company figures that it will have to serve these homes with electric light, which will necessitate running a service, and that it might as well get a customer who will give it $50 a year revenue as one who will only give it $18. The company is also of the belief that the difference in cost of running a service for a lighting load and running a service for a range load on new construction is not material. Hence it keeps this man "plugging away" on home builders, endeavoring to sell them the electric cooking idea and to get them to install an electric range as a part of the original equipment.

EXPERIENCE OF A KANSAS COMPANY IN HIRING WOMEN

For the Same Amount of Work More Women Are Required than Men, but Cost of Operating Department Remains Practically the Same

W. A. Wadsworth, manager of the Kansas Gas & Electric Company, Wichita, Kan., speaking on the tendency of central-station companies to displace young men of the draft age with female employees, stated that in the experience of his company it takes about five intelligent women to replace four men on the ordinary sort of central-station routine work. It is figured that about one out of every twelve women will be absent every day. Moreover, the rate of turnover of labor is somewhat increased, so that it is necessary to keep a certain percentage of additional help to fill in gaps which are caused by positions being suddenly vacated.

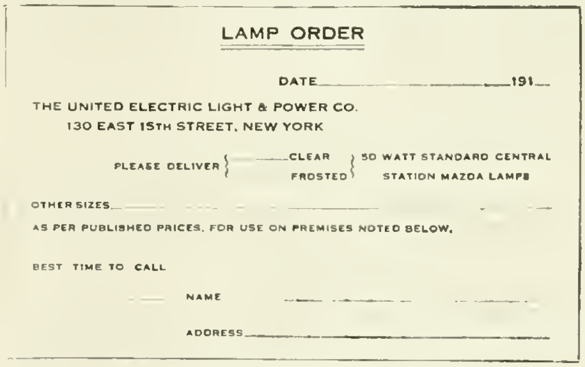
The company now has twenty-five employees in its accounting department and all but three of these are women. Formerly the proportion of men and women in this department was reversed. The same thing prevails in the application department, which has about twelve employees. The company also expects to employ women as collectors, but does not believe it will be possible to use them for meter reading.

The experience indicates thus far that more women are required for the same work than men, but that female labor can be employed at a cost slightly less than that of male clerks. On the whole, therefore, the cost of operating a department remains about the same, as the one increased cost balances the other decreased cost.

NEW YORK COMPANIES DISCONTINUE LAMP SERVICE

United Electric Light & Power and New York Edison Companies Now Go on Merchandising Basis, Charging Higher Prices

On July 1 the New York Edison Company and the United Electric Light & Power Company, supplying New York City and the Bronx, discontinued the practice of furnishing incandescent lamps under the lamp-service contract which includes the furnishing of the first installation and subseqeunt renewals of 50-watt lamps and larger at a monthly charge of ½ cent per kilowatt-hour of energy used. For the use of these lamps subsequent to July 1 the company has decided to make no charge to present lamp-service customers supplied with lamps under the lamp-service contract. From now on the two companies will supply lamps to customers only at the standard list prices, but in supplying these lamps will maintain an adequate delivery service in addition to counter service. Moreover, facilities will be afforded to customers so desiring to purchase their initial equipment of lamps on a deferred-payment plan, full payment to be made in six equal monthly installments to be added to the lighting bill.



LAMP ORDER

DATE ______________ 191__

THE UNITED ELECTRIC LIGHT & POWER CO.
130 EAST 15TH STREET, NEW YORK

PLEASE DELIVER { ______ CLEAR / FROSTED } 50 WATT STANDARD CENTRAL STATION MAZDA LAMPS

OTHER SIZES ______________

AS PER PUBLISHED PRICES. FOR USE ON PREMISES NOTED BELOW.

BEST TIME TO CALL

NAME ______________

ADDRESS ______________

FORM OF LAMP ORDER FOR CUSTOMERS' USE ADOPTED BY THE NEW YORK EDISON COMPANY

There are several reasons for discontinuing the lamp-service arrangement other than excessive cost. First, the service was not altogether satisfactory to the consumer, owing largely it was felt to the inability of a consumer thoroughly to understand the arrangement; second, it was somewhat unfair to the consumers using heating and other appliances to be charged for lamp service on the basis of the entire energy used when a considerable portion of that energy was used for other than lighting; and third, the addition of 10 per cent at the first of the year to the standard price of lamps was a greatly added burden to the companies, which distributed annually in the neighborhood of $1,000,000 worth of lamps and which would have required considerable advance in the lamp-service contract. Even an advance to 1 cent a kilowatt-hour would not have taken care of all of the additional charges, it is understood, and therefore the service has been discontinued.

The companies have standardized on the 50-watt lamp and by making it easier for the customer to purchase 50-watt lamps than other lamps hope to maintain the average lighting wattage.

Customers have been furnished with return post cards on which they may place their order. One of these is here shown, and as will be noted, by using this card it is much easier to purchase the 50-watt lamp than any other size. In notifying the customers of this change, a circular was sent out which gave also the prices at which lamps would be sold. A 10 per cent discount is allowed to purchasers of standard package quantities.

The company has taken the stand that it will not permit customers to receive discounts on yearly purchase of lamps for deliveries at specified intervals throughout the year. Discounts will be given only on purchases as made. In this way the company relinquishes a considerable amount of business to the local dealer in lamps.

TOO MUCH FAMILIARITY FOUND NOT DESIRABLE

Customers Are Apt to Impose to a Considerable Degree on Manager with Whom They Are Well Acquainted

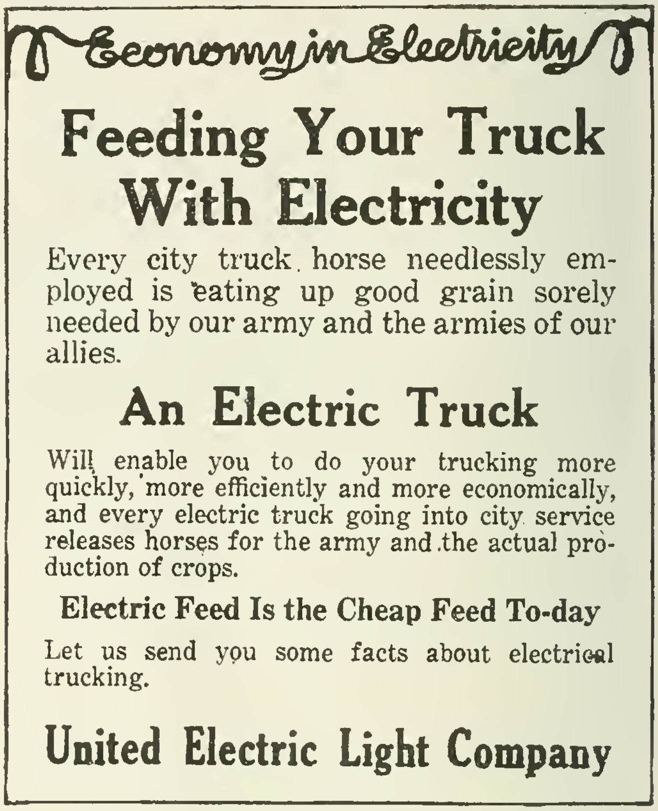
A central-station man who has been acting as local manager for a utility company in the Middle West has had an opportunity to try his hand at the business in several different towns of about 3500 population. When recently asked what mistakes he made in the first of these he handled, he said one of his greatest mistakes had been to permit the public to become too well acquainted with him.

In the first town under his direction he became familiarly known as "Bill" to almost everybody in the city. From one standpoint this was an asset to the company. On the other hand, out of this familiarity grew many requests for expensive gratuitous service. People discovered that they needed to have certain poles moved from in front of their houses or that the street lamp was not in the right location and should be moved up closer to their property. Others, because they thought the manager was a good fellow, began to take more time than was justifiable in the payment of their bills. This went on until the sum total of the impositions which the new manager was forced to endure because of his familiarity with the citizens became formidable. In his subsequent experience in other cities of the same size this manager adopted the policy of keeping on somewhat less familiar terms with his customers, and it is his belief that the change of policy was one that quickly justified itself.

GIVING WAR SLANT TO VEHICLE ADVERTISEMENT

Springfield (Mass.) Lighting Company Shows How Electric Trucking May Be Made to Acquire a Hooverizing Value

The electric truck as a part of the food conservation program seems somewhat far-fetched at first glance, but that is exactly the war-time slant which the United Electric Light Company of Springfield, Mass., is giving to its vehicle publicity, as shown in the reproduction of one of its advertisements in the local papers. The food and fuel saving features of storage-battery transportation lend themselves well at this time to a publicity campaign.



Economy in Electricity

Feeding Your Truck With Electricity

Every city truck horse needlessly employed is eating up good grain sorely needed by our army and the armies of our allies.

An Electric Truck

Will enable you to do your trucking more quickly, more efficiently and more economically, and every electric truck going into city service releases horses for the army and the actual production of crops.

Electric Feed Is the Cheap Feed To-day

Let us send you some facts about electrical trucking.

United Electric Light Company

A NICE LITTLE VEHICLE "AD" WITH A WAR SLANT

BOYS UNSATISFACTORY AS READERS OF METERS

The Type of Lad Required in This Work Difficult to Obtain Owing to the Higher Wages That Other Employment Offers

The Topeka (Kan.) Edison Company has discontinued its practice of using boys, picked up as temporary employees, for reading meters. The services of the boys in this respect proved to be unsatisfactory and men are taking their places. The men are being employed permanently and do other work when they are not reading meters. A. H. Purdy, general superintendent of the company, expressed the opinion that the company's experience with boys was unsatisfactory because it is becoming increasingly difficult to secure, for temporary work, boys of the type needed, since so many of them are engaged in other occupations that pay more than a utility company can afford to give for this class of work.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Relation of Transformer Design to Load Factor.—S. D. SPRONG.—With the average energy rate and transformer investment the annual losses in a transformer are equivalent to about 6 to 8 per cent of the investment. An extension of secondary mains to what at the time might appear unjustified distances has the advantage first of securing greater diversity factor and thereby increasing the load factor on the transformers, and, second, of reducing energy loss per kilowatt-hour sold. In addition, the investment in secondary mains is largely in copper and a relatively small percentage is in insulation, with the result that there are very small carrying charges, so far as depreciation, obsolescence or repairs are concerned, in addition to the interest on the original investment. Advantages are to be gained by the adoption of a standard-size transformer of, say, 50 kw., and at some later time by the tying together in a general network of the more or less isolated sections supplied by single large-unit transformers as the business in the intervening area develops. The most important result of carrying out such a policy over a five-year period is shown by comparison of the results obtained during the interval. Regulation is easily taken care of where transformers are used in networks, especially with present methods of automatic compensation and regulation. Copper temperatures have been largely limited by the use of cellulose insulation and insulating oil, but with the newer forms of insulation now available, which safely withstand high temperatures without impairment of dielectric value, it may be desirable to consider a reversion to the old air-cooled form, if it is impossible to find any fluid insulator that will remain stable under the higher temperatures. A transformer designed to meet the conditions described would reduce present transformer losses by about 25 per cent.—*Electric Journal*, June. 1918.

Lamps and Lighting

Lamp Renewals.—It is shown that for a period of 4000 to 5000 hours' total use of a new lighting installation the rate of lamp renewals for certain periods may be considerably higher than would be normally expected, and for certain other periods the rate may be lower than the normal rate.—London *Electrical Review*, June 7, 1918.

"Mazda" Lamps for Motion-Picture Projection.—A. R. DENNINGTON.—The principal advantages of this lamp include the steady light emitted, the permanent focus obtainable, better color tone of the picture, no carbon dust to scratch the film and cause wear on the bearings of the machine, and reduced breakage of condensers.—*Electric Journal*, June, 1918.

Generation, Transmission and Distribution

Banking of Distribution Transformers.—P. O. REYNEAU and H. COLE.—Considering economy separately from quality of service, it is necessary to make a complete study of the annual charges against any system to determine the most economical size and arrangement of the units of that system, no matter whether the transformers are banked or unbanked. The following items should be considered: Annual charges on wire, annual charges on transformers and accessories such as lightning arresters, fuses, etc., core losses, transformer and secondary copper losses, and annual operating, maintenance, inspection and testing charges. The study would show the combination of wire and transformers which would be best for a given density of load considering the load to be uniformly distributed along the secondary mains. If the best possible service is required, banking will undoubtedly be preferable as it is possible by this method to insure practically perfect service so far as the secondary distribution system is concerned, because trouble on a well-constructed secondary main is very rare.—*Electrical Review*, Chicago, June 8, 1918.

Scope and Application of the National Electric Safety Code.—The need for the code is explained and the manner of application by engineers and inspectors is briefly explained. A short summary is given of the provisions of each of the four principal parts of the code. —*Circular No. 72, Bureau of Standards*, June 17, 1918.

Transmission-Line Practice, Part VI.—LIEUT. E. T. DRIVER and E. V. PANNELL.—Brief reviews of the construction of various transmission systems, including the Mississippi River Power Company, Cedar Rapids line, Tennessee Power Company, Pacific Light & Power Corporation, Tata Hydroelectric Company (India), Victoria Falls & Transvaal Power Company (South Africa), Lake Coleridge development (Southern Alps), and the Inawashiro Hydroelectric Company (Japan).—*Electrical News*, June 1, 1918.

Installations, Systems and Appliances

Standardization of Frequency.—H E. WARREN.—The benefits which will accrue from the standardization of frequency and from maintaining it accurately at the selected value are emphasized. A method of doing the latter in what the author considers a more effective manner than has been done is explained.—*Journal of Electricity*, June 15, 1918.

Feeder Voltage Regulators for Outdoor Operation.—I. C. MINICK.—Details of construction which have been employed to adapt feeder regulators for outdoor service are outlined. One feature is the attaching of the completely assembled regulator with all its accessories to the top cover so that the parts may be lifted as a unit from the tank without disturbing the housing. This feature is of considerable importance from an operating standpoint as complete inspection or repairs to any part of the regulator may be made without drawing off the insulating oil and without removing the tank from its location. A felt gasket and flange on the housing form a moisture-proof joint when the top cover is bolted down, and further protection from inclement weather is afforded by the overhang formed by the lower edge of the housing. The leads are brought out of the tank through porcelain bushings babbitted in the flange.—*Electric Journal*, June, 1918.

Tubular Earths for Lightning Conductors.—KILLINGWORTH HEDGES.—There are several objections to the use of the plate form of earths, even when they are buried to a suitable depth in moist ground. One is that the soil may dry away, leaving the plate only in partial contact, so that the resistance increases sometimes to such an extent as to insulate the ground connection. On the other hand, the tubular earth, with its point driven firmly into the ground, does not lose efficiency by changes in the soil which are noticeable in the proximity of new buildings, owing to drainage, and it has a constant resistance. Another important factor is its lower first cost.—London *Electrical Review*, May, 3, 1918.

Turbo-Electric Ship.—Description of the propelling apparatus of the turbo-electric ship Wulsty Castle. Two sets of Ljungstrom three-phase turbo-alternators are used which ordinarily operate in parallel and drive two induction motors connected with the propellers through speed-reduction gears. The stators of the generators and motors are wound with solid bar in each slot, the insulation consisting of seamless mica tubing and the end connections of massive flat strip. Ventilation is assured by blades on the rotors. The end windings of the generators are supported by especially rigid brackets to prevent damage in case of short circuits. Each rotor consists of a solid steel forging in which slots are milled to receive the windings. The rotors of the motors are of the cylindrical barrel type. Gun-metal slip rings are used and the brushes are equipped with lifting and short-circuiting gear to eliminate unnecessary loss and wear.—London *Engineer*, May 17, 1918.

Electrophysics and Magnetism

Distribution of Electric Field in Vacuum Tube.—TOSHIO TAKAMINE and USABURO YOSHIDA.—The distribution of the electric field in the Crookes dark space of a vacuum tube of very small diameter is determined by Lo Surdo's method. The gas with which the vacuum tubes were filled was in most cases hydrogen, but in a few cases it was a mixture of helium and hydrogen. The glow was never uniform in the dark space, but was mainly concentrated in the axial portion of the tube, except in the space just in front of the cathode, where a glow of nearly uniform intensity occupied the whole portion of the tube. In the course of investigations on the effect of the electric field on the spectrum lines of hydrogen and helium it was found in practically every case that a parabolic formula expressed fairly well the distribution of the electric field in the Crookes dark space.—*Memoirs of the College of Science*, Kyoto Imperial University, October, 1917.

Effect of Electric Discharge on Photographic Plate.—USABURO YOSHIDA.—The author concludes that the light which impresses a discharge figure on a sensitive film is of the same nature as that of a spark so far as the Clayden effect is concerned. The article is illustrated by several remarkable photographs of phenomena observed.—*Memoirs of the College of Science*, Kyoto Imperial University, October, 1917.

Photoelectric Sensitivity of Bismuthinite and Other Substances.—W. W. COBLENTZ.—An increase in electrical conductivity was observed in crystals of selenium, stibnite, boulangerite, jamesonite, bismuthinite, cylindrite, molybdenite and silver sulphide when exposed to light. In the case of bismuthinite the change in conductivity is confined to quite narrow regions along the length of the crystal, occurring usually at the intergrowth or line of contact of two bundles of acicular crystals. In the case of molybdenite the change in conductivity is to some extent a function of the thickness (heat capacity) of the lamina. Further experiments are in progress to determine to what extent and for what wave lengths this resistance change is a true photoelectric phenomenon. Light was also observed to change the resistance of thin blackened strips of platinum or gold. Of the various substances examined, none was found which is so sensitive to light as are the selenium cell and the potassium photoelectric cell.—*Scientific Paper, Bureau of Standards*, June 14, 1918 (No. 322).

Miscellaneous

Industrial Electric Heating.—ARTHUR F. ALLSOP.—The advantages of a heating load to central stations are discussed in the following order: What electric heat can be used for; typical examples of advantageous uses; healthfulness and safety of electric heat; electric heat from the central-station viewpoint and the field of industrial heating; the advantages of industrial electric heat. A table of uses and users of electric industrial heating devices is included.—*Electrical Review*, Chicago, June 15, 1918.

Data Necessary for Rate Determination.—BERT H. PECK.—In establishing rates for utility service a regulating body must give consideration to practically the entire scope of the utility operations, which may be classified as follows: Value of the property; operation expense; character of the enterprise; local conditions affecting the operation and development of new business; conditions which determine the accruing depreciation, and effect of proposed forms of rates. —*Journal of Western Society of Engineers*, Chicago, January, 1918.

Pacific Coast Engineering Problems.—The discussion at the recent Del Monte conventions brought out considerable information that is valuable in solving electrical problems of the West in the present crisis. The subjects dealt with are: Possible water-power development in California; shortage of fuel oil; water-power conservation; transmission and distribution losses; steam-power-plant economies; power-plant economies in the Northwest; hydroelectric economy; transmission and distribution economies; iron and steel conductors; standardization of pin-type insulators; substitute for cedar poles; report on special pine poles, and insulator deterioration.—*Journal of Electricity*, San Francisco, June 1, 1918.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

Apparatus Available

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Technical Theory and Practice" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

MEASURING INSTRUMENTS, ELECTRODYNAMOMETER.

A double-element astatic deflecting electrodynamometer has been designed and constructed at the Electrical Testing Laboratories recently. It can be used as a voltmeter, an ammeter or a polyphase wattmeter, according to conditions. It has also been found very useful as a differential voltmeter as well as for comparing alternating-current and direct-current voltages for purposes of standardization. The fixed coils, which are circular, are attached to vertical slabs of alberene stone. The coils on the front slab are connected into the circuit through four studs so that the front can be removed at any time without detaching any wires, and the moving system is completely accessible. Each element of the moving system is composed of two semi-elliptical coils which are tied and cemented with sealing wax to a thin glass tube. This tube also carries the mirror. Current is carried to the coils by four light silver strips (similar to oscillograph strips). Two of these extend upward from the top pair of coils and the other two downward from the bottom pair. These strips are not subjected to tension and contribute very little to the controlling force of the apparatus. The suspension is a thin steel strip and is fastened to a small slab which is attached rigidly to the back of the instrument and constitutes its top. Suspended from the bottom of the tube is a vane which moves in a small glass vessel filled with oil and provides damping which can be adjusted by changing the character of the oil used. The base is of alberene stone, which also constitutes the back of the instrument. The front is composed of a similar slab supported by four long studs of brass fastened into the back. The sides are of glass fitting in slots in the stone slabs.—*Clayton H. Sharp, Electrical Testing Laboratories, New York City.*

Suggestions for Research

CABLES, TEMPERATURE RISE.

An insulation by the use of which underground cables may be operated at higher temperatures than at present is greatly needed. The insulation need not be suitable for any but low-voltage circuits, up to 750 volts. Circular segmental porcelain tablets strung on a cord, or a tape made of bakelite or similar substance, might be used. Mica in the thickness that would be necessary would probably be too expensive to apply, and asbestes would be too low in dielectric strength.—*Selby Haar, New York City.*

CONDUCTIVITY, THERMAL.

There is need for data in convenient form for the flow of heat from one liquid to another through a separating wall, as in the cooling of transformer oil by water. A search through the literature shows serious disagreement, lack of essential constant, typographical errors, indefinite and confusing terms, etc. The theory is necessarily very complicated, as the controlling factor is the surface resistance, hence also the surface velocities of the liquids. Experimental data are desired covering the ranges frequently occurring in practice, but accompanied by all the necessary facts, as a single missing factor may make the data absolutely useless.—*Carl Hering, Philadelphia.*

CONDUCTORS, HEATING OF.

There is a very great and growing use of low-voltage direct current in large volume for electrolytic and electric furnace installations. These require the use of rotary converters and hence involve heavy alternating currents at low voltages. The inductive drop, the energy losses, the operating temperature and the unequal division of current between parallel feeder conductors are limiting factors in the design. There is a woeful lack of information on which to base reliable calculations for any actual installation, especially in the matter of operating temperature. Data are required for heavy currents, say 3000 amp. to 8000 amp. direct current and 5000 amp. to 15,000 amp. actuating current. The temperature rise of bare copper conductors should be determined as a function of their dimensions, shape, arrangement, condition of surface, air drafts, mutual induction in the case of polyphase currents, etc. *P. H. Thomas, New York City.*

CORE LOSSES IN MOTORS.

The core loss in an alternating-current motor is much greater than the amount calculated by the transformer method, on account of the irregularities in flux densities and combination of field and armature. It has been the writer's experience that the so-called added iron loss, or the amount of iron loss over and above that which can be accounted for by the transformer losses, varies from 25 per cent to 250 per cent or 300 per cent more than transformer loss. In predetermining the characteristics and losses of motors all of the factors can be calculated with a fair degree of accuracy except the iron losses Iron losses, on account of wide variations, may change the results appreciably from what is expected. Therefore a systematic investigation, both theoretical and experimental, of these "added losses" in revolving electrical machinery is a splendid subject for research.—*J. L. Hamilton, St. Louis, Mo.*

DIELECTRIC LOSS, EFFECT OF LIGHT ON.

It would be of interest to measure the dielectric energy loss of a sulphur condenser both in darkness and when exposed to the light. The condenser plates could be made with small holes in them to permit the action of the light. The measurements could be made with the series inductance bridge described in the ELECTRICAL WORLD for March 9, 1918, and would give some interesting information on the nature of dielectrics, the photo-electric effect and the actino-dielectric effect.—*C. A. Butman, Rockport, Mass.*

INDUCTION MACHINES.

Frequently the number of the conductors of the rotor of a polyphase induction motor is not divisible by the number of poles and phases. It would be of value to determine by experiment and by theory the exact field shapes which are produced by such windings. There may be two fields produced, one having as many poles as the armature has poles and the other having a number of poles different from the number of poles in the armature.—*H. Weichsel, St. Louis, Mo.*

LIGHTNING ARRESTERS, HIGH-VOLTAGE RESISTANCES IN GROUND CONNECTIONS.

To prevent an excessive dynamic current discharge over horn-gap lightning arresters on 33,000-volt transmission systems it has been customary to insert in the ground connections of such arresters high-resistance rods of some material such as carbon, carborundum, kopat or concrete. The last material being somewhat less expensive, attempts have been made to construct resistances which would have sufficient mechanical strength and sufficient electrical resistance to limit the current to a desired value. Experiments carried out on an actual operating line seem to indicate that such concrete resistances are both practical and effective. It seems that the richer the concrete the greater the electrical resistance. It would be of considerable value to have complete information as to the relations existing between the concrete mixture and the electrical resistance, and some means should be found so to waterproof concrete columns that the resistance would not change in value because of differences in humidity or weather conditions. Great variations in the resistance have been found due to this cause. —*V. L. Hollister, University of Nebraska, Lincoln.*

DIELECTRICS, STUDY OF DETERIORATION.

Two methods for testing insulation in service are in use—(a) resistance measurement or megger test, (b) overvoltage test. Both tests are admittedly unsatisfactory, because the value of the resistance alone gives but very meager information about the state of the material under stress, and the overvoltage test in many cases shortens the life of the insulation. It would be of great benefit if some one would undertake a thorough and accurate study of the physical and chemical changes in various kinds of partly impaired or overstressed insulation. As a result of such a study, it may be possible to devise practical and reliable methods for testing insulation without subjecting it to abnormal stresses.—*Editorial Suggestion.*

MACHINERY, ELECTRICAL NOISES IN.

It would be very desirable to investigate in detail the causes of noises in electric motors, special attention being paid to the noises produced by the electric and magnetic conditions of the machine. Furthermore, a detailed investigation would be valuable regarding the most suitable foundation for motors, to prevent the noise caused by the machine from traveling through the foundation into the building.—*H. Weichsel, St. Louis, Mo.*

MACHINERY, ELECTRICAL, VENTILATION OF.

No formulas or investigations seem to be in existence which could be used for predetermining the amount of air which blowers with radial plates are capable of producing.—*H. Weichsel, St. Louis, Mo.*

MANGANIN.

Relation between the temperature coefficient and the composition of manganin.—*M. E. Leeds, Philadelphia.*

PHOTOELECTRIC SENSITIVENESS.

This is a field of endeavor which has received a good deal of attention from physicists, though it is apparently not very well systematized. It is of considerable importance at the present time because of its commercial applications (self-lighting buoys, objective photometry, telelectric transmission of pictures, etc.). The photoelectric sensitiveness of a material is the variation of its electrical resistance as conductor when subjected to different intensities of illumination. Selenium has been largely utilized for this purpose, but is unsatisfactory because of its very poor conductivity and unreliability. Many other materials are sensitive to light, but apparently no thorough investigation has been made of this subject.—*Chester I. Hall, Fort Wayne, Ind.*

PYROMETERS.

Optical pyrometer applied to various industries. Emissivities of materials for determining corrections to true temperature.—*M. E. Leeds, Philadelphia.*

SKIN EFFECT IN STRANDED IRON CONDUCTORS

Some power transmission companies use stranded iron conductors for high-tension lines on which the load is rather light. We have used a three-wire strand made of No. 9 B.B. galvanized iron telephone wires and a seven-wire strand made of No. 9 E.B.B. telephone wires. For a line in Chile conductors will be used of ⅜-in. Siemens-Martin steel strand. The Bureau of Standards has published some data and theory on skin effect and inductance of solid iron wires (*Scientific Papers*, No. 252), but no information seems to be available on stranded iron conductors. This subject deserves further investigation to enable the designer to predict the performance of a proposed line more closely.—*H. H. Cochrane, Montana Power Company, Butte, Mont.*

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

WORK FOR COAL SAVING IN MASSACHUSETTS PLANTS

Advisory Engineering Committee to New England Division of United States Fuel Administration Taking Active Steps

Organized and detailed methods of saving coal set forth in non-technical language are embodied in a bulletin just issued by the advisory engineering committee to the United States Fuel Administration, New England division, for service among manufacturers, central stations, operating engineers, firemen and other coal users.

The bulletin was prepared under the direction of President Ira N. Hollis, Worcester (Mass.) Polytechnic Institute; Charles T. Main, Boston, president American Society of Mechanical Engineers; W. G. Starkweather, Boston; George P. Gilmore, Fall River, Mass.; Arthur T. Safford, Lowell, Mass.; Joseph A. Skinner, Holyoke, Mass., and Thomas Hawley, Boston. Arthur E. Norton is secretary of the committee and James J. Storrow is New England Fuel Administrator.

The prominent engineers composing the committee were selected some weeks ago to co-operate with Mr. Storrow in conserving fuel in face of an existing shortage in New England of at least 6,000,000 tons, and are ready to give information and general advice on this subject as a war measure. The committee has already been instrumental in organizing in many industrial plants fuel and power committees whose duties are to see that fuel is burned economically and that steam and power are not wasted. An organization chart showing the duties of representative industrial plant officials and members of such a committee has been prepared.

"Coal economy or no coal at all" is the situation which many New England industrial plants face. In the coming year there will be (in fact, now is) a shortage of at least 6,000,000 tons of steam coal in that section of the country, and the entire region will suffer unless measures are taken to reduce the consumption. Massachusetts is endeavoring to do her share, not only to get through the winter without closing down manufacturing plants, most of which are doing war work, but also to give the army and navy the fullest possible support in the war.

The advisory committee is working in co-operation with the local fuel committees of the Fuel Administration, and through them the manufacturers and operating men, to outline plans for reducing the consumption of coal. Emphasis is being laid upon the fact that waste is not confined to boiler and engine room equipment, but that the loss or misuse of steam within a mill or factory is just as fatal as the waste of coal in steam production, and that the loss of power in shafting or motors and the waste due to too many lamps are exactly as fatal to economy.

Consequently savings of coal can be effected only by taking up a manufacturing establishment as a whole, beginning with the unloading of coal from cars or barges and ending with the shipping of the manufactured product. It is absolutely necessary, the committee feels, that every manufacturer in the state should willingly take measures to eliminate waste of all kinds.

Something may be accomplished by cutting considerable supplies of wood, the committee states, but it must be taken up at once if the wood is to be fit for use. Green wood cut next winter is not nearly so good as partly dried wood cut this summer. It is urged that every fuel committee take up the cutting of wood within easy reach of its district. There will probably be no possibility of hauling much cord wood by rail. Short distances are the prime consideration. Oil fuel offers very little relief at this time, as the demand is heavy for marine purposes and the supply doubtful for companies not protected by long-term contracts.

Many textile mills and shops on Massachusetts rivers use water power when it is available. In some cases this power furnishes but a small fraction of the total power developed and for this reason has not had much attention. Most of these developments do not use nearly all the high flows of spring, early summer and fall. With present prices of coal, increased development of 25 per cent or more will prove good business and save coal. A hundred horsepower in water means a saving of at least 1.5 tons in a ten-hour day.

In addition, the revamping of old transmissions and change to vertical hydroelectric units will increase the power at the machines anywhere from 30 to 100 per cent. The committee announces that it will be glad to furnish general advice and, in specific cases, a list of hydraulic engineers, waterwheel companies and efficient waterwheel settings which may be useful for revamping waterwheel equipment.

To produce as much as possible in whatever work we are engaged and economize consistently in the use of materials of every kind is now the patriotic duty of all. The Westinghouse Electric & Manufacturing Company, with about 85 per cent of its business directly or indirectly for the government, must operate its plants with the greatest efficiency in order to produce the largest output with the smallest possible use of labor and material, and thus give economically the service required. Conservation, care and diligence should be practiced as never before. Every officer and other employee in doing his best for the company is doing his best for the country and for himself.—*E. M. Herr.*

Order your coal

NOW

Get it out of Uncle Sam's way

——*he needs the railroads for the war*

UNITED·STATES·FUEL·ADMINISTRATION

LARGE COAL SAVING MADE IN PITTSBURGH INDUSTRIAL PLANTS

Inspection of These Plants as Reported to United States Fuel Administration Yields Immediate Results

Thomas R. Brown, administrative engineer of the United States Fuel Administration for the Pittsburgh district, in a report received in Washington, says that through the inspection of industrial steam plants, which was begun there only a few weeks ago, a saving of 81,000 tons of coal per year has been effected in the Pittsburgh district. This saving represents a little more than one week of actual inspection under the general program announced by the Fuel Administration.

In five manufacturing plants using coal for production of power an annual saving of 53,942 tons of coal has been made by improved methods of firing, stopping leaks around boiler settings and other factors which make for economy in the general conditions of boiler plant operation.

Mr. Brown's report discloses that one great plant operated in his district was rated at only 59 per cent of efficiency in the use of coal. If this ratio, or anything like it, should hold good for the industrial plants in other districts where the efficiency is recognized as not being nearly so high as in the Pittsburgh district, then the Fuel Administration feels assured that it will be an easy matter to save from 25,000,000 tons to 30,000,000 tons in the 250,000 industrial plants in the United States without in any way reducing the quantity or quality of the output. However, in fairness to the Pittsburgh district, it may be said that the report shows an average efficiency of almost 80 per cent.

Announcement of the appointment of these state administrative engineers has been made: Hans J. Meyer, consulting engineer, Minneapolis, for Minnesota; Henry Adams, consulting engineer, Baltimore, for Maryland; Horace S. Hunt, consulting engineer, Jackson, for Michigan.

Eugene C. Eppley, of Sioux City, Iowa, president of the Hotel Men's Mutual Benefit Association, has been appointed head of the hotel section of the Conservation Bureau, United States Fuel Administration. Regulations for the conservation of heat, light and power in hotels, in keeping with plans laid down at a recent conference between the Hotel Men's War Service Committee and the Conservation Bureau, are under consideration.

SECTION OFFICERS OF THE ASSOCIATED MANUFACTURERS

Electrical Supply Makers in Various Lines Elect Section Officials—International Trade Committee Tariff Meeting Announced

Sections of the Associated Manufacturers of Electrical Supplies have elected officers recently as follows:

Lamp Receptacle and Socket Section—H. R. Sargent, General Electric Company, chairman; H. J. Morey, Pass & Seymour, Inc., secretary; George E. Maguire, E. H. Freeman Electric Company, treasurer.

Industrial and Street-Lighting Fixture Section—C. O. Baker, Wheeler Reflector Company, chairman; C. E. Stephens, Westinghouse Electric & Manufacturing Company, secretary; W. F. Minor, Ivanhoe Regent Works of General Electric Company, treasurer.

Snap Switch Section—E. R. Grier, Arrow Electric Company, chairman; F. E. Watts, Hart Manufacturing Company, secretary; F. P. Gates, Arrow Electric Company, treasurer.

Knife Switch Section—J. H. Trumbull, Trumbull Electric Manufacturing Company, chairman; W. T. Pringle, Pringle Electric Manufacturing Company, treasurer; T. A. McDowell, Westinghouse Electric & Manufacturing Company, secretary.

Attachment Plug Section—C. A. Bates, Bryant Electric Company, chairman; F. T. Wheeler, Trumbull Electric Manufacturing Company, secretary; A. H. Fleet, Cutler-Hammer Manufacturing Company, treasurer.

Outlet Box Section—F. W. Hall, Sprague Electric Works of General Electric Company, chairman; H. G. Knoderer, National Metal Molding Company, secretary; H. D. Betts, Thomas & Betts Company, treasurer.

Fuse Section—Robert C. Buell, Johns-Pratt Company, chairman; Clarence A. Bates, Bryant Electric Company, secretary; F. V. Burton, Bryant Electric Company, treasurer.

Panelboard and Switchboard Section—Charles E. Wilson, Sprague Electric Works of General Electric Company, chairman; F. T. Wheeler, Trumbull Electric Manufacturing Company, secretary; W. T. Pringle, Pringle Electric Manufacturing Company, treasurer.

The Heating Appliance Section, the preliminary organization of which was reported in the ELECTRICAL WORLD of June 1, 1918, has effected permanent organization with the following officers: F. D. Goode, Cutler-Hammer Manufacturing Company, chairman; Harry S. Mirrieless, Manning, Bowman & Company, secretary; B. S. Manuel, Westinghouse Electric & Manufacturing Company, treasurer.

The international trade committee of the Associated Manufacturers of Electrical Supplies will meet at 2 p.m. on July 24 at the association offices, New York. William Burgess, adviser of the committee in tariff matters, will be present. It is proposed to discuss the detail work which must be done in each section under the advice and direction of Mr. Burgess in making a careful analysis of the various lines of products in the industry so that definite recommendations may be decided upon by each branch of the industry for submission to the United States Tariff Commission.

CONTRACTORS' MEETING IS HELD AT CLEVELAND

Eighteenth Annual Convention of the National Association Is the First Meeting with New Form of Organization

The eighteenth annual convention of the National Association of Electrical Contractors and Dealers, the first meeting of the body under the new form of organization, opened at Cleveland on Wednesday of this week with an attendance of nearly 300. The convention followed a two-day meeting of the executive committee for the transaction of routine association business as provided by the new plan.

In welcoming the convention to Cleveland, A. L. Oppenheimer, president of the local association, urged the contractors to study ways to make their efforts useful toward winning the war.

W. Creighton Peet, national chairman, drew attention to the changes effected in the method of conducting the association, pointing out that the association has thrown open all its convention and legislative committee sessions in order that the electrical industry and the public may better know its aim and methods.

William Ganson Rose of Cleveland spoke on the subject of enthusiasm in business and its power to overcome obstacles. "Enthusiasm," he said "is the electric headlight on the train of progress."

Earnest McCleary, Detroit, urged confidence in association as well as national affairs.

G. M. Wheeler, New York, presented William L. Goodwin of New York with a Tiffany engrossed gold and leather testimonial on behalf of the electrical contractor-dealer associations of Greater New York, and by rising vote Mr. Goodwin was made an honorary member of the national association.

At the afternoon session E. E. Van Cleef, Chicago, presented L. K. Comstock's paper on "A Proposed Scientific System of Wage Adjustment." This paper, advocating automatic adjustment of wages to meet advancing "cost of living," covered the same ground as Mr. Comstock's articles in the Electrical World for March 16 and March 23 last.

E. D. Sickles presented a paper on "Unit Labor Costs," by F. W. Lord, New York, outlining a system of reports on productive and non-productive labor costs, and discussing the best practice in estimating methods.

John R. Smith of the Electrical Estimators' Association, Chicago, presented a report on labor data based on the actual accounting experience of a group of important Chicago contractors. The report contained valuable data, with schemes for checking estimates.

An address by William L. Goodwin on "The Goodwin Plan," citing twenty-one fundamental planks of the "Pacific Coast merchandising platform," was the feature of Thursday morning, and at noon the convention adjourned to Nela Park. At the afternoon session Sullivan W. Jones spoke on "The Electrical Contractor's Duties to the Nation," and Franz Nielsen, association attorney, discussed differentials from a legal standpoint. Dwight D. Miller, Society for Electrical Development, Inc., read a paper on "The Application of Electricity to Industrial Plants."

Merchandising and farm-lighting topics occupied the sessions of the closing day, Friday.

WAR FINANCE LOAN TO COMMONWEALTH COMPANY

Government Corporation to Advance $2,400,000 Toward Providing for $8,047,000 Matured 5 per Cent Bonds

The War Finance Corporation has agreed to advance $2,400,000 to the Commonwealth Power, Railway & Light Company toward retirement of $8,047,000 convertible 5 per cent bonds on condition that the company obtain an extension of the balance of the securities. The bonds were due on May 1, 1918. Anton G. Hodenpyl, president of the company, offers holders of the bonds two plans for completing the arrangement.

Under one plan owners may receive a new $1,000 five-year 7 per cent secured convertible gold bond and $25 in cash, representing 2½ per cent discount on the new bond, for each thousand-dollar old bond. The other plan calls for a new $700 five-year 7 per cent convertible gold bond, together with $17.50, representing a discount of 2½ per cent on the $700 bond, and $300 in cash for each $1,000 of bonds matured.

PRIMARY PURPOSE OF THE WAR FINANCE CORPORATION

Treasury Department in Formal Statement Says that War Finance Corporation Is Designed Primarily to Extend Credit Through Banks

The Treasury Department authorizes the following:

The War Finance Corporation was designed primarily to extend credit through the banks of the country, and not directly to borrowers, to industries which are necessary or contributory to winning the war. Only in exceptional cases, in rare instances, will loans be made directly to industries.

War conditions have brought to bear a very heavy burden on the banks of the country. They are called upon to assist largely in financing the government, as well as to meet the increased legitimate financial demands of the industries of the country. The War Finance Corporation was created to enable them to continue to furnish essential credits for war industries and enterprises necessary or contributory to the prosecution of the war.

The corporation, therefore, is an instrumentality to which the banks can resort to obtain assistance to finance war industries and is not intended to be a direct lender to corporations or individuals.

GEORGE A. HOADLEY IS MADE I. E. S. PRESIDENT

Acting Secretary of the Franklin Institute Is Elected to Head Illuminating Engineering Society in New Year

George A. Hoadley, acting secretary of the Franklin Institute, Philadelphia, has been elected president of the Illuminating Engineering Society for the new year, which begins on Oct. 1, 1918. He was formerly professor of physics and electrical engineering at Swarthmore College.

Election of the following officers is also announced: Vice-presidents, Otis L. Johnson, H. K. Morrison and H. A. Hornor; general secretary, Clarence L. Law; treasurer, L. B. Marks; directors, John C. D. Clark, Evan J. Edwards and James J. Kirk.

POST-WAR PROBLEMS OF THE ELECTROCHEMICAL INDUSTRY

Fall Meeting of American Electrochemical Society at Princeton, Sept. 29 to Oct. 1, Will Take up Reconstruction Matters

The American Electrochemical Society will hold its fall meeting at Princeton, N. J., Sept. 29 to Oct. 1 and is planning to devote one session to a consideration of the reconstruction and post-war problems of the industry. The status of all our industries after the war is a most important question, and it is felt that it deserves careful study at this time. This is especially true of many electrochemical industries which the demands of the war have stimulated to a point of expansion far beyond the requirements of peace.

Many of these industries, such as the chlorine and alkali industry, the ferro-alloy industry, the manufacture of electric steel and the carbide industry, have undergone an enormous expansion.

"We shall have the problem of the disposition of government-owned plants," says the announcement of the society. "We must develop new uses in the arts of peace for the products of our war plants. Almost all of these questions of reconstruction and readjustment are pressing in view of the world-wide competition which will follow a declaration of peace. Other subjects are the future of air nitrates, the electric power situation and research after the war in its varied university, governmental and industrial phases.

"A topic of far-reaching importance is the future relations of technical men to the affairs of government. Can the very important work of some of our technical boards be continued after the war and be made to function with the administrative and legislative branches of the government?"

DISCUSS THE SHORTAGE OF STUDENTS AND INSTRUCTORS

W. L. Abbott Describes Experiences of the Commonwealth Edison Company Before Society for Promotion of Engineering Education

How to meet the increasing demands for engineers to carry on the war and industry now and also to provide for the reconstruction period were the impelling questions back of much of the discussion at the convention of the Society for Promotion of Engineering Education held June 26 to 29 at Evanston, Ill. Prof. C. R. Mann, who outlined the forthcoming report of the joint committee on engineering education and also the latest decisions of the government with reference to students' training camps, was the center of debate nearly the whole of one day. During an evening session members of the Western Society of Engineers and sections of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers added their views, a joint meeting being held for the purpose of getting the views of the practicing engineer.

W. L. Abbott, chief engineer Commonwealth Edison Company, detailed methods by which the public service companies recruited engineers. Formerly a young graduate was put to work at $2 per day with the gang. At the end of the year the man might still stick but not from any effort on the part of the company. His trustworthiness and eagerness to take responsibility were about the only things that would bring him to the attention of his employer. That day passed some years ago, as recruits failed to materialize. This reluctance on the part of men to seek work was progressive from East to West, and finally the Central Station Institute was founded, in which thirty to fifty were trained for a year. A charge of $400 a year was made, and the men were paid $40 per month for the part time spent in the different departments. In four years there were eighty-five graduates, one-half of whom stayed with the company until the war began, when 80 per cent left, practically terminating the experiment.

Now the plan is to give the men a large part of the preliminary work in five vacation periods while at school. Only one-half day a week is given to classroom study. The pay is $60 to $90 per month. As before, the men are shifted often from one department to another. The latter is a serious drawback because department heads are not enthusiastic about training a green man charged to them only to have the new man transferred when he is ready to do productive work. Taking the men during vacation works so well that Mr. Abbott is of the opinion that it would be desirable to put them on during freshman year and possibly take them from high school. Just at present the government is combing out the lists, and he believes that this is a mistake, for if the men had completed their full course there would now be thousands of graduates well equipped to handle the necessary war industries.

In the address of the president, Milo S. Ketchum, read by John F. Hayford, on "Essentials in Engineering Education," he pointed out that the most critical problem in engineering education to-day is to obtain a sufficient number of competent teachers. No greater task, in his opinion, can be undertaken by the society, than to improve the conditions and increase the emoluments of engineering teachers.

"Help the Red Cross"

In this Red Cross sign, displayed in New York, the letters in "Help the Red Cross" are 7 ft. (2.1 m.) high. The eagle is 26 ft. (7.9 m.) high and the structure itself is 44 ft. high by 72¾ ft. (13.4 m. by 22.1 m.). The use of this sign was donated to the Red Cross by the Anheuser-Busch Company. The sign was designed and built by the O. J. Gude Company, New York.

OHIO'S WAR CONVENTION TALKS OF TIMELY BUSINESS

Constructive Committee Activities—War-Time Operation Discussed at Round-Table Meeting—I. L. Oppenheimer Elected President

While the registered attendance at the twenty-fourth annual convention of the Ohio Electric Light Association at Cedar Point, July 10, 11 and 12, was only about 225, as against the usual 400 or 500, the sessions were better attended than in normal years. This was taken as an indication that those who attended were there for business and that the executive committee had acted wisely in deciding to hold a convention instead of postponing it as was done last year. No entertainment was provided for delegates. This plan, according to Secretary D. L. Gaskill, appeared so satisfactory that it will doubtless be followed each year, for the duration of the war at least.

War-Time Operation

Discussion at the round-table meeting on war-time operation was timely. J. C. Martin of Columbus spoke on the legal status of rate contracts in Ohio. He said that for several years Ohio utility men had been endeavoring to assist in any work that would tend to clothe the Public Utilities Commission with more power. Just now, however, when the utilities more than ever before need the help of the commission in getting relief from rates which are too low, it appears that the Supreme Court of Ohio has taken from the commission some of its power. According to Mr. Martin's interpretation of a recent Ohio Supreme Court ruling, public utility franchises granted prior to the passage of the public utility act were to be considered as valid contracts between the company and the municipality and not subject to the jurisdiction of the commission. This, the speaker pointed out, is a complete reversal of established trend and will place the utility companies back in the hands of municipal authorities, where they were years ago. He suggested as remedial measures an appeal to the Supreme Court of the United States, to get if possible a reversal of the opinion of the Supreme Court of Ohio, or an appeal to the Legislature to enact an indeterminate franchise law under which all old franchises could be surrendered.

F. H. Hooper of Van Wert, commenting on Mr. Martin's interpretation of the court ruling, expressed the opinion that the outlook was not so dark. He said that the commission had always held it had no jurisdiction over lighting rates fixed by city ordinance and suggested in such cases the direct help of municipal authorities. On some power contracts he said he believed the ruling would be beneficial, for many companies have made power contracts at prices less than published schedules. This ruling will afford an opportunity to increase these rates to those in published schedules if the necessity of increasing them exists.

D. L. Gaskill of Greenville spoke on the non-essential demands which those in authority make of public utilities. There has been no thought of conserving effort by asking fewer or less voluminous reports from public utilities or asking less costly public improvements. The reports to the Public Utilities Commission are not so bad, but some others, such as those required by the tax commission and the government, are burdensome. Orders for municipal improvements, such as repainting poles, which are not at all necessary and which require money, are still being issued. Mr. Gaskill expressed the opinion that there should be a concerted effort to correct this situation and that attention should also be turned to getting other manufacturing and mercantile businesses taxed as going concerns just as public utilities are now taxed.

At this session Dr. M. G. Lloyd spoke on the "Work and Scope of the Bureau of Standards." He urged central-station operators to send in constructive criticism of the National Electrical Safety Code because it is in process of revision for final publication and probable adoption by state and municipal authorities.

Reports of all standing committees were presented at the meeting. The fact that interest in the association has not lagged was attributed largely to the work of standing committees.

The illumination committee, of which Prof. F. C. Caldwell of Columbus is chairman, was first to report. The illness of Professor Caldwell has prevented accomplishment of some work contemplated. In the coming year, with open committee conferences scheduled and with an elementary textbook under way which is intended to give the public much needed instruction in the elementary principles of good lighting, it is expected much progress will be made.

In discussion of this report the question arose as to what stand a company should take in regard to street-lighting revenue it would lose by curtailment of public lighting service. E. H. Beil of Youngstown said that in the former period of lightless nights the city expected to be granted the regular rate established for outages in the street-lighting contract. The representatives of the company pointed out, however, that its investment was active whether the city was using it or not. On this basis the city agreed to pay the cost of operation even during lightless night outages. G. E. Miller of Cleveland suggested that where only the cutting down of intensity was essential it would be possible in some cases to reduce the size of lamps used and then to make reduction in price comparable with the difference in the amount of energy used.

Modern Central-Station Methods

The work of the station operating committee, of which Henry B. Dates of Cleveland is chairman, consisted during the last year of eleven papers, discussions and visits to the modern power stations. The committee had held four conferences. The following topics were covered:

1. The discussion of the fuel question, not only from the standpoint of supply and cost, but, of prime importance to the operating man, the questions of quality and efficient use of the fuel.

2. Power-plant losses and their prevention, this subject including the types and applications of power-plant efficiency meters.

3. The organization of labor in power-house work and educational work among power-plant operators.

4. A first-hand study in the most modern power plants of actual apparatus and operating practices.

Discussion by W. E. East of Toledo, H. W. Bromley of Youngstown, W. A. Wolls of Columbus, H. L. Wallau of Cleveland and William Long of Toledo proved instructive. The Toledo company by using Bailey boiler meters, at a cost of about $400 each on each boiler, is effecting a 10 per cent saving in coal. Labor troubles were also reviewed. Opinion as to the practicability of the bonus plan was about equally divided, although all conceded its advantages.

George E. Snider of Toledo, chairman of the meter committee, in his report said: "The labor situation during the last year has been an exceptionally difficult problem, due principally to the fact that the average age of the meter department employees is such that about 75 per cent of them come within the draft, and the loss from this cause, especially with the larger companies, has been difficult to replace. In most cases this situation has been met by employing female labor wherever possible. In clerical, repairing and shop-testing work the results obtained are very encouraging. In other cases it has been necessary for the time being to abandon some of the less important work and also lengthen the intervals between service tests to three years or three and one-half years on the smaller meters."

The report contained carefully prepared papers on three timely topics, namely, "Demand Meter Performances," by Charles P. Garman, Dayton, Ohio; "The Problem of Securing Training and Keeping Adequate Help in the Meter Department," by A. H. Bryant, Cleveland, and "Meter Record Systems," by Ray Wolford, Newark, Ohio. These papers showed the opinion and practice of many representative companies.

In the discussion George E. Miller of Cleveland declared that the present is an admirable time to change to a demand system of metering if any company is contemplating a change. Present high costs of equipment make it easy for people to understand investment costs in plant equipment on which demand charges are based. As indicative of present prices Mr. Miller cited a recent quotation on a 100-hp. tubular boiler, which amounted to $6,800. F. B. Steele of Dayton expressed the opinion that demand meters greatly reduce the number of complaints and help to settle those made by power customers. Mr. Wood of the Duquesne Light Company, Pittsburgh, Pa., said that while he could train girls to test meters as well and as cheaply as any men, he had been thus far prevented from using women on outside testing by an order of the industrial board. He will appeal to the Public Utilities Commission.

The report of the new-business co-operations committee was divided into two sections, one on commercial lighting and merchandising under Chairman C. E. Yacoll of Youngstown and another on industrial power and heating under Chairman F. B. Steele of Dayton. These committees had sensed the change in the times and had devoted a large part of their attention to the broader commercial problems and less to business-getting methods.

A summary of all papers presented before the committee conferences was contained in the report. The committee recommended that the Ohio Electric Light Association take out a membership in the American Electrochemical Society and authorize some member to attend its principal meetings to bring back information of value to central stations. It is believed the executive committee will act on this recommendation.

The discussion brought out that residence wiring business is proceeding at a lively pace in Sandusky, Dayton and other sections. Financing is not being done by central stations. At Dayton the new-business department is starting to sell $91,000 of 6 per cent preferred stock to finance necessary extensions to plant. Cash or time payment plan at $10 down and $15 a month is the terms. The minimum sale will be one share and the maximum twenty shares. Sale of the stock at 85 was authorized by the commission.

The year's work of the committee on transmission and distribution, under Chairman M. H. Wagner of Dayton, was divided into three main parts, namely: underground distribution, overhead distribution, and high-tension transmission. The underground section of the report summarized what the committee felt was best practice on routing and installation. Secondary systems and transformers were covered in the part on overhead construction. Switching, remote control and overhead protection were taken up under high tension.

Discussion of the report occupied almost an entire morning. Those who participated were H. B. Hibben of Cleveland; W. H. White, General Electric Company, Schenectady; Fred Alsaker, Chicago, Delta Star Electric Company; M. G. Lloyd, Washington, and W. E. Richards, Toledo.

Officers elected for the ensuing year are: President, . L. Oppenheimer, Pomeroy; vice-president, C. H. Howell. Coshocton; secretary-treasurer, D. L. Gaskill, Greenville; executive committee, O. H. Hutchings of Dayton, F. H. Golding of Canton, Robert Lindsay of Cleveland, E. L. Franklin of Warren, W. A. Wolls of Columbus; finance committee, W. W. Freeman of Cincinnati, E. P. Matthews of Dayton and J. C. Martin. The standing committee chairmen are: Meter committee, Charles P. Garman, Dayton; illumination committee, F. C. Caldwell, Columbus; voltage standardization committee, H. L. Wallau, Cleveland; transmission and distribution committee, R. R. Krammes, Newark; station-operating committee, Henry B. Dates, Cleveland; new-business co-operations committee, commercial lighting and merchandising section, F. H. Hooper, Van Wert; industrial power and heating section, C. D. Carlson, Cleveland.

Hartford Employees Volunteer for Farms

VOLUNTEER FARM WORKERS
OF HARTFORD ELECTRIC LIGHT CO

Farm work is being efficiently performed by relays of central-station employees loaned for a week each by the Hartford (Conn.) Electric Light Company in the interest of patriotic crop production.

PREPARING STUDENTS FOR MILITARY SERVICE

Committee on Electrical Engineering of the Society for the Promotion of Engineering Education on the War Problems

A brief survey of the present status and future plans of the various institutions of the country, with respect to special preparation of electrical engineering students for military service, was made by the committee on electrical engineering at the recent meeting of the Society for the Promotion of Engineering Education at Evanston, Ill.

The changes for instruction in electrical engineering have been investigated at twenty-six representative institutions throughout the country. In twenty of these, says the committee, special courses have been conducted during the second semester in radio communication. In most instances equivalent credit has been granted for senior courses previously required for graduation. The general tendency seems to be to give credit in elective courses or for theses. Several institutions insist that all or a large portion of this credit be confined to courses outside of the School of Electrical Engineering. The committee calls special attention to this, in view of the fact that these radio courses are highly specialized and theoretical in nature and tend therefore to increase unduly the amount of instruction in pure electrical engineering at the expense of culture and general electives, which are very often given too little consideration in the education of an engineer.

Courses in radio communication, with the exception of code practice, have been pretty generally administered by the regular staff of instructors with the coöperation in many instances of the department of physics. The code practice has been administered either by local telegraph operators or by students or assistants who have become expert in the code as amateurs in wireless telegraphy. From four to five hours per week have been devoted to the code practice in most institutions reporting on this feature of the course. In some cases students were permitted to devote their own time to such work during hours when they were free, using as an incentive the fact that the Signal Corps recommends a proficiency of at least ten words per minute, and preferably twenty words per minute, for technically trained officers.

Although at the convention of the society last year in Washington, the committee adds, plans of the various institutions seemed to indicate that a large degree of intensification and possible shortening of the training in electrical engineering were anticipated for the year, comparatively little has been put into effect in the institutions investigated. In ten schools out of the twenty-six such a policy has been adopted. In most cases this involves merely the elimination of holidays and vacations, resulting in closing the institution from one to four weeks early this spring. In most instances a very positive statement was recorded to the effect that no further attempt would be made to intensify or shorten the course during the forthcoming year.

At four institutions only a summer session is planned for the present junior class in electrical engineering, with the idea of graduating this class in January or February. Several schools report a consideration of such a possibility with the later abandonment of the idea resulting from faculty vote or adverse student sentiment. With the expressed policy of the War Department and the navy to the effect that students in engineering, anticipating military service, should complete their regular courses, and with the provisions of the Naval, Signal and Engineering Reserves, the committee feels that the need for shortened and intensified courses has been pretty generally eliminated.

The demands for technical graduates in the military service have reopened in many instances consideration of the desirability of continuing university training for all classes throughout the year on the four-term basis. At Purdue University and one or two other institutions faculty committees are considering this possibility. So far as reported to the committee, however, the University of Washington is the only institution investigated where final decision has been made in favor of the four-term plan.

In many schools where either the faculty or the student body, or both, has defeated the plan for a summer session for senior electrical engineers, this fact would seem to indicate that the summer session of a four-term schedule would be neither popular with nor largely attended by engineering students. The personnel of both student body and faculty, and hence the nature and quality of the work accomplished, would probably be quite different as compared with the other three terms of the year.

With regard to plans for the forthcoming year, many schools are arranging for a considerable amount of extra military drill, particularly in institutions where such training has not been administered in the past. In a few cases it is planned to conduct a radio course throughout both semesters of the senior year rather than to concentrate this work in the second semester, as was generally the case during the past year.

The addition of new courses of special value during the war has been recognized in most instances to have a stabilizing effect upon the student body.

This war in magnitude, intensity and destructiveness exceeds every other calamity which has afflicted the human race. The side more likely to win is that which more quickly invents and successfully utilizes various engineering devices. To devise and employ these instruments engineers, and still more engineers, are needed. Whenever the war terminates there will be need for engineering skill to repair the destruction wrought. Educational methods should be quickly and effectively modified to anticipate or meet demands of the new world of experience and ideals. To "promote" engineering education we should concentrate on effective schemes for (a) more materials, more students attracted and held; (b) better methods, less wasted time; (c) better men, more pay for instructors to prevent the best men from going out of educational work.—*Prof. F. H. Newell before the Society for the Promotion of Engineering Education.*

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Conference Club.—The regular quarterly meeting of the Conference Club will be held in Schenectady, N. Y., on July 22 and 23. The General Electric Company is making arrangements for delegates' accommodations.

A. I. E. E., San Francisco Section.—J. C. Clark of Leland Stanford University has been elected chairman and Allen Jones, General Electric Company, secretary of the San Francisco Section of the A. I. E. E. for the coming year.

A. I. E. E., Rochester Section.—Following a dinner held by the section recently, R. H. Manson was elected chairman and W. W. C. Freeman, Stromberg-Carlson Telephone Manufacturing Company, was elected secretary for the year 1918-19.

A. I. E. E., Minnesota Section.—At the last meeting of the Minnesota Section the annual election resulted in the choice of F. A. Banert for chairman and F. D. Marshall for secretary. Captain Richard gave an instructive talk on trench warfare, dealing with personal experiences.

A. I. E. E., Panama Section.—W. L. Hersh was recently elected chairman and M. P. Benninger, Balboa Heights, C. Z., was elected secretary. The meeting of June 9 was given over to an inspection trip to the Central & South American Cable Company's ship Guardian, conducted by Mr. Hecksher.

New York Electrical Society.—At its last meeting, June 6, officers of the New York Electrical Society were elected for the coming year as follows: Arthur L. Doremus, president, and G. H. Guy, secretary. It is reported that tentative plans for next season, beginning in October, are well under way.

Portland Sections, N. E. L. A. and A. I. E. E.—At the final joint meeting of the Portland Sections of the N. E. L. A. and A. I. E. E., Prof. O. F. Stafford spoke on the "Utilization of Waste Wood for Producing Distillation Products and High B.t.u. Gas." R. M. Boykin was elected chairman and W. D. Scott secretary.

A. I. E. E., Erie Section.—H. O. Westendorf, General Electric Company, delivered a lecture on the subject of "Reversible Control Rudders," illustrated by slides and motion pictures, at the section meeting of June 11. Officers for the coming year have been elected as follows: Chairman, Clayton P. Yoder, and secretary, Scott S. Hill. The subject for discussion on this evening was "The Part Electricity Is Serving in the World War."

Washington Electrical Contractors' Association.—At the quarterly meeting of the Washington electrical contractors, Seattle, June 13, it was decided to adopt the constitution and by-laws of the National Association of Electrical Contractors and Dealers. This will be formally accomplished in September. Representatives from Spokane, Ellensburg, Yakima, Bellingham, Everett and Tacoma were present in addition to a large number of Seattle members. The officers of the Washington association are V. S. McKenny, president, and H. D. Allison, secretary.

British Columbia Contractors and Dealers.—The second annual meeting of the British Columbia Association of Electrical Contractors and Dealers will be held at Victoria, Aug. 16 and 17, 1918. An invitation is extended to all electrical men, including managers, power company men, wholesalers, engineers, contractors, retailers, salesmen, etc. Officials in charge of the meeting say that this is going to be the "greatest get-together electrical meeting ever held in western Canada." The secretary's address is 406 Yorkshire Building, Vancouver, B. C.

Illuminating Engineering Society.—The election of the following officers of the council for the fiscal year 1918-1919 was confirmed by the council on June 13. They were elected to fill the offices made vacant by expiration of terms: President, George A. Hoadley; general secretary, Clarence L. Law. The chairmen and secretaries of the sections are respectively: New York Section—Chairman, F. M. Feiker; secretary, L. C. Porter. New England Section—Chairman, H. F. Wallace; secretary, Horace W. Jordan. Philadelphia Section—Chairman, James D. Lee, Jr.; secretary, H. B. Anderson. Chicago Section—Chairman, A. O. Dicker; secretary, Frederic A. DeLay.

National District Heating Association.—Central stations which may be contemplating district steam heating in view of the fact that the rising cost of fuel may make this method economical may be interested in the report of an executive committee meeting of the National District Heating Association held at Cedar Point, Ohio, July 8 and 9. The advancement committee of this association is studying the question of accounting in combination companies and is ascertaining a profitable basis of operation for heating companies. The station-operating committee is discussing plant economies. The research committee and the educational committee have been collecting data on heating-company costs. A new committee has been created by the executive committee to co-operate with the Bureau of Standards in establishing rules for all heating companies. It has been decided to hold a convention in 1919, but the time and place have not been arranged. George W. Martin, New York, and D. L. Gaskill, Greenville, Ohio, were re-elected president and secretary-treasurer respectively for the coming year.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Delegation of Legislative Power.—An ordinance of a municipality passed pursuant to law which confers upon an administrative board authority to grant to a corporation the right to operate a public utility owned by the municipality, upon the terms and conditions specified in the ordinance, and empowers such board to perform certain specified administrative duties which are necessary to the carrying out of the plan provided for in the ordinance, does not thereby delegate legislative power in violation of the constitution, the Supreme Court of Ohio held (119 N. E., 735).

Increasing Height of Water.—The mere fact that after construction of a new dam water backed further up river than when the old dam was in use furnishes no criterion from which to measure the probable increase in the height of the dam, in the absence of proof of the additional depth of the back water, the Supreme Court of Iowa held in Walters versus Anamosa & Oxford Junction Light & Power Company (167 N. W., 765). Where flashboards were customarily used on an old dam builders of the new dam were entitled to maintain it, or flashboards above it, to the height of the flashboards on the old dam, since such boards are considered part of the dam.

Increasing Rates Pending Commission's Action.—Under the Public Service Commission's law prohibiting an increase in gas rates except after thirty days' notice to the commission accompanied with a schedule of the proposed new rates, a gas company has a full right, upon giving thirty days' notice to the commission and due publication thereafter, to file a schedule of increased gas rates, the New York Supreme Court held (170 N. Y. S., 692). Where gas company filed notice and schedule of proposed increase in charges and complaint was made thereupon the company, having by stipulation assumed the burden of proof of reasonableness of rates in any proceeding to fix rates, could not charge the proposed rates after the specified effective date of the new schedule until it had convinced the commission that the proposed new rates were just and reasonable. Offer of gas company which had filed schedule of higher rates, but had not convinced commission of justice and reasonableness thereof, to rebate any amounts received in excess of the old rate, if the commission should rule against it, did not entitle it to charge the proposed new rate pending determination by the commission.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Domestic Rate at Springfield Increased.—The rate for domestic light service at Springfield, Ohio, has been increased to 8 cents per kilowatt-hour. The franchise ordinance was amended in such a manner as to place future changes in the hands of the City Commissioners. This ordinance expires on Sept. 1, 1919.

Ohio Public Utilities Commission Will Decide Jurisdiction in Columbus Light Rate Case.—July 17 was the date set by the Ohio Public Utilities Commission for a hearing as to its jurisdiction in the matter of appeals from rate ordinances passed by the Columbus City Council by the Columbus Railway, Power & Light Company, the Columbus Gas & Fuel Company and the Federal Gas & Fuel Company. The Supreme Court recently rendered a decision to the effect that the commission has no authority to hear appeals from ordinances enacted prior to the creation of that body. The Columbus Railway, Power & Light Company is appealing from the action of the Council in reducing its service rate from 7 cents to 5 cents.

California Companies Seek Rate Increase.—The Southern Sierras Power Company, which supplies electricity in Inyo, Kern, San Bernardino and Riverside Counties, and the Holton Power Company, which supplies electricity in Imperial County, have filed with the Railroad Commission a joint application for authority to raise their rates. The application says that the two companies were organized under the same management, and in order to encourage and assist in the rapid upbuilding and development of the territory served low rates were made from the beginning and many reductions have also been given. The application says that the policy pursued has quickly built up a large and growing business, and the system is rapidly acquiring a good load, but no return upon the investment has been realized. The increased cost of labor and material since the war commenced, including the more than doubling of the price of fuel oil, the companies say, makes the increases necessary. The companies say the excess operating costs for the year 1918, due to increase in prices of labor and material and the increased use of oil-generated power as compared with 1915, amount to much more than $200,000 and are daily increasing. Moreover, in order to finance the urgently needed additions to hydro facilities, costing nearly $1,100,000, it is necessary that the companies' finances be in a sound condition.

Rate Increase Asked in California.—The Mount Whitney Power & Electric Company, Visalia, has asked the California Railroad Commission for permission to increase its electric rates by charging and collecting a temporary surcharge of 10 per cent on all bills.

Intercity Traffic by Electric Truck.—A. Jackson Marshall, secretary Electric Vehicle Section, National Electric Light Association, writes that in the Eastern States—for instance, on the New York-Philadelphia turnpike—the unusually heavy traffic has so torn up the roadbeds that high speed is impracticable for heavily laden trucks. Thus the slower speed of the electric is often sufficient to cover distances with speed nearly as great as, if not equal to, that of the gas truck. The trip between these cities has been conveniently made by electric trucks in a day. By charging batteries at Philadelphia and recharging or changing at Trenton and Newark sufficient power will be available for the entire trip. A demonstration of this character was made some time ago with a Ward electric truck. Following is the record of a trip from Newark to Camden, the latter city being just across the river from Philadelphia: Left Newark 6:30 a. m., arrived at Trenton 11:50, in Trenton from 11:50 a. m. to 3:30 p. m., arrived at Camden 8 p. m.; total mileage for the day, 110; total time on road, 9 hours 50 minutes; total ampere-hours consumed, 137.

The Opportunity in Electrical Engineering.—A booklet on "Electrical Engineering as a Profession" has been issued recently by the University of Arizona, Tucson. G. M. Butler is dean of the College of Mines and Engineering of the university. It calls attention to "an unparalleled opportunity" and a duty as follows: Never has the work of engineers, no matter what branch they follow, been in such demand as it promises to be during the next generation. Every sign points to the rapid approach of the engineering millennium, if, indeed, it has not already arrived, and wise is the young man who equips himself now to reap the harvest that is imminent. . . . In Europe after the war whole cities must be rebuilt, hundreds of bridges replaced, a great merchant marine provided, many mines reopened and re-equipped, and an almost countless number of highways, railroads, water works, power plants, transmission lines and manufacturing establishments repaired and improved or diverted from martial to peaceful uses. . . . Never has such a gigantic task confronted any profession, and it cannot be doubted that the rewards will be commensurate with the needs and opportunities. Not only is it true that after the war there will immediately develop an unprecedented demand for engineers, but it is a well-recognized fact that this is an engineers' war, and it is absolutely essential that thousands of engineers be trained for our own army and those of our allies if we are to hasten the coming of a victorious peace."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Cutting Red Tape.—In deciding to authorize advances in rates in a recent case affecting different classes of utility service in combined companies the Illinois Public Utilities Commission says: "This is an emergency case. The government of the United States requests that all public utilities shall be maintained at the highest possible state of efficiency and yet conserve all the fuel and materials possible, consistent with the maintenance of their efficiency. The commission considers that for the purposes of this case it is not necessary to make a complete separation of the various units of property that constitute such a combined plant of a single company, and at this time the commission will consider, among other things, whether the increased rates proposed will yield a reasonable rate of return on the fair value of the combined property of such utility during the present emergency."

Canvass Among Consumers on Rate Increase.—In allowing an increase to rates of the East St. Louis & Interurban Water Company, the Illinois Public Utilities Commission took into consideration the results of a canvass among consumers. "The witness Riley," the report of the proceedings says, "testified that in the East St. Louis district some thirty-three consumers would be affected by the proposed rates, which would result in a total increase in revenue of $40,194, and in the Granite City district twenty-one accounts would be increased with a net increase of $15,910. Some attempt was made on the part of the applicant to obtain the consents of the consumers to be affected, and the results of this canvass of consumers are given by the witness. He states that in the East St. Louis district the company has signed consents from consumers who will pay 16 per cent of the revenue increase and that verbal consents were obtained from consumers representing 7 per cent of the proposed increase. There are accounts of stock yards and packing houses, which represent 50 per cent of the proposed increase, from which no consent could be obtained. The remaining 27 per cent of increase is to come from twelve railroad accounts, and the witness stated that he has not interviewed these consumers, owing to the relation existing between them and the federal government. In the Granite City district consent was secured from consumers who represent 87 per cent of the proposed increases, the total remaining 13 per cent representing railroad consumers who were not interviewed for the reason just given."

R. M. Little, formerly a trustee of the American Museum of Safety, has been elected director of the Museum, succeeding Arthur H. Young, resigned.

Harold M. McClure of Lewisburg, Pa., has been appointed a member of the Pennsylvania Public Service Commission, succeeding Robert K. Young, deceased.

M. L. Derge has resigned as manager of the Salina (Kan.) Light, Power & Gas Company, to become connected with the Trumbull Manufacturing Company at Warren, Ohio.

John B. Fisken, for many years head of the light and power system of the Washington Water Power Company, has been advanced to be chief engineer, succeeding Carl F. Uhden.

Arthur H. Young, who succeeded Dr. W. H. Tolman as director of the American Museum of Safety on Jan. 1, 1917, has resigned to take charge of the employees' relations department of the International Harvester Company. He will continue, however, as vice-president of the Museum.

T. F. Grover has resigned as vice-president and general manager of the Chicago, South Bend & Northern Indiana Railway Company and the Southern Michigan Railway Company. For the last year Mr. Grover has been operating these properties as well as the Terre Haute, Indianapolis & Eastern Railway Company. Prior to that time Mr. Grover was general manager of the Terre Haute company, in charge of both the electric lighting and railway business for more than ten years. In the last twenty-eight years he has been continuously connected with public utility businesses. He has been president of the Fond du Lac Street Railway & Light Company, the Fond du Lac Gas Company and the Fond du Lac & Oshkosh Railway Company and was vice-president and general manager of the Eastern Wisconsin Railway & Light Company. Mr. Grover expects to enjoy a vacation for a few months.

F. W. Ballard, former commissioner of light and heat for the city of Cleveland, Ohio, has been appointed power specialist attached to the office of the vice-president of the United States Shipping Board Emergency Fleet Corporation, in charge of construction. Mr. Ballard will be in charge of the interests of the corporation in the matter of power requirements for shipbuilding and associated industries. In these matters he will act as the personal representative of the vice-president. Before his appointment at the beginning of 1912 as constructing engineer for the Cleveland municipal plant he was manager of the engineering and construction department of the Sherwin-Williams Company. While in the employ of the city of Cleveland he frequently acted for other municipalities in an advisory capacity with regard to the local relations of cities with lighting companies. Late in 1915 he was retained by the city of Philadelphia to assist in the appraisal of the property of the Philadelphia Electric Company.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

Willard B. Felton, first engineer of the Arkansas Valley Railway Light & Power Company's Pueblo plant, has joined the United States Marines.

J. E. Davidson, vice-president and general manager of the Nebraska Power Company, Omaha, Neb., was re-elected president of the Nebraska Electric Association at its recent convention in Omaha. Mr. Davidson has always been very prominent in N. E. L. A. activities, having been secretary and treasurer of the Michigan Electric Association 1900-1901, president of the Vermont Electric Association 1909, chairman of the New England Section of the N. E. L. A. 1910-1911, president of the Northwest Electric Association 1911-1912, chairman of the Portland (Ore.) Section of the N. E. L. A. 1915-1916, and chairman of the executive committee of the Northwest Section of the N. E. L. A. 1915-1917. Mr. Davidson was formerly with the public utility companies at Port Huron, Mich., and since then has been president and manager of the Consolidated Lighting Company, Montpelier, Vt., and vice-president and general manager of the Pacific Power & Light Company, Portland, Ore.

J. E. DAVIDSON

Martin H. Clapp, formerly telegrapn superintendent of the Northern Pacific Railroad and president of the Association of Railroad Telegraph Superintendents, has been appointed manager of the telegraph section, division of operation of the United States Railroad Administration, with office in the Southern Railway Building, Washington, D. C. Mr. Clapp will have supervision over telegraph and telephone lines belonging to the railroads under federal control.

H. A. Joslin has been transferred from the position of manager of the Eugene office to be manager of the Dallas office of the Oregon Power Company, succeeding R. U. Steelquist.

W. E. Quillin, new-business manager of the Lorain County Electric Company, has been transferred by the Doherty Organization to the Salina (Kan.) Light, Power & Gas Company as manager. Mr. Quillin has been with the Doherty Organization since 1907, when he joined the new-business staff of the Lincoln (Neb.) Gas & Electric Light Company. He was a graduate in electrical engineering at Purdue University and secured his first position with the General Electric Company. Later he was with the Terre Haute, Indianapolis & Eastern Railway and then went to the Doherty Company.

Martin J. Insull, who as announced in the June 15 issue of the ELECTRICAL WORLD was elected second vice-president of the National Electric Light Association, is senior vice-president of the Middle West Utilities Company, Chicago. Mr. Insull was born in Reading, England, Sept. 18, 1869, and received his education in the City of London Middle Class School and at Cornell University, being graduated from the latter institution as mechanical engineer in 1893. Previous to leaving England in March, 1887, he spent two or three years in the telephone business. Upon arrival in the United States he entered the shops of the Edison Machine Works, Schenectady, N. Y. On leaving college he became a partner of Sargent & Lundy for five years, when he started the Martin J. Insull Company, manufacturers' agents. About a year later this business was turned over to the General Incandescent Arc Light Company of New York, and Mr. Insull then went to New York as vice-president and general manager of the company and the New York Electric Equipment Company. About three years later the General Incandescent Arc Light Company was acquired by the General Electric Company and the plant moved to Pittsfield. Mr. Insull continued with the company as president until its merger with the Stanley company, when he became second vice-president of the Stanley G. I. Manufacturing Company, having charge of its Middle West business, with offices in Chicago. In 1906 he resigned to go to New Albany, Ind., to take charge of the gas, electric lighting, water and railway properties in and around New Albany and Jeffersonville. In 1912 these properties among others were taken over by the Middle West Utilities Company, and Mr. Insull went to Chicago as senior vice-president of the company, which position he still retains.

Obituary

Charles A. Wilkinson, engineer of the power station of the electric department of the Flatbush Gas Company, Brooklyn, N. Y., died on June 24, at the age of fifty-three years.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

CLEANER MANUFACTURER CHARGED WITH PRICE FIXING

Federal Trade Commission Asserts that Trade Methods of United Electric Company Tend to Eliminate Competition

The United Electric Company, Canton, Ohio, licensed manufacturer under the Kenney patents of stationary ("Tuec") and power portable ("Ohio") vacuum cleaners, has been served by the Federal Trade Commission with a complaint charging illegal price fixing.

In its complaint the commission charges the company with violation of Section 5 of the Federal Trade Commission act as follows:

"That with the intent, purpose and effect of stifling and suppressing competition in the manufacture, marketing and selling and reselling of its vacuum cleaning machines in the course of such commerce, and as a means of securing the trade of dealers and obtaining their aid and co-operation in enlarging the sale of its price-maintained machines to the prejudice and injury of its competitors, and with the purpose of eliminating competition in the selling price among the various dealers in its machines and thereby depriving the dealers of their freedom to sell such machines at prices which in their judgment would be warranted by trade conditions, and for the purpose of preventing competitors of the parties who purchase its machines from entering into free competition in the sale and distribution of products manufactured by the United Electric Company, and for other purposes, the respondent, United Electric Company, has fixed and maintained specified standard prices at which the machines manufactured and sold by it shall be resold by the purchaser thereof and requires its purchasers to agree to maintain such standard selling prices; and for the purpose of maintaining said standard resale prices and of inducing and compelling its customers to maintain and keep such standard prices, and for the purpose of preventing those who do not maintain such standard prices from entering into free and regular unsuppressed and unhindered competition with purchasers who do maintain such standard prices, the respondent for more than six months last past has refused, and still is refusing, to sell its products to customers or dealers who will not agree to maintain such specified standard resale prices or who do not resell such products at the specified standard selling prices which are fixed and determined by the respondent, as aforesaid."

The company is also charged with violation of Section 3 of the Clayton act in that for more than the past two years it has, in the course of interstate commerce, "made contracts for sale and is now selling and making contracts for sale of large quantities of such vacuum cleaning machines for use, consumption and resale within the United States, and has fixed and is now fixing the price charged therefor or discount from or rebates upon such price, on condition, agreement or understanding that the purchaser thereof shall not use or deal in the goods, ware, merchandise, supplies or other commodities of competitors of respondent, and that the effect of such sales and contracts for sale, or such conditions, agreements or understandings, may be, and is, substantially to lessen competition or to tend to create a monopoly in the vacuum cleaning machine industry."

A hearing will be held at Washington on Aug. 20.

The Kenney patent license, under which the manufacturer operates, does not restrict the licensee in any way as to price.

The United Electric Company, in answer to a telegram from the ELECTRICAL WORLD asking for a statement regarding these charges, says:

"Will say the Federal Trade Commission has preferred charges against us for the alleged refusal to sell to dealers who cut retail prices.

"It is a fact we have a fixed wholesale price, but we have never refused to sell a dealer, provided his credit is good. Where these charges originated we do not know, but believe it was either in New York or in our Middle West territory. We believe there is nothing serious involved, for the reason that we are like all other manufacturers in appointing representatives for exclusive territories. The vacuum cleaner business has not developed to a point where the machines can be sold like sugar or any other staple article, although we believe the time is coming when they will be handled in like manner."

JOBBERS SUPPLYING MOTORS FOR SERVICE IN WAR WORK

Despite Scarcity of Larger Sizes, Manufacturers State Many Motors Can Be Supplied for Immediate Delivery for Local Stocks

In view of the intense activity of electric motor manufacturers on war work, it is doubtful if the vigorous efforts the more progressive jobbing houses are making to furnish such equipment for government and allied service are generally realized. For many months these jobbers have striven hard to maintain stocks of motors for immediate delivery, and gradually quite a substantial reserve has been accumulated in the moderate and smaller sizes, notably in New England. Stock sheets go out regularly to various addresses in the trade likely to be interested, but there is no doubt that there is room for a decided enlargement in mailing lists. There is still a good deal of lost motion, so to speak, in locating motors available for immediate shipment, and it is advisable for engineers, dealers and industrial buyers to get their names on these mailing lists without loss of time where there is any prospect of more motors being needed. Cases are not wanting where the buyer has gone so far as to be willing to pay more for second-hand equipment because of immediate delivery prospects than for new designs of apparatus.

To illustrate the service the jobber is performing in motor supply at the present time, one jobbing house alone, the New England Engineering Company of Waterbury, Conn., shipped from stock in a single week four 25-hp. motors to a munitions plant in New Jersey; two motors of the same rating to a munitions plant in Meriden, Conn., and a Waterbury munitions plant was furnished with about $9,000 in motors, all from stock. This one concern—and of course there are many other jobbers very active in war work—carries at present $25,000 in motors on its warehouse floor ready for immediate shipment, and a like amount on order, all of which are due for early delivery.

Such instances show that, despite admitted scarcities in motors of sizes from 25 hp. up, and especially over 100 hp., there are now to be found many motors ready for immediate service, singly or in groups, subject to shipment from the jobber's stockroom upon receipt of order. The manufacturers are accumulating some stocks of motors in the smaller ranges of size also, but the buyer who wants power at the earliest possible moment, even at some sacrifice in the efficiency of the rush installation, should not overlook the jobber.

THE WEEK
IN TRADE

ADVANCING costs of doing business are being discussed by jobbers who are evidently making an effort to obtain a better margin of profit. One example of yielding to this argument is afforded by an Eastern manufacturer who recently announced an additional 10 per cent discount on a large part of his line. A higher price has been tacked on to a number of other staple articles. It is also intimated that further price increases may be expected before long.

In the Pacific Northwest and on the coast building activities are pronounced in both industrial and residential work. This is also true of the Southwest, where a large volume of work is under way. The United States Railroad Administration has issued a circular giving in detail instructions aimed to speed the loading and unloading of cars.

Crops and their prospective yields for the season are a factor of importance to the trade. For the week ended July 6 winter wheat was regarded favorably and corn reported as coming on in fine shape. Good reports are made on spring wheat and alfalfa, but the oat crop is not so optimistically considered as in 1917.

Collections are reported to be improving and in some sections are excellent. It is said that jobbers' paper in the hands of manufacturers has increased 75 per cent over last year. Credits are firm.

NEW YORK

Jobbers are not criticising the current condition of business, which is on a high level as to volume; but they say they do object to the margin of profit, which, comparatively speaking, is about that of normal times. The distinction between volume, which has increased fully 100 per cent, and the value of transactions, which has not grown in proportion, is clearly discernible; and it becomes increasingly apparent with the tightening of war restrictions.

Prices continue to increase, although in quite a few instances the peak was supposed to have been reached some time ago.

Collections are reported from good to prompt, favorable comment being made on the manner in which jobbers and dealers are meeting the short credit terms enforced on different lines.

FUSES.—A steady growing demand for fuses, especially of the renewable types, is noted. On this line jobbers, as a rule, are buying in larger quantities.

SEAMLESS TUBING.—On July 8 the government commandeered all the brass and copper tubing used largely by the electrical trade and prohibited shipments unless under special order. The effect on the market and supply for commercial purposes is not yet apparent.

INDUSTRIAL MOTORS.—In the last two weeks, or possibly more, a falling off in the demand for industrial motors of from 25 hp. to 250 hp. rating has unaccountably taken place. Various reasons are given for this decline. It is generally ascribed, however, to the shifting of the business from the Eastern section to the West, where the government is making its necessary expansion in industrial activities in connection with the production of war materal. An increase in price is looked for. Deliveries are still far back —from three months to two years, according to size and type.

LAMPS.—The 10 per cent advance announced as effective July 1 on gem and miniature lamps also applies to carbons. These revised prices are held by a prominent producer as being inadequate to meet the increasing manufacturing costs. It is further believed in certain quarters that there will be a shortage of glass in the fall on account of insufficient and unsatisfactory basic material. Shortage of competent labor is also a factor. The government is buying enormous quantities of carbon lamps, but for what purpose is not known. One large manufacturer will accept no further orders for carbons this season. Stocks on standard sizes of metal-filament lamps are heavy and growing larger; in fact, it is said there never were so many lamps of these types at the factories as at the present time.

BELLS AND GONGS.—Trade is active, with sales increasing. Inside of a month one manufacturer, who said the revision was general, increased his prices from 10 to 25 per cent.

FANS.—Unseasonable weather has interfered with the anticipated rapid movement of fans. Four-blade fans of 12 in. and 16 in. are scarce. There is quite a heavy reserve stock of 12-in. six-blade fans in the hands of one manufacturer, which, it is expected, will be quickly taken up with the first warm spell.

WASHING MACHINES.—On July 15 an Eastern distributer advanced prices on all types of electric washers from 7 to 10 per cent. Two Western manufacturers have also sent out advanced prices on their products.

HEATING APPLIANCES.—Advances in the heating device license schedule effective Aug. 10 are made all along the line. Regular 6-lb. irons go from $5 to $6 and toasters likewise. Grills, toaster and disk stoves, rectangular heating plates, percolators and other hollow ware, immersion heaters, air heaters, soldering irons, flatirons and a number of other devices are included in the advance. Furthermore, central stations and holding companies purchasing to the extent of a certain fixed amount annually may receive a better discount for purchases made after Aug. 10.

COLLECTIONS AND CREDITS.—Generally speaking, credits are very satisfactory. One distributing concern having large manufacturing interests stated that its usual practice was to extend a credit of sixty days to jobbers, but prompt settlement was required. The customers of this house understood the policy, and it is rarely called upon to eliminate a delinquent debtor. The feasibility of the thirty-day collection period is questioned by some jobbers, who say bills are seldom met under forty, fifty and even sixty days.

SCHEDULE MATERIAL.—Harvey Hubbell, Inc., Bridgeport, Conn., announces as of July 10 a 10 per cent discount additional on the following items: Reflectors, shade holders (contractile collar type), lamp guards, hull switches, toggle snap switches, incandescent attachments for oil lamps, bead chain (in bulk), pull socket attachments, insulating and splicing links, candelabra fittings, direct threading shade holders, flush plates, toggle switches, automobile and battery circuits.

CABLE AND COVERED WIRE.—One manufacturer, operating on a rubber-covered base of 31 cents a pound, which possibly may be raised to 34 cents, announced an increase of 3 cents a pound, effective July 5, on all wire and cable. The increase in the cost of copper, cotton, tin, braid, labor, paint in compound and rubber has occasioned the revision. The same company on June 28 advanced its price on braid from $2.50 to $5 per 1000 ft. on No. 14. The increase involved is about 40 to 100 per cent for braids from No. 14 up. This concern has 600,000 ft. of No. 14 in stock, and jobbers in this territory also have heavy stocks, but neither the firm nor the jobbers have enough to fill orders 100 per cent. About 65 per cent is the rule on commercial requirements. Another important manufacturer with a 37-cent base increased his covered wire and cable prices 2½ cents a pound July 6.

STORAGE BATTERIES.—Manufacturers of standard storage batteries have been increasing their prices. On or about July 1 an Eastern manufacturer of prominence advanced his list 10 to 15 per cent on all types, with the exception of automobile batteries, which went up 10 per cent, owing to the increased cost of labor and rubber, lead and other material. Deliveries are dilatory. This company is finding it very difficult to obtain material to fill commercial orders.

CHICAGO

The past week has been rather quiet in Chicago jobbing circles. Announcement has been made by government officials of a large new camp for the training of 53,000 men to be constructed at West Point, near Louisville, Ky. One of the biggest building permits of the year issued in Minneapolis has been taken out by the Minneapolis General Electric Company, covering an extension to the power house to be erected at a cost of approximately $485,000. The extension to the plant will double the company's present steam generating capacity.

LAMPS.—Stocks of jobbers continue to improve. "Gem" lamps are up 10 per cent to a 24-cent base. This is the second 2-cent increase since the first of the year. Automobile and flashlight lamps have also increased about 10 per cent. The sales of carbon lamps are reported by some jobbers to be off 15 per cent to 20 per cent. It is expected in some quarters that this falling off will gradually increase as the demands for fuel-saving become more urgent.

FANS.—While fan stocks in Chicago are still intact no one is despairing. It is remembered that last year the real fan season was in August.

COPPER WIRE.—Copper wire is quoted as follows: Rubber-covered at 34 cents, weatherproof at 32 cents and lamp cord at 33 cents.

SOOT BLOWERS.—One manufacturer of soot blowers is having difficulty with production owing to difficulty in getting chain. Blowers are being shipped to customers with instructions to secure chain locally.

LIGHT FIXTURES.—Thirty-five thousand dollars' worth of business has been turned over by one manufacturer of commercial lighting fixtures to his competitors because of his inability to handle the volume at hand.

TRANSFORMERS.—Transformer manufacturers are doing a large amount of government work, but are now in a position to use some domestic business and are looking for orders.

METERS.—The domestic meter business is reported to be very poor, but the export trade continues to keep some factories supplied.

BOSTON

The demands of war work continue to drive the wheels of industry at top speed, and trade goes on with no sign of the customary summer recession. The increasing scarcity of trained men is becoming a serious factor in the dispatch of business. More and more women are coming into the field, but the factories and stores, jobbing houses and utilities are still far from the anticipated maximum of female assistance which must be realized if the war continues a year or two more. Some improvement is to be seen in deliveries involving short hauls to the buyer, but the longer hauls are still handicapped by railroad congestion and shortage of marine carriers.

The first destroyer to be built at the Squantum plant was scheduled for launching early this week. The merchant marine grows apace, and so does the market for wiring and lamps for service on shipboard. Unrest is evident in the labor field. The central stations weathered the recent strike of linemen in eastern Massachusetts without interruption of service and are forcing their power equipment for war work all through this section. About 10 per cent of the employees of the Lynn (Mass.) factories of the General Electric Company attended a strike meeting at the end of last week, and it was expected that an attempt would be made to interrupt production in this way early this week; but at last accounts the company had the situation well in hand. Jobbers' stocks are large in most lines, and at last some signs of life appear in the sale of fans.

COLLECTIONS AND CREDITS.—Collections are reported to be on a firm basis at this time. Some anxiety is felt regarding the extension of taxation in the war revenue bill to commodities of higher quality, but it is expected that readjustment will be effected in a patriotic spirit and the fundamental soundness of the electrical trade is undisputed. Just at present collections are unusually prompt in the Connecticut valley. Munitions work is the basis of so much activity to-day that there is no ground for pessimism.

CONDUIT.—Long-sighted buyers are reaping the reward of their provision in the arrival of occasional carload lots of pipe, but the general supply is uneven in flow and in distribution. Prices show little change. A fair demand is now noted for even the smaller sizes of pipe, probably for use on shipboard. Some jobbers are still quite well stocked with conduit, while others are buying from hand to mouth and are worried about the future supply.

FIXTURES.—A fair trade is now being enjoyed in fixtures, despite the reduction of new residence construction to the minimum. Daylight saving has had no appreciable effect on the trade, according to one of the largest houses. Of course, stocks are unusually large, and prices are at times shaded to stimulate buying, but many summer residences of the best class are being refitted. High wages are also leading the laboring class to buy fixtures on a hitherto unprecedented scale. It would perhaps be untrue to characterize the fixture trade as undergoing a boom, but it is far from moribund, and the outlook for the fall is much better than it was feared would be the case.

STORAGE BATTERIES.—The demand for automobile ignition and lighting batteries continues heavy. A representative dealer is maintaining excellent stocks by means of boat shipments from Long Island. Prices are firm, and although a large amount of rebuilding of cells is a feature of the trade, the sale of new equipments continues at the previous high rates of buying.

APPLIANCES.—Warmer weather is at last causing the sale of fans on a somewhat larger scale, but the chances are that 1918 will go down into electrical trade history as one of the poorest fan years ever experienced. Here and there dealers have had exceptionally good sales, but chiefly in cases where the government was an early purchaser, as at the Springfield Armory. This year there have been a good many table appliance sales for wedding gifts, and some of the high-class jewelers and silversmiths are retailing grills, percolators and toasters to good advantage. Sewing-machine motors are moving well, and flatirons are always in good demand.

MOTORS.—Little change is to be seen compared with last week. If anything, stocks are improving from week to week, but the demand for particular sizes is spasmodic, and the larger units (above 75 hp.) are still difficult to obtain at once. Jobbers, however, are giving special attention to the collection of varied sizes for immediate delivery.

ATLANTA

There is very little change to be noted this week. Standard materials and staples are moving steadily. Commercial lines are being further subordinated to government callings, and the bulk of transactions appear to be along so-called essential lines. Heavy investments are being made in Southern industrial enterprises, especially for government account. These include a new powder plant at Louisville, Ky., dry docks at Norfolk, Va., and a steel-fabricating plant at Birmingham, Ala. The Mandeville Mills, Carrollton, Ga., and the Okeh Manufacturing Company, Greenville, S. C., will erect new yarn mills. A more liberal view is being taken regarding devices at military camps, and it is expected that appliances will move more freely to these quarters. An authority states that the government has placed an order for 15,000 fans.

There is a large volume of work under way and well distributed, and present indications point to continued activity for some time to come. A number of Southeastern concerns have done practically nothing but government work for the past year, which has thrown the industrial work to others now not actively engaged on government jobs. Workmen are still in big demand, and the supply grows less each day as the draft makes itself felt.

DRY BATTERIES.—This week shows a creditable increase in the demand for dry cells. The market for these has been sluggish during the past few months. Stocks are away below normal, and shipments are poor.

CREDITS AND COLLECTIONS.—Manufacturers' collections are showing up fairly well so far this month, being about the same as June, which was slightly off compared with May. Collections from municipalities are lagging and away off in a number of cases. Retailers', contractors' and jobbers' collections are good and compare favorably with the past few months. On the whole, the amount of jobbers' paper held by the manufacturers has increased materially of late and may be estimated as 75 per cent greater than in the same period a year ago. This is accounted for by the fact that the jobbers are buying in larger quantities in order to secure shipments and at correspondingly higher values. Then, too, government takings being still heavy, the jobber has to wait for these accounts to be vouchered through the proper departments. Numerous requests for time extensions from central stations are being received by the manufacturers, and while the utilities are experiencing great difficulty in financing it is not expected that the call for note payments will be other than temporary.

CABLE.—Although the demand for heavy sizes has lessened of late, there is a potential market for all sizes as soon as less uncertainty is felt. The Standard Underground Cable Company secured an order for approximately $40,000 worth of assorted lead-covered cable this week from the Georgia Railway & Power Company.

SAN FRANCISCO

There has not been any material change in general business conditions. Collections remain good. The orders received cover largely commodities required for the maintenance and completion of industrial installations.

The Moore Shipbuilding Company in Oakland has been awarded a contract to build twenty-two freighters, which will involve an expenditure of $16,000,000.

FIXTURES.—The decrease in building construction has had a proportionate effect with the electrical fixture manufacturer, business in this line being somewhat quiet at present, although there has been a little activity in the repair and alteration work.

LAMPS.—Supplies are still accumulating stocks of the regular large types as protection against an anticipated heavy fall demand. Good stocks are available of flashlight lamps, but only scattered stocks can be found of automobile lamps, and even such stock is not complete, there being a ready sale for the headlight bulbs.

FLOODLAMPS.—There seems to be a general slowing up on the demand. Unquestionably inquiries for prospective installations will commence with the approaching shorter days.

WASHING MACHINES.—There is no supply to speak of on the large family size. The demand is good, and no immediate shipments can be expected from the factories. Stocks of the smaller-sized washers are rapidly coming down to a minimum.

ELECTRIC IRONS.—This is another article that is selling well, and it is felt the latest price advance will not cause a falling off in the volume of sales. In fact, unless overdue shipments are received shortly, the present supply will not meet the demand.

SEATTLE

Business conditions continue satisfactory, with general confidence in the future denoted by considerable advance buying. The volume is predicated on the war foundation and government buying program expanding. Collections continue on the same satisfactory level that has characterized the last few months. Higher freight rates are tending to advance prices along some lines. The increasing prices are also superinduced by the commandeering of steel by the government. The increase in prices over last week is not marked excepting on wire, which made a slight advance. Jobbers report a satisfactory increase in sales, particularly on household devices. Washing machines especially show a pleasing advance. Inquiries for power apparatus for lumber mills to be electrified are scattering. Few new projects developed during the week. Dealers are buying everything they can get in an effort to replenish depleted stocks. Great difficulty is encountered in getting certain classes of materials on account of heavy government demands, which have priority.

No improvement is noted or in prospect on the freight situation, and statements heretofore made regarding the labor situation still hold true. The shortage of labor is daily becoming more acute. Prospects for stupendous increases in the volume of trade in the Northwest with the Orient, especially in the event of America going to Russia's aid, are being generally discussed.

Working drawings are completed for houses to be erected by the bureau of housing at the Puget Sound Navy Yard at Bremerton. The plans provide for a large hotel, an apartment house and 350 bungalows.

CONDUIT.—The situation shows no improvement.

LAMPS.—Smaller sizes are coming through well and stocks are in fair condition. The larger sizes are very hard to obtain. Automobile lamps are very scarce, and the demand is brisk and increasing. The industrial demands are quite large.

METAL MARKET SITUATION

Commercial Consumers of Copper in Quandary Over New Price Contracts for Third Quarter

It appears that the unexpected advance in the price of copper from 23.50 cents a pound in carload lots or more to 26 cents is placing some manufacturing consumers in an embarrassing position. Considering the government's prior order fixing Aug. 15 as the limitation of the old price, they accepted orders for finished merchandise and material at the lower figure. Therefore when the cost of the metal went suddenly to 26 cents on July 2 the manufacturers were in a predicament. At a meeting of the large brass and wire manufacturers held July 10 this question was thoroughly gone over, and a committee was appointed to confer with the copper producers and the War Industries Board for a discussion and settlement of the matter. It is understood that all contracts drawn for third quarter shipment at 23.50 cents and 24.75 cents (jobbers' price) will be delivered according to agreement. There is a possibility of copper being placed on an official basis of from 28 cents to 30 cents a pound on Aug. 15.

Lead continues very scarce and such quantities as are being offered are selling at a premium. The present quotation of 8.05 cents a pound at New York will probably remain unchanged, although one wire and cable manufacturer has now established a 9-cent base for lead and another one a 10-cent base. The latter has withdrawn entirely from the tin and lead market. Brass has advanced 2 cents a pound. Tin is still high and scarce. Slight variations of price occur in old metals.

NEW YORK METAL MARKET PRICES

	July 8	July 15
Copper:	£ s d	£ s d
London, standard spot	110 0 0	No 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26 00	Govt. price 26.00
Casting	Govt. price 26.00	Govt. price 26.00
Wire base	30 00	29.25
Lead, trust price	8 05	8 05
Antimony	13 00 to 13 37½	13 12½ to 13 25
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	Govt. price	Govt. price
Spelter, spot	8.80 to 8.90	8 80 to 8.90
Tin, Chinese*	$1.00	$1.00
Aluminum, 98 to 99 per cent	Govt. price †33.00	Govt. price †33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	23 00 to 23.50	23 50 to 24 00
Brass, heavy	14 00 to 14 50	14 00 to 14 50
Brass, light	12 00 to 12.25	12.00 to 12.25
Lead, heavy	7 12½ to 7.50	7.12½ to 7.50
Zinc, old scrap	6 50 to 6 75	6.50 to 6 75

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* No Straits offering. † In 50-ton lots or more; carload, 33.10 cents per lb. 1-ton to 14-ton lots, 33.20 cents per lb.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List Per 1000 ft.
No. 14 solid	$61 00
No. 12 solid	71.00
No. 10 solid	90 00
No. 8 solid	106 00
No. 6 solid	145.00
No. 10 stranded	95 00
No. 8 stranded	115 00
No. 6 stranded	160.00
No. 4 stranded	205 00
No. 2 stranded	266.00
No. 1 stranded	315 00

Twin-Conductor

No. 14 solid	104 00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370 00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10% to 57 25
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10% to 66.75

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10% to $97.75
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10% to 126.80

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20% to list
Coil to 1000 ft	5% to 15%
	No. 12 Solid
Less than coil	+20% to list
Coil to 1000 ft.	5% to 15%

Twin-Conductor

	No. 14 Solid
Less than coil	$80 00 to 5%
Coil to 1000 ft	75 00 to 5%
	No. 12 Solid
Less than coil	+20% to +5%
Coil to 1000 ft	5%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1 5 std. pkg	$24 00 to 12%
1,5 to std. pkg	19 80 to 20%
Std. pkg	18 75 to 44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to 12%
1 5 to std. pkg	List to 20%
Std pkg	25% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 40	$0.40
12 to 50	.35 to $0 36	35 to $0 36
50 to barrel	31 to 32	32 to 33
Barrel lots	28 to 289	29 to 299

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	35
50 to barrel	.3190 to $0 3220	3290 to $0 3320
Barrel lots	2890 to 2920	2990 to 3020

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5 00
3/8	250	7 50
1/2	100	10 00
3/4	50	13 00
1	50	21 00
1¼	50	26 00
1½	25–50	35 00
2	25–50	45 00
2½	25 50	52 00

NET PER 100 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp.	$75 00	$63 75 to 69.75
3/8-in. d. stp.	75 00 to $82.50	72.00 to 75 00
1/2-in. s. stp.	100 00	85 00 to 93 00
1/2-in. d. stp.	100 00 to 110.00	96.00 to 100 00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft
3/8-in. single strip.	$75 00	$63.75 to $64 25
3/8-in. double strip	78 75	71.25
1/2-in. single strip.	100 00	85 00
1/2-in. double strip.	105 00	93 00 to 95 00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In	List per Foot
7/32	$0 05½	1	$0 25
1/4	06	1¼	33
3/8	09	1½	40
1/2	12	1¾	47
5/8	15	2	55
3/4	18	2¼	65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$25 00–$55 00	$24 00–$24 45	$21 50–$23.00
1/4-in.—	$30 00 $60 00	$27 00 $28 00	$23 50–$26 00

NET PER 1000 FT—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$60 00	$30 00	$26.50
1/4-in.—	$65 00	$32 50	$29 00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 39

Size, In.	Conduit, List per Foot
1/4	$0 08½
3/8	.08½
1/2	08½
3/4	11½
1	17
1¼	23
1½	27½
2	37½
2½	58½
3	76¾

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
1/4	$0 05	$0 19
3/8	06	19
1/2	07	19
3/4	10	.25
1	13	37
1¼	17	45
1½	21	.50
2	28	1.10
2½	40	1 80
3	60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in
Less than 2500 lb.	12%	14%
2500 to 5000 lb	15%	17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ in.	¾ to 3 in
Less than 2500 lb.	1 5% to 6 8%	4 5% to 10 7%
2500-5000 lb.	3 5% to 8 8%	6 5% to 12.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5 00 to $6.00
Discount	30%

CHICAGO

List price	$5 00 to $6 00
Discount	30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp	100	35
65-amp. to 100-amp	50	90
110-amp. to 200-amp	25	2.00
225-amp. to 400-amp	25	3.60
450-amp. to 600-amp	10	5 50
600-Volt		
3-amp. to 30-amp	100	$0.40
35-amp. to 60-amp	100	60
65-amp. to 100-amp	50	1 50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5 50
450-amp. to 600-amp	10	8 00

DISCOUNT—NEW YORK

Less than 1 5 std pkg	30%
1/5 to std. pkg	41% to 50%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$5 00 to $7 00
1/5 to std. pkg	4 50 to 4 75

Standard packages, 500. List, each $0.07

CHICAGO

	Per 100 Net
Less than 1 5 std. pkg	$7 00
1/5 to std. pkg	5 75

Standard packages, 500 List, each, $0 07

LAMPS, MAZDA

105 to 125 Volts

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0 30
60-watt—B	100	35
100-watt—B	24	70
75-watt—C	50	70
100-watt—C	24	1 10
200-watt—C	24	2 20
300-watt—C	24	3 25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25	50	53
25-watt—G 25	50	55
40-watt—G 25	50	55
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30	24	77
Round Bulbs, 4⅜-in., Frosted:		
100-watt—G 35	24	1 10

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg.	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$29 13 to $35 90
Coil to 1000 ft	2o 22 to 26.95

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$29.00 to $30.00
Coil to 1000 ft	21.50 to 25 00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100.	$24 00

CHICAGO

Net per 100	$21 75 to $30 00

OUTLET BOXES

Nos.	List, Per 100
101—A, A1½, 4 S.C., 6200, 320	$30 00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S	30 00
103—C.A., 9, 4R, B 1½	25 00
106—F.A., 7, C.S., 1½, 3 R	20 00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list.	25% to 33%	20% to 27%
$10.00 to $50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50 00 list.	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$15 80 to $38.00
1/5 to std. pkg	14 80 to 19 00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$15 80
1/5 to std. pkg	14.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500 5½ N C	Std. Pkg. 4000 Solid Nail-it N C
Less than 1/5 std. pkg	$11 85 to $20 00	$30 75
1/5 to std. pkg	11 10 to 15 60	24 00

CHICAGO

Per 1000 Net	Std. Pkg. 3500 5½ N C	Std. Pkg. 4000 Solid Nail-it N C
Less than 1/5 std. pkg.	$9 48 to 11 85	$20 75 to $30 7
1/5 to std. pkg	8 88 to 11 10	24 20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
¼-in. cap key and push socket	500	$0 33
¼-in. cap keyless socket	500	30
¼-in. cap pull socket	250	60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+ 10% to 10%
1/5 to std. pkg	5% to 8%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List to 10%
1/5 std. pkg	16⅔% to 20%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0 80
60-amp. S. P. S. T	1 20
100-amp. S. P. S. T	2 25
200-amp. S. P. S. T	3 48
300-amp. S. P. S. T	5 34
30-amp. D. P. S. T	1 20
60-amp. D. P. S. T	1 78
100-amp. D. P. S. T	3 38
200-amp. D. P. S. T	5 20
300-amp. D. P. S. T	8 00
30-amp. 3 P. S. T	1 80
60-amp. 3 P. S. T	2 68
100 amp. 3 P. S. T	5 08
200-amp. 3 P. S. T	7 80
300-amp. 3 P. S. T	12 00
Low Grade.	
30-amp. S. P. S. T	0 42
60-amp. S. P. S. T	74
100-amp. S. P. S. T	1 50
200-amp. S. P. S. T	2 70
30-amp. D. P. S. T	68
60-amp. D. P. S. T	1 22
100-amp. D. P. S. T	2 50
200-amp. D. P. S. T	4 50
30-amp. 3 P. S. T	1.02
60-amp. 3 P. S. T	1.84
100-amp. 3 P. S. T	3 76
200-amp. 3 P. S. T	6 76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+5%
$10 to $25 list	11%
$25 to $50 list	14%

	Low Grade
Less than $10 list	5%
$10 to $25 list	16%
$15 to $50 list	24%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 5%
$10 to $25 list	+10% to 11%
$25 to $50 list	+14% to 14%

	Low Grade
Less than $10 list	5%
$10 to $25 list	16%
$25 to $50 list	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole	250	$0 28
5-amp. single-pole, ind	250	32
10-amp. single-pole	100	48
10-amp. single pole, ind	100	54
5-amp. three-point	100	54
10-amp. three-point	50	76
10-amp., 250-volt, D. P	100	66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0 45
10-amp. three-way	50	70
10-amp. double-pole	50	70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+ 10%
1/5 to std. pkg	5% to 8%
Std. pkg	23% to 25%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to 10%
1/5 to std. pkg	list to 20%
Std. pkg	25% to 28%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar	List Each
No. 155	$0 34
No. 160	60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2 00 list	List to 40%	5% to 30%
$2 00 to $10.00 list	10% to 50%	5% to 40%
$10 00 to $50 00 list	20% to 64%	10% to 52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2 00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6 00
Discount	30%

CHICAGO

List price	$5 50 to $6 00
Discount	30%

WIRE ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools.	$0 4340 to $0 4625
No. 18, full spools	3840 to 4425

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0 65 to $0 69
No. 18, full spools	55 to 575

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15 00–$20 00	$12 00–$15 00	$10 50–$11 25
12	23 22– 27 10	21 29– 23 20	17 05– 17 42
10	29 70– 37 80	27 00– 32 40	23.75– 24 80
8	41 91– 53.35	38 10– 45.70	32 58– 33 55
6	60 33– 84 40	54 27– 72 35	51 56– 53 05

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$19 00–$21 00	$14 00–$16.00	$12 50–$13 25
12	27 53– 28.70	23 86– 28 70	22 02– 24 50
10	33 02– 40 10	30 48– 40 10	27 44– 34 23
8	46 09– 56 50	42 54– 48 23	38.99– 41 34
6	61 30– 91 18	61 76– 77 84	52 18– 66 72

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4 0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$35 10 to $38 40
25 to 50 lb	35.10 to 36.40
50 to 100 lb	32 40 to 34 10

CHICAGO

	Per 100 Lb. Net
Less than 25 lb	$37.00 to $39.72
25 to 50 lb	36 00 to 38.72
50 to 100 lb	35 00 to 37 72

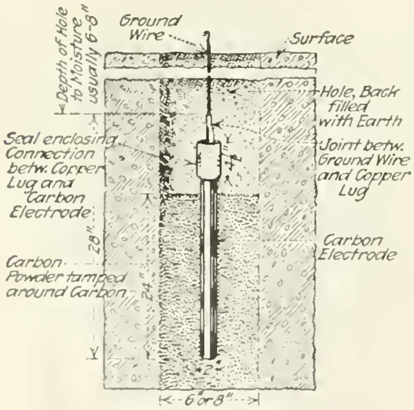
NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Carbon Ground Cones

Carbon earth-ground cones are being manufactured by the Burn-Boston Battery & Manufacturing Company, 134 State Street, Boston, which, the manufacturers claim, will assure continuous service during lightning and surging in so far as the earth grounds are concerned. These cones are made entirely of carbon and have no metal in contact with the earth, thus eliminating the corrosion that usually occurs with copper grounds and the rusting likely with iron grounds. Carbon grounds are neutral with the earth and, according to the makers, will last indefinitely. They may be placed in any soil or may be made into a salted ground without deterioration. Being non-metallic, they have no induction and therefore do not throttle the discharge. In metals and their alloys there is an increase of resistance with temperature rise, whereas in the carbon earth grounds this disadvantage is not apparent.

It is claimed that under existing conditions iron-pipe grounds cost more installed than the first cost of the Burn-Boston ground. Copper grounds cost very much more per unit of rating. Carbon has the same contact resistance per unit surface as bright copper when first placed in the ground. The ground is also made in what is known as type LR, which is used to obtain a ground of less than 25 ohms resistance as required for low-tension 220-volt transformer secondaries.

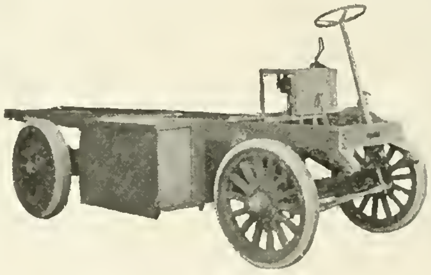

Depth of Hole to Moisture usually 6-8"
Ground Wire
Surface
Hole, Back filled with Earth
Seal enclosing Connection betw. Copper Lug and Carbon Electrode
Joint betw. Ground Wire and Copper Lug
28"
Carbon Electrode
Carbon Powder tamped around Carbon
24"
2"
6" or 8"

GROUND CONNECTION THAT WILL NOT THROTTLE DISCHARGE

This type LR carbon earth ground is installed in the ordinary post hole. The construction consists of a solid electrode rod of great mechanical strength and not liable to breakage. This solid carbon rod electrode is impervious to water. The dimensions are 2 in. in diameter by 24 in. long (5.08 cm. by 1.8 m.). At the top end is a sealed-in copper connector with lug exposed for soldering to the usual No. 4 B. & S. line wire. The other end is buried in powdered carbon. This carbon rod is dropped into a post hole and the post hole is filled with Burn-Boston carbon powder, tamped around the solid electrode. A few pails of water are thrown on top of the carbon powder for the initial moistening of the carbon, or the powder may be moistened into a tamping consistency by mixing with water before filling the hole. The rest of the hole is filled with the removed earth. The carbon powder, being very hygroscopic, will remain moist.

All-Steel Electric Truck

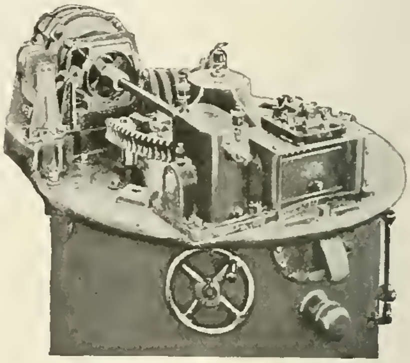
An electric truck made all of steel excepting the wheels and which may be used instead of a gas-driven truck is being placed upon the market by the Ward Motor Vehicle Company of Mount Vernon, N. Y. The feature of this truck is that it is driven by a motor directly connected to the main shaft. The wheels are driven by the utilization of a Spicer universal drive through a worm gear on the Sheldon axle. It is equipped with Edison batteries hung on the side of the shaft as shown in the accompanying illustration. The motor and electric controller are made by the General Electric Company, Schenectady, N. Y.



MOTOR DIRECTLY CONNECTED TO MAIN TRUCK SHAFT

Large Polyphase Induction Regulators

The mammoth polyphase induction regulator which has just been completed for the Hartford (Conn.) Electric Light & Power Company is rated at 1000 kva. and provides 10 per cent regulation on a 10,000-kva., 11,000-volt, three-phase, 526-amp. transmission line. The regulator, which is manufactured by the General Electric Company of Schenectady, N. Y., is an oil-immersed, forced oil-cooled type which is said to give good service. In this method of cooling the cold air is forced in at the bottom of the regulator to the lower portion of the windings, which extend below the core and which are especially spaced so as to give free passage of the oil. As the oil passes upward it is forced through three separate and distinct passages, each passage being of such size as to allow a flow of oil in proportion to the heat generated. One oil passage is inside the rotor iron along the rotor, one outside the stator iron between the regulator and the tank, and the third through the gap between the shunt and series windings. After passing through the upper portion of the windings, which are spaced in the same manner as the lower portion, the oil overflows into a channel along the inside of the tank. In order that the flow in the channel be uniform from all directions a special distributor is provided. From the channel the oil is conducted by gravity through a series of cooling coils to a storage tank and from the storage tank is again forced through the regulator. The strand insulation of the shunt winding is exceptionally strong and additional insulation is used between layers. The series coils are of one turn per layer, and the turns are insulated from each other with insulation which will withstand a potential greater than the full-line voltage.



TOP VIEW OF THREE-PHASE OIL-IMMERSED FORCED 1000-KVA. REGULATOR

In order to allow a free passage of the oil through the coil insulation into the coil, each coil is provided with a vent at the bottom. In addition, the complete machine is given a vacuum oil treatment to remove any air pockets that may exist in the coils. The parts of the coils which extend above and below the core are provided with mechanical reinforcing to withstand the strains due to short circuits. The shunt coils are banded to an iron support, and around the series coils is placed a heavy iron ring, properly insulated, to which each coil is corded securely. The regulator is motor-operated and will travel from one limit to the other limit in forty seconds. The dimensions of the regulator are 4 ft. 6 in. (1.4 m.) at the base with a height over all of 10 ft. 3½ in. (3.1 m.), and the weight is approximately 23,000 lb. (10,432 kg.).

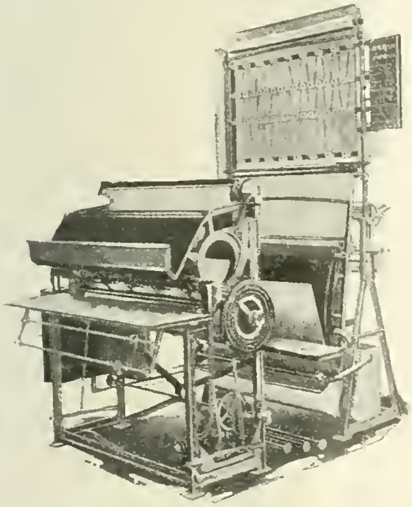
Lock-Socket Reflector

In order to insure continuous service for lamps illuminating signboards the A. & W. Electric Sign Company, Cleveland, Ohio, has placed upon the market a lock-socket reflector which will prevent the lamps from being stolen. This device, shown herewith, in addition to eliminating loss of lamps by theft, also prevents them from getting loose in sockets. The lock socket is made by Pass & Seymour, Inc., Solvay, N. Y.

PREVENTS LAMPS FROM GETTING LOOSE IN SOCKET

Electrical Blue-Printing Machine

The maxim "Do it electrically" is worked to the limit in the blue-printing machine marketed by the C. F. Pease Company, 213 Institute Place, Chicago. As shown in the illustration, the driving motor is controlled by a rheostat mounted conveniently on the side of the machine. The manufacturers state that blue-print speeds of 4 in. (10 cm.) to 6 ft. (1.8 m.) per minute are obtained when the machine is driven by a 220-volt alternating-current motor. Five arc lamps are used for printing and are independently controlled. The drying unit, shown above the washer, requires about 50 amp. at 230 volts when the printer is running at maximum speed. It consists of an electric heater furnished with a series of switches giving eleven gradations of heat.

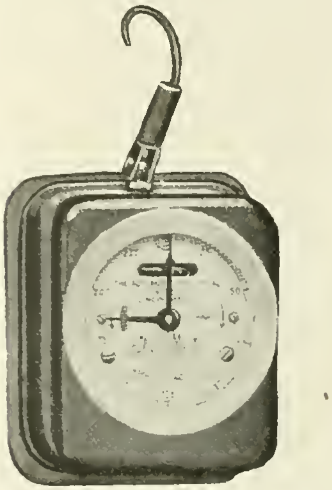


BLUE-PRINTS ARE DRIVEN, PRINTED, WASHED AND DRIED ELECTRICALLY

When the machine is equipped for direct current it is possible to place the resistance coils of the lamps in the electric heater, thereby decreasing by about one-third the amount of energy consumed in drying.

Meter That Indicates State of Battery Charge

An electric ampere-hour meter known as a "chargometer," which is designed for use on trucks or storage-battery cars to enable the operator to see at a glance the extent to which the battery has been discharged, is shown in the illustration reproduced herewith. The meter is calibrated in ampere-hours indicating zero when the battery is fully charged. The indicator moves in a clockwise direction as the battery is discharged.



CHARGING CIRCUIT IS OPENED WHEN POINTER REACHES ZERO

In order to charge the battery a flexible lead and clip connected to a charging set are joined at the top of the chargometer, as shown, and as the charging operation continues the pointer moves back toward zero.

The "chargometer," together with various panels to be used at the charging stations, is made by the Automatic Electric Devices Company, 120 Opera Place, Cincinnati, Ohio.

Metal Strips to Support Switch Boxes

To eliminate the old trouble-making and time-losing way of supporting switch boxes on wooden strips a type of metal-supporting strip has been developed. It is being sold by the Ohio Distributing Company of Chicago. The strips are made of sheet metal and are ⅝ in. (1.6 cm.) wide and 18 in. (45 cm.) long. The following advantages are claimed for these strips: They are provided with lath holders, they have indents which catch the ears of the switch box and prevent it from moving along the strip, they can be cut with pliers, they allow the switch box to be installed without reversing the ears, and they save time in mounting switch boxes.

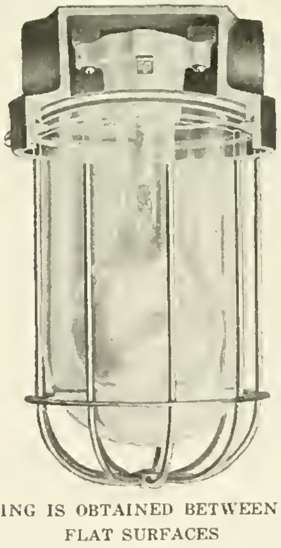
Vapor-Proof Fitting

Heretofore it has been difficult to obtain a reliable seal in vapor-proof fittings using threaded glass globes because of difference of expansion in the glass and metal base. In the Dennison fitting recently brought out by the Dennison Electric Fitting Company of New York this trouble is avoided because the seal is obtained by using a blown-glass globe having an extended flange clamped between gaskets. The clamping is permitted by a threaded ring engaging with the base of the fitting.

Instead of having a sealing surface of only the thickness of the glass wall, this seal is obtained between the two flat surfaces, to which great pressure can be applied with the assurance that it will be impossible for the seal to loosen or the glass to break with expansion.

The ring or collar may be used as a holder for a reflector or for a guard. The wiring space afforded in the base is ample for all splices, and the socket is so made that all the wiring can be done from the outside It is not necessary to take the socket holder, etc., apart when connecting. This feature alone is a great time saver.

Being blown instead of cast, the glass will allow a great temperature variation without cracking, as in the case where water or a spray will strike the glass heated by a lighted lamp. The fitting is particularly adapted to service where economy of space and ruggedness is demanded and is made for lamps rated at 25 watts to 200 watts and all standard pipe connections.



SEALING IS OBTAINED BETWEEN TWO FLAT SURFACES

The fitting is handled exclusively by Frank E. Watts, 30 Church Street, New York City.

Trade Notes

Government Contracts

The departments at Washington, D. C., during the past few weeks have awarded the following contracts:

ORDNANCE DEPARTMENT—Wagner Electric Manufacturing Company, National Electrical Supply Company, Westinghouse Electric & Manufacturing Company.

ARMY MEDICAL CORPS—Victor Electrical Corporation, X-ray material; National Electrical Supply Company, flashlight lamps; Domestic Electric Company, X-ray apparatus; General Electric Company, X-ray supplies.

MARINE CORPS, NAVY DEPARTMENT—Westinghouse Electric & Manufacturing Company, 0.1-kw. turbo-generator, electric supplies; Novelty Electric Company, tape; Frank H. Stewart Electrical Company, electrical supplies; Walker & Keppler, electrical supplies; Jones-Beach Company, electrical supplies.

BUREAU OF SUPPLIES, NAVY DEPARTMENT—Weston Electrical Instrument Company, ammeters and voltmeters; Western Electric Company, testing set, electrical supplies, telephone equipment, wire; National Metal Molding Company, electric wire; Sprague Electric Works of the General Electric Company, electric wire, cable, steel conduit, spare parts for motors; Columbia Metal Hose Company, electric wire; Eastern Tube & Tool Company, electric wire; Youngstown Sheet & Tube Company, electric wire; Bailey Electric Supply Company, electric supplies; John A. Roebling's Sons Company, strands, wire; Economy Fuse & Manufacturing Company, fuses; F. H. Lovell & Company, sockets; Manning, Maxwell & Moore, engineering lathes; Illinois Wire & Cable Company, wire; General Electric Company, electrical supplies, blower; Wetmore Savage Company, electrical supplies; Standard Underground Cable Company, cable wire.

GENERAL ENGINEERING DEPOT—Cutler-Hammer Manufacturing Company, motor starters, fuses, rheostats, spare parts for controllers, etc.; General Electric Company, rheostats, air chute, "mazda" lamps, spare parts for generating sets and searchlamps, insulated cable parts for gas-electric sets, projectors and parts, projector switches and magnetos; Carroll Electric Company, switch arrows, buzzers, rubber cement, rubber tape, exhaust fans; Bodine Electric Company, motors; Conduit Electrical Manufacturing Company, electrical supplies; National Electric Light Company, electrical tests; Northwestern Manufacturing Company, motor spare parts; Page Steel & Wire Company, steel wire weaving; Rome Wire Company, copper wire; Smith & Hemenway Company, lineman's climbers; Westinghouse Electric & Manufacturing Company, spare parts for motors and searchlights; Worcester Electric Manufacturing Company, switchboard frames; Crocker-Wheeler Company, motor spare parts; Peerless Electric Company, motor spare parts; Edison Storage Battery Company, batteries; H. W. Johns-Manville Company, asbestos sheets, packing; Ingersoll-Rand Company, hoists, compressors and parts; Driver-Harris Company, wire; Imperial Electric Company, motors; Chicago Pneumatic Tool Company, wood covers, hammers; National Carbon Company, carbons and containers; American Steel & Wire Company, steel hoisting rope; J. G. Brill Company, seats for limber and caisson wagons.

CHARLES F. TOWN, formerly connected with the Brooklyn Union Gas Company, has resigned to take the position of general manager of the Bailey Reflector Company of Pittsburgh, Pa.

MONKS & JOHNSON of Boston, Mass. architects and engineers, have established a branch office at 1825 Wylie Street, Philadelphia, and request the trade to send them catalogs at that address.

A. V. LARSON, formerly with the American Engineering Company, in Pittsburgh and Philadelphia territory, is now in the employ of the L. E. Pollard Company, Inc., of Minneapolis, Minn., as sales manager.

THE TAISHO TRADING COMPANY, LTD., a Japanese corporation, has acquired the business heretofore carried on by Kenjiro Kurasawa under the name of the Talsho Trading Company of New York City. Mr. Kurasawa remains with the new company as president, and Kitaro Kato has been made resident manager.

W. H CALLAN, general manager of plants, and W. P. Pressinger, general manager of sales, have been elected vice-presidents of the Chicago Pneumatic Tool Company of Chicago.

J. R. PALMER, who had charge of the line material sales of the Ohio Brass Company of Mansfield, Ohio, for a number of years, is now in Philadelphia, where he will be engaged in naval airplane production work.

A. NIEDERMEYER, for many years connected with the Worthington Pump & Machinery Corporation, most recently as works manager of the Snow-Holly Works of that company at Buffalo, N. Y., resigned on May 31 to devote his entire time to enterprises of his own.

D. C. GROVE, formerly advertising manager of the Diehl Manufacturing Company of New York City, manufacturer of electrical machinery, is now in the same department of the Ingersoll-Rand company, manufacturer of air compressors.

THE COMMERCIAL RESEARCH COMPANY, metal specialist for incandescent lamps, has sent out notices that after July 1 its executive and sales offices will be removed from Long Island City, N. Y., to 18 East Forty-first Street, New York City.

THE UNITED STATES TARIFF COMMISSION OF WASHINGTON, D. C., has published an outline of its work and plans in pamphlet form, as detailed in the address of F. W. Taussig, chairman, delivered before the Home Market Club of Boston, Mass.

H. W. WATTS has been transferred from Boston to become manager of the Diehl Manufacturing Company, manufacturer of electrical apparatus, in New York City. In fact, Mr. Watts is the manager of both offices. He was at one time connected with the company's selling staff in New York for five years.

THE FRED FULLERTON COMPANY, INC., has taken over the New York business of the Fullerton Electric Company, formerly at 109 West Twenty-sixth Street and now removed to Scranton, Pa. A general jobbing trade is carried on by the Fred Fullerton Company, Inc., which is located at 21 and 23 East Twenty-second Street, New York.

J. W. MAHONEY has just severed his relations with the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., to begin practice as a consulting mechanical and electrical engineer in New York City. Mr. Mahoney will specialize in industrial and power electrical control and switching equipment. Until further notice his address will be 574 Eighty-first Street, Brooklyn, N. Y.

JOHN G. WOOD of Anderson, Ind., formerly general manager of the Remy electric division of the United Motors Corporation, has been appointed president and general manager of the Mid-West Engine Company, a consolidation of the Lyons-Atlas Engine Company of Indianapolis and the Hill Pump Company of Anderson, Ind. The new company will specialize in turbine engines.

NORWEGIAN CABLE AND RUBBER PLANT.—At Christiania, Norway, has just been finished the first Norwegian cable and rubber goods factory. It will specialize in the manufacture of all kinds of wire cable and other products. The plant covers an area of about 8000 square meters in addition to space allotted for buildings for electrical transformers and other equipment. The cost of the plant entire is placed at $402,000.

THE GENERAL ELECTRIC COMPANY of Buffalo, N. Y., will build a new local plant on property recently acquired at East Ferry Street and Fillmore Avenue, about 195 ft. by 415 ft., to be devoted to the production of incandescent lamps. The first unit will be of brick and steel construction, the entire plant to have a capacity of about 90,000 lamps per day. The company is making rapid progress in the erection of a new two-story addition, about 15 ft. by 65 ft., to building No. 31, at Schenectady, N. Y. Improvements are also being made in this structure.

THE NATIONAL WAR LABOR BOARD of Washington, D. C., has ruled that individual employment contracts be abolished at Pittsfield, Mass., in the plant of the General Electric Company, employing about 7000 men. Former President William H. Taft and Frank P. Walsh, joint chairmen, were appointed to "establish a just system of collective bargaining between the company and the men." It is understood that the board will establish a system of elections by which the workers may choose committees to represent them in dealing with the company.

THE WESTINGHOUSE LAMP COMPANY of New York City has leased property at 536-546 West Twenty-third Street, which will be used for extensions.

M. KEITH DUNHAM, formerly consulting engineer of New York City, is engineer in charge of apparatus for the Bastian-Blessing Company, manufacturer of apparatus for welding and cutting, of Chicago, Ill.

D. C. GOULD, who has been connected with the Willard Storage Battery Company for a number of years as district manager of the Chicago territory, has been transferred to Indianapolis, Ind., and made manager of the company's branch there.

HOWARD F. VIOT, for the past ten years manager of the Omaha district of the Shelby lamp division, National Lamp Works, has recently been promoted to the management of the Chicago district for the company, with headquarters at 730 South Michigan Avenue.

THE BABCOCK & WILCOX COMPANY of Bayonne, N. J., manufacturer of boilers, etc., has commenced operations in a large new addition to its plant recently completed. The structure, which with its new equipment is estimated to cost $1,500,000, is about 150 ft. by 330 ft.

THE INDUSTRIAL ELECTRIC FURNACE COMPANY of Chicago, has installed two single-phase Snyder electric furnaces, to be operated together on a polyphase current system, at the plant of the Western Steel Car & Foundry Company of Chicago. These two furnaces, are each 1½ tons capacity. They are designed for acid operation on steel castings.

THE HAMILTON-BEACH MANUFACTURING COMPANY of Racine, Wis., reports that it is 40,000 small motors behind. In its present plant it is producing 25,000 small motors per month. Sixteen salesmen of the company have been put on vacation for two months with full pay. The factory rooms which were formerly used as storerooms, are now filled with machinery used in production. The company is also engaged in building a 50-ft. by 150-ft., three-story addition to its factory in the hope of bringing production up to demand.

THE SANGAMO ELECTRIC COMPANY of Springfield, Ill., sent out a shipment of 75,000 lb. of meters one week in June consigned for redistribution in this country and abroad. Most of the meters will see "overseas service." Of interest because of the wide distribution are the foreign shipments. Six hundred meters are bound for Barcelona, Spain; 500 are to be sent to the government plant at Montevideo, Uruguay; 500 will be used by an electric light company in Lima, Peru; nearly 1000 have for their destination Melbourne, Australia; 300 go to Durbin, South Africa, for distribution to other points in South Africa, and there also are included in the lot shipments for Cuba and for Christiania, Norway. In addition to this, the Sangamo company recently sent allotments to Bangkok, Siam, and New Zealand. Every month regular shipments are sent to the company's assembling and testing plant at Osaka, Japan, from where meters are distributed through Japan and China.

Trade Publications

FLASHLAMP.—The Import Sales Company, 33 West Twentieth Street, New York City, has issued a bulletin illustrating and describing its flashlamp and electric trench mirror.

MOTOR-GENERATOR SETS.—In bulletin 33, issued by the Perfection Storage Battery Company, Fortieth Street and Rhodes Avenue, Chicago, may be found descriptions of battery-charging sets manufactured by that company.

PIPE-BENDING MACHINES.—Machines for bending metal pipes, tubes and rods of various sizes are described in a bulletin entitled " 'Wonder' Pipe Benders," distributed by the American Pipe Bending Machine Company, 37 Pearl Street, Boston.

PROFITABLE EMPLOYMENT WITH PLEASANT SURROUNDINGS.—This is the title of a booklet that has been issued by the Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia. This booklet is published for the purpose of giving information regarding employee conditions at this plant, and it says that this company offers opportunities for employment to boys, girls, young men, young women and high-grade mechanics and toolmakers. It tells about the business and the opportunities for the betterment of positions of employees.

DRAFTING-ROOM EQUIPMENT.—Electric blue-printing machines, drafting-room equipment and surveying instruments are described and illustrated in catalog B, issued by C. F. Pease Company, 213 Institute Place, Chicago. The book contains 265 pages of descriptive matter and is bound in heavy cardboard.

ELECTRICAL EQUIPMENT FOR GARMENT MANUFACTURERS.—This is a title of a bulletin that has recently been issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. It is known as Motor Application Circular 7150, and tells of the complete line of electrical apparatus for garment manufacturers that this company makes, which includes motors for power tables and individual sewing machines, electric pressing irons, electric lamps, electric fans and electric ventilating fans.

New Incorporations

THE AMERICAN POWER & RAILWAY COMPANY of Charlotte, N. C., has been chartered with a capital stock of $100,000 by H. M. Victor, C. B. Bryant and D. D. Traywick.

THE VICTORY BATTERY COMPANY of New York, N. Y., has been chartered with a capital stock of $20,000 by C. Kreiger, M. Wilkenfield and J. Berman, 996 Home Street.

THE SACRAMENTO (CAL.) ELECTRIC VEHICLE COMPANY has been incorporated for the purpose of taking over the electric vehicle department of the James F Pepper Company.

THE REPUBLIC (MO.) LIGHTING & POWER COMPANY has been incorporated with a capital stock of $5,000 by G. W Thurman, Manerva Chaffin and H L. Pemeyor, all of Republic.

THE MODERN ELECTRIC COMPANY of Erie, Pa., has been chartered with a capital stock of $5,000 by K E. Tederous, Abdo M. LeAsner of Erie, and D. E. Tederous and K. Tederous of Dunkirk, N. Y.

THE R. H. MILTON ELECTRIC COMPANY, of Greensboro, N. C., has been incorporated with a capital stock of $25,000 by S. R. Morrison, S. G. Milton and L. V. Milton. The company proposes to do a general electric business.

THE WILBUR B. DRIVER COMPANY of Belleville, N. J., has been chartered with a capital stock of $500,000 to manufacture wire rope, cables, etc The incorporators are Irving Eisenberg, Evelyn T. Adam and Irving T. Vanderbilt, Newark.

THE ELECTRIC WELDING COMPANY of Newport News, Va., has been incorporated with a capital stock of $50,000. The officers are: William Schenstrom, president; Charles H. Peoples, secretary, both of Brooklyn, N. Y., and K. B. Johnson of Norfolk, Va., treasurer.

THE L S BRACH SUPPLY COMPANY, 127 Sussex Avenue N. J., has been incorporated with a capital stock of $200,000 to manufacture and sell electrical devices, railway signals and insulating specialties The incorporators are Leon S. Brach, Alexander G. Brach and Rebecca Tuchman.

THE DERF MANUFACTURING COMPANY of New York, N. Y., has been incorporated by W. B. Noble, 1089 Prospect Place, Brooklyn, and F. L. Hartt, 300 West 141st Street, New York City. The company is capitalized at $100,000 and proposes to manufacture spark plugs, motor engines, etc.

THE INTERNATIONAL MARINE COMPANY of New York, N. Y., has been incorporated by C. R. Stewart, N. Murphy of Ridgewood, N. J., and R. T. Anderson of Greenwood Lake, N. J. The company is capitalized at $100,000 and proposes to do a general marine, mechanical and electrical engineering business.

THE AUTOMATIC BATTERY CORPORATION of Boston, Mass., has been incorporated with a capital stock of $25,000 to manufacture and deal in electric batteries. The incorporators are: James Mackenzie of Boston, Mass.; G M. Washburn of Providence, R. I., and C. W. Dunbar of Holyoke, Mass.

THE TELEGRAPHONE MANUFACTURING COMPANY of Kittery, Me., has been incorporated by Charles S. Ballard of Springfield, Mass.; Aaron B. Cole, L. B. Cole, Ralph E. Clark and M. E. Anderson of Kittery. The company is capitalized at $500,000 and proposes to manufacture and deal in mechanical and electrical devices.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

BIDDEFORD, ME.—The Clark Power Company has petitioned for permission to erect an electric transmission line from Union Falls to Biddeford to supply electricity to the Pepperell Mills.

DOVER, N. H.—Extensive improvements are being made by the Twin State Gas & Electric Company, which will involve an expenditure of about $60,000. A direct line has been erected between Dover and the power station at South Berwick. A new substation has been erected at South Berwick and two new transformers are being installed. Arrangements have been made with the Rockingham Light & Power Company whereby an exchange of power between the two companies has been agreed upon.

BURLINGTON, VT.—Plans are being prepared by the E. B. & A. C. Whiting Company for the construction of a new power plant, 50 ft. by 50 ft., at its works.

BOSTON, MASS.—Plans have been prepared by the Boston & Maine Railroad Company, North Station, for extensions and improvements in its power house near Lawrence, to cost approximately $14,000.

BOSTON, MASS.—Bids will be received by the Commission on Mental Diseases, State House, Boston, until July 22 for construction of an addition to hospital in Mattapan District, to cost about $385,000. The plans include equipment for building. Kendall Taylor & Company, 93 Federal Street, are architects.

DALTON, MASS.—The local substation of the Pittsfield Electric Company was damaged by fire recently, causing a loss of about $2400.

FALL RIVER, MASS.—Arrangements are being made by the Water Board for the erection of an auxiliary water-pumping station equipped with a motor-driven centrifugal pump of 8,000,000-gal. capacity.

FALL RIVER, MASS.—The Executive Council has approved the petition of the Fall River Electric Light Company for permission to erect and maintain electric transmission lines over Warren and Coles Rivers, between Swansea and Somerset.

IPSWICH, MASS.—A special town meeting has been called to take action on the question of purchasing electricity from the Newburyport Gas & Electric Company instead of generating it at the municipal plant

LAKEVILLE, MASS.—A new power plant will be erected at the Lakeville State Sanitarium in connection with the construction of a new laundry building at that institution. The cost of that work is estimated at about $15,000. Curtis Bixby, 8 Beacon Street, Boston, is architect.

LENOX, MASS.—A fund has been given by Andrew Carnegie for a new electric lighting system for the Lenox Library.

NEWBURYPORT, MASS. — The Newbury Gas & Electric Company is reported to have acquired 500 ft. of water frontage on the Merrimack River, on which it proposes to erect a large central power plant of sufficient output to supply electricity for lamps and motors for industries within a radius of approximately 25 miles. The cost of the proposed plant is estimated at $10,000,000.

NORTH ADAMS, MASS.—Preliminary work has begun on the construction of an addition to the boiler house, 40 ft. by 55 ft., of the North Adams Gas Company.

NORTH DANA, MASS.—The Gardner (Mass.) Electric Light Company has submitted a proposal to the Board of Trade to supply electricity in Dana, under the terms of which it will deliver energy at Petersham. This would require the erection of an electric transmission line 6 miles long, if erected direct to North Dana, or 9 miles by the way of Dana Center, either by the town or local interests.

SOMERSET, MASS.—Arrangements have been completed by the Shipping Board, Washington, D. C., for the construction of a shipbuilding plant at Somerset to be operated by the Crowningshield Shipping Company, South Somerset. It will cost approximately $250,000 and will include large machine and erection shops. Contract has been awarded to the Aberthaw Construction Company of Boston.

HARTFORD, CONN.—The Spencer Turbine Company is reported to be asking for bids for a new factory, 77 ft. by 300 ft., one story, with two-story section, 40 ft. by 77 ft., to be erected on New Park Avenue. The Spencer company was recently merged with the Organ Power Company.

NEW HAVEN, CONN.—The government, it is understood, will assist the Connecticut Light & Power Company to secure material and labor to complete its proposed hydroelectric generating plant on the Housatonic River at Stevenson. Surveys are being made for the erection of a high-tension transmission line from the plant at Stevenson to Bunker Hill, where a substation will be erected, and the power lines connected with the Bull's Bridge line. The plans provide for an initial installation of 20,000 kw. The cost is estimated from $3,000,000 to $4,000,000. Charles L. Campbell is secretary and treasurer of the company.

Middle Atlantic States

BROOKLYN, N. Y.—The Standard Oil Company, 26 Broadway, New York City, is planning to erect a new pumping plant, 40 ft. by 70 ft., at its local plant. The cost of the plant, which will be electrically operated, is estimated at about $10,000.

BUFFALO, N. Y.—A one-story power house, 40 ft. by 85 ft., will be erected by the Ferguson Steel & Iron Company, 1499 Bailey Avenue, in connection with the construction of its new shipbuilding works on Abbott Road.

BUFFALO, N. Y.—The application of the City Commission for permission to issue $120,000 in bonds to provide funds for the installation of a new flashlight signal system in the water-front section has been denied by the Capital Issues Committee at Washington.

BUFFALO, N. Y.—Contract has been awarded by the Ferguson Steel & Iron Company, 1399 Bailey Avenue, to the J W. Cowper Company, Fidelity Building, Buffalo, for the erection of its shipbuilding works on Abott Road, which will include a one-story machine and shipworks building, 40 ft. by 105 ft.; a four-story assembling shop, 120 ft. by 400 ft.; one-story mold works, 50 ft. by 200 ft.; electric power plant, 40 ft. by 82 ft. and office building, 40 ft. by 105 ft.

BUFFALO, N. Y.—To meet the demand for additional power for war industries in this section extensive additions are being made to the steam generating plants of the Buffalo General Electric Company and the Niagara, Lockport & Ontario Power Company, aggregating 62,000 hp. By means of a further development the American hydro-power companies at Niagara Falls will increase their output by about 160,000 hp. The present capacity of the plants at Niagara Falls is about 250,000 hp.

COHOES, N. Y.—The Cohoes Company and the Cohoes Gas Company have petitioned the Public Service Commission for permission to transfer their plants and holdings to the Cohoes Power & Light Corporation, recently organized. The new company is capitalized at $5,000,000. The company also asks for permission to issue $2,5000,000 in bonds and the same amount in capital stock, part of which will be used for extensions and improvements.

ELLIS ISLAND, N. Y H., N. Y.—Bids will be received at the office of the United States Commissioner of Immigration, Ellis Island, New York Harbor, until July 22, for furnishing and installing a new boiler feed pump in main power house at the United States Immigration Station at Ellis Island.

LONG ISLAND CITY, N. Y.—The War Department, Cantonment Division, Washington, D. C., is planning to erect a gas defense plant in Long Island City, to cost about $88,500.

NEW YORK, N. Y.—The Bureau of Yards and Docks, Navy Department, Washington, contemplates the purchase of electrically driven capstans for the New York Navy Yard, specification No. 3172, to cost about $21,000.

NEW YORK, N. Y.—Plans have been prepared by the New York Steam Company, 280 Madison Avenue, for improvements and extensions in the coal-handling system at its steam generating plant on East Fifty-ninth Street, to cost about $12,000.

NEW YORK, N. Y.—Arrangements have been made by the Western Union Telegraph Company for the erection of a six-story building at 38 and 40 Broad Street to be used as its principal operating terminal and commercial office. It is proposed to move the cable terminals from the present offices to the new building as soon as it is ready for occupancy. The facilities for handling the cable business will be greatly improved.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., July 22, for furnishing and installing an electric power system in the structural shop at the navy yard, New York, N. Y. Drawings and specification No. 3131 may be obtained upon application to the above bureau or to the commandant of the navy yard named, upon deposit of $10.

SYRACUSE, N. Y.—The Semet-Solvay Company, Milton Avenue, is planning to rebuild its works, recently destroyed by an explosion. The proposed work will include three T. N. T. plants, one nitric-acid plant, laboratory, boiler house and office.

CAMDEN, N. J.—The City Council has authorized an issue of $15,000 in bonds for the installation of a new fire-alarm system.

ELIZABETH, N. J.—Plans have been prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a new naval air station with shop buildings at Elizabeth, N. J., to cost about $300,000.

KEASBEY, N. J.—The local substation of the Public Service Company was destroyed by fire on July 6. The plant, it is understood, will be rebuilt at once.

MONTCLAIR, N. J.—Contract has been awarded by the City Commission to the Public Service Corporation for alterations and improvements to the overhead lines of the fire-alarm system in the North End section.

NEW BRUNSWICK, N. J.—Plans are being considered by the Board of Freeholders for the construction of a new electrically operated drawbridge over the Delaware and Raritan Canal. Application has been made to the Capital Issues Committee for approval of a bond issue for $80,000 for the work.

POMPTON LAKES, N. J.—In connection with the proposed addition to the municipal electric light plant a bond issue of $46,000 has been approved recently, and an additional appropriation of $10,000 has been provided by the Borough Council. All bids received for the proposed work have been rejected by the Council, and new bids will be asked for at an early date.

PHILADELPHIA, PA.—The Philadelphia & Reading Railroad Company is planning to erect a power plant at its works at Tulip and Somerset Streets, to cost about $30,000.

PHILADELPHIA, PA.—Plans have been filed by the Hulton Printing, Processing & Dyeing Company, 3851 Frankford Avenue, for alterations and improvements in its power house on Coral Street.

PHILADELPHIA, PA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning to purchase air compressors, to cost about $75,000 (specification No. 3173); electrically driven capstans, to cost about $21,000, (specification No. 3172), for the Navy Yard at Philadelphia, and to install two electrically operated cranes in air-craft factory, to cost about $30,000 (specification No. 3202).

PITTSBURGH, PA.—Plans are under consideration by the Standard Underground Cable Company for the construction of a one-story addition, 60 ft. by 100 ft., to its plant, to cost about $10,000.

WILKES-BARRE, PA.—The City Council has passed on first reading an ordinance to grant the Wilkes-Barre Company (the old company) the lighting contract. The Wilkes-Barre Light Company, the new concern, was awarded the contract two years ago. Six months were allowed the company to prepare for the service; the time was extended and the company was unable to fulfill its contract.

ANNAPOLIS, MD.—The Navy Department, Washington, D. C., is contemplating the construction of an electric power plant at Annapolis, to cost about $320,000.

BALTIMORE, MD.—Contracts, it is understood, will soon be awarded by the American Can Company, Maryland Trust Building, for the construction of a building, 105 ft. by 176 ft., four stories, on Boston and Hudson Streets, Canton, to cost between $150,000 and $180,000. N. M. Loney, 120 Broadway, New York, N. Y., is architect.

ST. HELENA, MD.—Plans are being prepared by Smith & May, 1133 Calvert Building, Baltimore, for the erection of a public school building, to cost approximately $300,000, for the United States Shipping Board. J. Rogers Flannery, 1319 F Street, N. W., Washington, D. C., is director of housing.

SPARROWS POINT, MD.—Contract has been awarded by the Bethlehem Steel Company, acting as agent for the United States Building Corporation, to the A. Burlingame Company, 22 Cypress Street, Worcester, Mass., for furnishing power plant and power piping work for the addition to the Sparrows Point shipbuilding plant.

KEYSER, W. VA.—The Baltimore & Ohio Railroad Company is reported to be considering extensions and improvements to its local car and locomotive works.

NORFOLK, VA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning to purchase electrically driven capstans for the navy yard at Norfolk, to cost about $21,000 (specification No. 3172).

North Central States

CASSOPOLIS, MICH.—Plans are under consideration by the Village Council for improvements to the water-works system, including the erection of an 80,000-gal. steel tank, two motor-driven centrifugal pumps, one 350-gal. and one 750-gal. capacity and chlorinating apparatus. Holland, Ackerman & Holland, 122 Fourth Avenue, Ann Arbor, are engineers.

HASTINGS, MICH.—Improvements are being made to the local plant of the Thornapple Gas & Electric Company, including the installation of a 625-hp. turbine wheel. The company is building a large cement flume to replace the wooden structure carried away by flood at its dam across the Thornapple River at La Barge. The company is controlled by the J. G. White Management Corporation, 43 Exchange Place, New York, N. Y.

LANSING, MICH.—Plans are being prepared by the Michigan Power Company for the installation of a 6200-kw. turbine engine, new boilers and rebuilding its distribution system, which will increase its capacity by 200 per cent. David R. Thomas has been appointed receiver.

ST. JOHNS, MICH.—Plans are being considered for the installation of a new electric generating unit in the municipal electric light plant.

WYANDOTTE, MICH.—The Austin Company of Cleveland, Ohio, has been awarded contract by the Detroit Shipbuilding Company for the construction of a power house, 40 ft. by 100 ft.

BRYAN, OHIO.—At an election held recently the proposal to enlarge the municipal electric light and power plant was carried.

CINCINNATI, OHIO.—The contract for the installation of electric lighting fixtures in the new Hamilton County court house at Cincinnati has been awarded to Edward F. Caldwell & Company, 38 West Fifteenth Street, New York, N. Y., at $56,770. The Caldwell Company agrees to complete the work within 135 days.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, Ohio, until July 25 for transformers for the division of light and heat. Specifications may be obtained on application to the office of the division of light and heat.

COLUMBUS, OHIO.—Contract has been awarded by the Toledo & Ohio Central Railroad Company to the Austin Company of Cleveland for the construction of a twenty-stall roundhouse, machine shop boiler house, oilhouse, etc., at its West Columbus yards. The cost is estimated at $250,000.

COLUMBUS, OHIO.—The Columbus Railway, Power & Light Company has applied to the Ohio Public Utilities Commission for permission to sell $3,000,000 in notes, the proceeds to be used for extensions and improvements, some of which have been made but are still unpaid.

HAWESVILLE, KY.—Owing to the failure of the City Council and W. H. Williams, owner of the local water-works system to reach an agreement in regard to the renewal of the water franchise, which expired July 1, the water system ceased operation on that day. The electric plant of the Hawesville Electric Light, Heat & Power Company was forced to close down on account of the lack of water, and the city of Hawesville will be without electrical service until terms can be made.

MAYSVILLE, KY.—The new power station of the Maysville Power Company will soon be put into operation. The old power plant of the Maysville Gas Company will be closed down but will be held as a reserve plant. The new station will supply energy to the Maysville Gas Company and the Maysville Street Railroad & Transfer Company.

WILLARD, KY.—The Black Raven Coal Company, recently incorporated, is planning to develop 275 acres of coal land to provide for a daily output of 1200 tons of coal. It is proposed to install electrical equipment, coal-cutting machines, screens, tipple screens, etc. The company is capitalized at $100,000.

CARROLLTON, ILL.—At a meeting of the Mayors and some of the Aldermen of the cities of White Hall, Roodhouse, Greenfield, Kan., and Carrollton held recently in Carrollton to protest against the proposed advance in rates for electric service by the Central Illinois Public Service Company, a proposition to construct a central electric power plant on Apple Creek to furnish electricity to all the cities in Green County was suggested by J. T. Calloway of Greenfield. Another meeting will be held in the future to consider the proposal.

CHICAGO, ILL.—The Acme Steel Goods Company, 2834 Archer Street, is contemplating the construction of a hoop-steel rolling mill in the Calumet district, to cost about $1,000,000.

CHAMPAIGN, ILL.—Extensive improvements are contemplated by the Illinois Central Railroad Company to its buildings and yards, involving an expenditure of about $250,000. The proposed work will include a new roundhouse, four cinder pits, carpenter shop, new track, etc.

CHICAGO, ILL.—The electrification of the Chicago, Milwaukee & St. Paul Railroad between Othello, Seattle and Tacoma will proceed to completion under the government regime. An expenditure of $5,346,606 for this purpose has been approved by the Director-General of Railroads during the current year, and an additional expenditure of $2,811,035 is contemplated for 1919. It is expected to complete the work by July 1, 1919.

DECATUR, ILL.—Bids, it is reported, will soon be asked by the Comet Automobile Company for the construction of a new power station. Two new boilers of 250 hp. each will be installed.

MATTOON, ILL.—The Chuse Engine & Manufacturing Company is planning to build a new manufacturing plant, to cost about $75,000. This is the first of a series of buildings the company will erect here.

GREEN BAY, WIS.—Arrangements are being made by the Northland Lumber Company of Green Bay for rebuilding its main sawmill and steam generating plant at the mouth of the Fox River, recently damaged by fire. A large part of both the power plant and mill will have to be replaced. R. C. Green is general manager.

MILWAUKEE, WIS.—Contracts will soon be awarded by the Allen-Bradley Company, 495 Clinton Street, Milwaukee, for further extensions to its plant, to consist of an addition of three stories and basement to its original shop and a new concrete smokestack. The company manufactures electric controlling devices, rheostats, etc. A. C. Eschweiller, Goldsmith Building, is architect.

RIPON, WIS.—The Central Utilities Company, recently incorporated, will take over the local electric light and power plant waterworks and gas systems and proposes to enlarge the systems and extend the service. The company is capitalized at $150,000. The incorporators are E. J. B. Schubring, D. E. Lonegan and A. R. Peterson.

WEST ALLIS, WIS.—The Universal Machinery Company, 784 Thirtieth Street, Milwaukee, it is reported, is ready to place contracts for engines, generators, switchboards and other equipment and machinery for its steam generating plant to be erected in connection with its new foundry and machine shop group at the foot of Sixty-fourth Avenue.

MINNEAPOLIS, MINN.—A permit has been granted the Minneapolis General Electric Company for the erection of reinforced concrete and steel power house at Twenty-ninth Avenue and the river bank, to cost about $450,000.

CLINTON, IOWA.—Plans are being prepared by the Klein Paper Company, Nineteenth Avenue, Clinton, for the erection of a new paper mill, including power plant, motors, pumping machinery, etc. The cost is estimated at about $175,000.

ELKHART, IOWA.—Bids will be received by the Mayor and Council of Elkhart until Aug. 5 for the erection of transmission line, substation and distribution system in Elkhart. E. A. Lankford of Boone, Iowa, is engineer. For details see Searchlight Section.

HUMBOLDT, IOWA.—The contract for electric wiring of the new high school has been awarded to Carstens Brothers of Ackley. The cost of the building is estimated at $110,000.

HOLDEN, MO.—Plans are being prepared by Archer & Stevens, engineers, 609 New England Building, Kansas City Mo., for rebuilding the municipal power plant.

ABERDEEN, S. D.—Work has begun on the installation of the new street-lighting system by the Aberdeen Light & Power Company. Under the terms of the new contract the present arc lamps (83) are to be replaced with series incandescents.

MITCHELL, S. D.—At an election to be held on July 23 the proposal to issue $185,000 in bonds for improvements to the electric lighting system and water-works will be submitted to the voters.

BRONSON, KAN.—Bids will be received by W. S. Low, city clerk, Bronson, until July 22 for furnishing material and construction of an electric lighting system, including construction of substations, transformers, line material, street lamps, etc., for a complete distribution system in Bronson; also for material for transmission line and transformer stations for the proposed transmission line between Bronson and Moran. Freeman D. Martin of Fort Scott is engineer.

GALVA, KAN.—Preparations are being made for the installation of an electric lighting system in Galva, for which bids have been received. The proposed work will include the erection of an electric transmission line about 6 miles long and a distributing system, to cost about $8,648. Nathan L. Jones of Larned is engineer.

MORAN, KAN.—Plans have been approved by the Public Utilities Commission for improvements to the water-works, to cost about $10,000. The proposed plans provide for the installation of an engine and an electric generating unit.

PARSONS, KAN.—The Kansas Electric Utilities Company is installing a 1000-kva. frequency-changer set in its power station.

Southern States

CHARLOTTE, N. C.—The American Power & Railway Company of Charlotte, recently organized with a capital stock of $100,000, proposes to construct and operate electric and steam railways, and also to generate and distribute electricity for lamps and motors. The incorporators are H. M Victor, C. B. Bryant and D. D. Trawick.

MAXWELTON, GA.—The Fairview Farms, recently organized, is planning to establish a dairy farm of 275 acres and will erect barns, silos, creamery, ice factory, electric plant, etc., to cost about $35,000. Maxwelton has not a postoffice

SOUTH JACKSONVILLE, FLA.—Bonds to the amount of $100,000 have been voted for extensions to the electric-lighting, sewer and water systems to 300 dwellings to be erected by the Emergency Fleet Corporation.

WAUCHULA, FLA.—The City Council is considering calling an election to vote on the proposal to issue $20,000 in bonds for the purchase of the electric plant of the Mauchula Light & Power Company and $4,000 for additional machinery.

KNOXVILLE, TENN.—The John G. Duncan Company of Knoxville would like to receive prices on a 100-kw., three-phase, 60-cycle, 2300-volt turbo-generator unit.

PINE BLUFF, ARK.—The Pine Bluff Company is contemplating the purchase of two 600-hp. boilers.

GARBER, OKLA.—The Garber Light & Ice Company would like prices on material and equipment for pole-line distribution system for electric plant to cost about $10,000. William Musser is president.

MIAMI, OKLA.—A committee has been appointed by the Miami Business Men's League to construct and operate an interurban railway, to be operated by electricity for other motive power, through the Miami mining districts. The cost is estimated at $650,000. Dr. W L. McWilliams, George L. Coleman and F. D. Griffith are among the members of the committee.

OKLAHOMA CITY, OKLA.—The Oklahoma Gas & Electric Company is contemplating the construction of a concrete and wood cooling tower, to cost about $72,000.

YALE, OKLA.—Bonds to the amount of $200,000 have been voted for construction of a municipal electric-light plant and improvements to the water-works system.

SAN ANTONIO, TEX.—Arrangements have been completed by the United Quartermaster Department, Washington, D. C., for the construction of a machine shop, 500 ft. by 500 ft., near San Antonio. It will cost about $1,000,000 and will be used exclusively in machine repair work for motor vehicles for the War Department.

SEQUIN, TEX.—The Guadelupe Power Company is contemplating power development of the Guadalupe River, consisting of several small plants. The present plans, it is understood, provide for a total output of 40,000 kw. The hydroelectric plant will probably not be built until after the war. W. B. Dunlap of Beaumont is president.

SOMERVILLE, TEX.—Plans have been prepared by W. J. Smith of Galveston for remodeling and erecting office building and power house for the Gulf, Colorado & Santa Fé Railway Company in Somerville. F. Merritt of Galveston is chief engineer.

WICHITA FALLS, TEX.—Contract for construction of the Northwest Texas Insane Asylum in Wichita Falls has been awarded to J. C. Deilman of San Antonio. The plans provide for an administration building, receiving wards, infirmaries, power house, etc. Funds to the amount of $385,000 are available for the work.

Pacific and Mountain States

BREMENTON, WASH.—Congress has added $1,925,000 to the appropriation for improvements to the Puget Sound Navy Yard, which include $325,000 for improvements to the central power plant, $300,000 for the purchase of additional land, and $400,000 for grading, filling and sea walls.

CAMP MEADE, WASH.—Contract has been awarded by the Cantonment Division, War Department, Washington, D. C., to Smith, Hauser & MacIsaac, Inc., 18 East Forty-first Street, New York, N. Y., for the construction of a training camp for Signal Corps, with accommodations for 11,000 men, to cost about $4,000,000. The plans include new barracks, extensions to hospitals, filtration plants, etc.

CHELAN, WASH.—The Chelan Water Power Company has petitioned the Commissioners of Chelan County for a franchise to erect a pole transmission line from Entait to Maple Creek. This line will form part of the proposed new power system to be erected at Chelan, which will furnish electricity in Wenatchee and a large portion of the upper Columbia country in Chelan County.

SEATTLE, WASH.—The municipal lighting department has recently awarded the Burton L. Stare Company a contract for a 1000-kw. motor-generator set, at $24,780.

SEATTLE, WASH.—The Todd Drydock & Construction Company, 1891 Sixteenth Avenue, S. W., is planning to erect a two-story power house and storehouse building, 100 ft. by 50 ft., to cost about $9,000.

VANCOUVER, WASH.—The contract for construction of transformer station at the foot of Washington Street has been awarded to Parker & Banfield, of Portland, Ore., at $5260. This station will be used as an auxiliary to supply electricity to operate the draw span of the bridge in case the present source of power should fail,

MARSHFIELD, ORE.—Improvements are contemplated to the naval radio station at Englewood, near Marshfield, which will include the installation of a gas engine plant to furnish electricity in case of emergency. Two high-power gas engines, motors and two 1800-gal. tanks will be installed.

PORTLAND, ORE.—Work has been started on extensions to the car-manufacturing plant of Twohy Brothers of Portland in Montaville to provide for government orders for freight cars. About $150,000 will be expended in buildings and equipment.

FRENCH GULCH, CAL.—The Hazel Creek Gold Mining Company, it is said, will not rebuild its Crystal Creek power house, recently destroyed by fire. As this plant supplied the electrical service in French Gulch, it will be necessary to make other arrangements for the town. The nearest connection that can be made with the transmission lines of the Northern California Power Company is at the Washington Mine, 2 miles distant.

FRESNO, CAL.—The State Railroad Commission has granted the San Joaquin Light & Power Corporation of Fresno permission to operate in Kern County under a franchise granted by the county.

FRESNO, CAL.—Surveys are being made by the San Joaquin Light & Power Corporation on Dinkey Creek and the north fork of Kings River preparatory to developing the water power of those streams. It is proposed to carry the waters of Dinkey Creek by a conduit to north fork of Kings River and to erect the necessary dams to increase its hydroelectric power.

LOS ANGELES, CAL.—Word has been received that the Capital Issue Committee has approved $92,000 in bonds for the proposed ornamental lighting system on Broadway, between the tunnel and Tenth Street. R. H. Manahan, city electrician, has instructed the Municipal Light and Power Bureau to purchase the glass globes and electrical equipment for the system, amounting to about $15,000. The lamp standards will be installed by the Keystone Iron Works.

LOS ANGELES, CAL.—A report on the extension of the municipal electric distributing lines into the East Seventh Street industrial district, to be served from the municipal substation near Ninth and Mateo Streets, submitted by the special committee, consisting of E. F. Scattergood, chief electrical engineer, W. B. Matthews, special counsel, and Burdett Moody, business agent, has been adopted by the Public Service Commission. Contracts made or in immediate prospect, the committee states, contemplate the substitution of municipal hydroelectric power for nearly all of such steam power, representing a total of about 4500 hp. This will make possible an annual saving of 90,000 barrels of fuel oil. The cost of installing the distributing system is estimated at about $90,000.

LOS ANGELES, CAL.—Permission has been granted Marcus Pluth of Los Angeles by the State Water Commission to use 10 second-feet of water of the east fork, middle fork, north fork, and the main stream of Snow Creek in Riverside County to generate electricity to operate a Portland cement mill and for distribution in Riverside County. The plans provide for the construction of a low concrete dam at each of the points of the diversion and a main canal, flumes and pipe line aggregating 13 miles in length. The total fall to be utilized is 1232 ft. It is estimated that 2914 hp. can be developed at a cost of about $215,000. Mr. Pluth has also been granted permission to use 20 second-ft. of water of the north and south forks of Whitewater River in Riverside and San Bernardino Counties as part of the same project.

ONTARIO, CAL.—The State Railroad Commission has granted the Ontario Power Company permission to build a hydroelectric power plant in San Antonio Canyon, taking water from San Antonio Creek. The Southern California Edison Company will contract to take all energy generated which is not absorbed by the Ontario Power Company during the first five years of the contract. After five years the Edison company will take all the energy. The cost of the plant is estimated at $64,551.

MOAB, UTAH.—The dam of the Moab Light & Power Company on Mill Creek was recently carried away by a flood. At present the city is without electrical service. The dam, it is understood, will be rebuilt at once. The dam was 50 ft. in height and was located in a narrow gorge on Mill Creek, about 2 miles above Moab.

GLENDALE, ARIZ.—More than forty electrically driven pumping plants are to be purchased and erected by the Salt River Valley Water Users' Association. These pumping plants are to be installed upon wells that will be fed by the seepage water from the canal that is fed by the large reservoir created by the Roosevelt dam. Electricity to operate the pumps will be supplied by the hydroelectric plant of the Salt River Valley Water Users' Association at the Roosevelt dam. The cost of the proposed work is estimated at about $500,000.

CLOVIS, N. M.—Bonds to the amount of $50,000 have been sold, the proceeds to be used for improvements to the municipal water and light plant.

Canada

COURTENAY, B. C.—The Dyke Sawmill Company, it is reported, is planning to rebuild its mill, recently destroyed by fire. The cost of the new plant is estimated at $250,000.

REVELSTOKE, B. C.—The concrete dam at the municipal power plant was recently carried away owing to a rise in the Illecillewalt River. Repairs will be made immediately .

WHITE ROCK, B. C.—Plans are being prepared for the installation of a municipal electric light plant, to cost about $40 000, in White Rock.

LUMSDON MILLS, QUE.—Preparations are being made by the Kipawa Fibre Company for the erection of a sulphite plant on a site south of Lake Temiskaming. The cost of the proposed plant is estimated at $5,400,000.

TORONTO, ONT.—The Alloy Steel Company, it is reported, will soon install an electric furnace in a building on the Norcross property

1,269,419. Electric Switch; Frederic P. Gates, Hartford, Conn. App. filed Aug. 25, 1915. Multi-circuit switches which may be employed to control the several lights of an electrolier group.

1,269,425. Telephone Hook Switch and Cut-out; John T. Gray, Great Falls, Mont. App. filed March 4, 1916. An improved cut-out combined with the usual hook switch to be opened when the receiver is on the hook.

1,269,453. Automatic Party-Line Telephone-Exchange System; Alexander E. Keith, Chicago, Ill. App. filed Aug. 20, 1906. Telephone systems in which automatic switching machinery is under the control of the subscribers.

1,269,481. Protective Device; Howard D. Matthews, Schenectady, N. Y. App. filed Aug. 1, 1916. Relay devices of the reverse-power type.

1,269,485. Electrolytic Starting-Sheet Suspender; Henry S. Montgomery and Henry A. Tobelmann, Ajo, Ariz. App. filed Nov 13, 1917. An electrolytic starting-sheet suspender in which the ends of the suspender are slit longitudinally and secured to opposite faces of the sheet.

1,269,495. Ignition System; Frank M. Norris, Los Angeles, Cal. App. filed Jan. 17, 1917. Mechanism for igniting the charge in internal-combustion engines, known as "jump-spark" or high-tension" ignition.

1,269,499. Supervisory Control Circuits for Telephone Systems; Samuel Paterson, Kenton, Manitoba, Can. App. filed Oct. 17, 1914. Signal-control circuits for telephone exchanges employing magneto substations.

1,269,510. Bulb for Electric Headlights; James M. Richardson, Highland Park, Mich. App. filed Oct. 4, 1913. Provides a single incandescent electric lamp bulb having a plurality of separate filaments spaced apart therein.

1,269,520. Manufacture of Incandescent Lamps; Fritz Blau, Charlottenburg, Germany. App. filed April 18, 1916. Provides in the lamp a very efficient drying agent which will remove the water vapor in the lamp.

1,269,525. Demand Measurement; James R. Craighead, Schenectady, N. Y. App. filed Sept. 2, 1916. Demand apparatus for indicating or recording the demand made by an electrical installation upon a source of electric energy supply.

1,269,526. Protective Device; Elmer E. F. Creighton, Schenectady, N. Y. App. filed June 8, 1916. Devices for rapidly extinguishing an arc produced either by overvoltage or by the opening of a switch of the air-break type.

1,269,534. Protective Device; George F. Gray, Schenectady, N. Y. App. filed Feb. 3, 1918. Provides an improved lightning arrester of the vacuum type.

1,269,537. Dynamo-Electric Machine; William E. Holcombe, Schenectady, N. Y. App. filed Jan. 8, 1916. Relates to the ventilation thereof.

1,269,538. Adjustable Lamp Fixture; Henry R. Huherich, Cleveland, O., App. filed Aug. 21, 1915. Means for adjusting the light source to various positions.

1,269,539. Telegraph System; Oscar M. Leich, Genoa, Ill. App. filed Feb. 9, 1917. Operates telegraph relays or sounders through the agency of a rectified alternating current.

1,269,542. Alarm for Combination Locks; Floyd B. McNabb and Richard M. Skinner, San Francisco, Cal. App. filed July 31, 1916. Causes an alarm to be sounded whenever the knob of the combination lock is turned too far in either direction.

1,269,563. Electric Switch; Clark T. Henderson, Milwaukee, Wis. App. filed Sept. 14, 1914. Relates to electromagnetic switches called "series switches."

1,269,564. Electric Switch; Clark T. Henderson, Milwaukee, Wis. App. filed Sept. 14, 1914. Series switches in which a single coil operates the contacts.

1,269,565. Process of Electrochemical Precipitation of Metals; Edward R. Holden, Los Angeles, Cal. App. filed Oct. 10, 1916. Electrolytically treating solutions containing metallic substances.

1,269,566. Electrolytic Apparatus; Archibald J. MacDougall and Guy N. Middleton, Toronto, Ontario, Canada. App. filed July 5, 1917. Electrolytic apparatus which continually changes the electrolyte in the zone of action.

1,269,590. Coil-Retaining Means; Allan B. Field, West Cliff-on-Sea, England. App. filed Feb. 21, 1914. Adapted for use in connection with the overhanging end portions of coils in the rotors of high-capacity turbo-generators.

Record of Electrical Patents

Notes on United States Patents

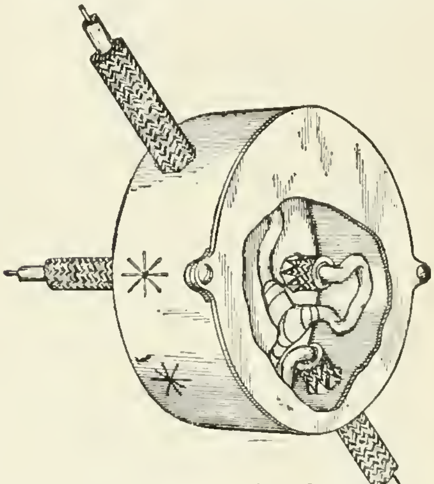
1,269,601. System of Control; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Nov. 25, 1914. Relates to the automatic acceleration of electric motors that propel electric railway vehicles.

1,269,602. Locomotive; Rudolf E. Hellmund, Swissvale, Pa. App. filed Oct. 30, 1916. Provided with a plurality of propelling motors having twin armatures.

1,269,611. Push-Button Switch; John E. Ketteman, Toledo, Ohio. App. filed Feb. 24, 1917. Snap switch.

1,269,617. Multiple Spot-Welding Machine; Joseph Ledwinka, Philadelphia, Pa. App. filed Jan. 10, 1917. Comprises a plurality of movable electrodes.

1,269,625. Auto-Starter; Walter O. Lum, Wilkinsburg, Pa. App. filed May 3, 1915. Provides a simple automatic means for successively establishing starting and operating connections.



1,270,062—Terminal Box

1,269,646. Electrically Heated Cup or Container; William P. Robertson, New York, N. Y. App. filed Sept. 15, 1916. A device comprising a container, a metal-incased electric resistance element therein and tubular supporting members.

1,269,655. Electric Switch; William C. Stevens, Summit, N. J. App. filed April 4, 1916. Electromagnetic switches for motor control.

1,269,679. Primary Battery; Menotti Bonora, Turin, Italy. App. filed Jan. 31, 1917. In a primary battery cell, an intermediate frame member without lateral walls and end frame members having lateral walls.

1,269,684. Electric Switch; James W. Cox, Wilmette, Ill. App. filed March 8, 1915. Provides a pair of stationary contacts and a pair of independently pivoted contact members.

1,269,702. Message-Register Circuits for Machine-Switching Telephone-Exchange Systems; Charles L. Goodrum, New York, N. Y. App. filed June 15, 1916. A set of repeating relays is installed before the first of a train of automatic switches.

1,269,712. Emergency Lighting System; John W. Jepson, Depew, N. Y. App. filed July 8, 1914. For electric motive power cars, where the regular lights are supplied with energy from the motive-power mains.

1,269,726. Welding Metals; Ralph D. Mershon, New York, N. Y. App. filed April 3, 1917. A method of welding that retains the parts together in the position in which they are to be united, connecting them to one terminal of a charged condenser.

1,269,748. Connector; Ralph R. Root, Cleveland, Ohio. App. filed June 14, 1915 Comprises a sleeve-like body portion having socket slots in one end thereof.

1,269,770. Metering Panelboard and Cabinet Therefor; William Wurdack, St. Louis, Mo. App. filed Aug. 11, 1916. Inclosing cabinet and a panelboard mounted securely within the cabinet.

1,269,776. Steering-Wheel Heater; William P. Barton, Salt Lake City, Utah. App. filed Aug. 2, 1916. A heating element for steering wheels consisting of a resistance wire and an asbestos covering.

1,269,778. Storage Battery; Julius Becker, Chicago, Ill. App. filed May 22, 1916. The combination with a cylindrical container of an active element within the same.

1,269,784. Circuit Coupling for Electrical Apparatus; Frederick E. Carlson and Joseph F. Lamb, New Britain, Conn. App. filed May 24, 1916. A hand portable electric utensil, resistor terminals and a binding post electrically connected to one of said terminals.

1,269,806. Timer for Gas Engines; Harold J. Gerpheide, South Bend, Ind. App. filed July 11, 1917. Relates to timers wherein the wire leads to the fixed contacts are arranged exteriorly of the timer.

1,269,838. Direction-Indicating Signal for Automobiles; Floyd N. Moore, Peoria, Ill. App. filed April 14, 1917. In a signal, a casing having an opening in one side and a clear glass pane covering the opening.

1,269,856. Annunciator; Adolph Rendle, New York, N. Y. App. filed July 19, 1917. Relates to signal systems for hotel by means of electric lamps.

1,269,889. Ignition Apparatus for Use with Internal-Combustion Engines; Sidney J. Williams, London, England. App. filed June 12, 1916. Comprises a source of electric energy and a trembler and primary coil in parallel with a non-trembler coil.

1,269,891. Current Rectifier; Fred Woodside and Doss Wright, Dillon, Mont. App filed Sept. 28, 1917. Adapted to the rectification of an alternating current into a direct current and may be employed upon self-propelled vehicles.

1,269,896. Electric Locomotive; George C. Abbe, Lansdowne, Pa. App. filed Nov. 9, 1917. An electric locomotive in which the guiding wheels are entirely dispensed with.

1,269,903. Means for Connecting Electric Lines; Leonard C. Bygrave, London, England. App. filed Nov. 22, 1916. Devices for establishing connection between two groups of lines are effected by relays.

1,269,909. Electric Motor; Thomas L. R. Cooper, London, England. App. filed Feb. 20, 1918. An induction motor, adapted to be used under water, comprising a stator, with field windings, and a rotor in which the currents are gererated by induction from the field.

1,269,913. Organic-Manganese-Compound Depolarizer; Carleton Ellis, Montclair, N. J. App. filed Oct. 18, 1915. Depolarizing material for use in galvanic cells of the Leclanché type.

1,269,916. Polyacid-of-Manganese-Dioxide Depolarizer; Carleton Ellis, Montclair, N. J. App. filed Jan. 17, 1917. Relates to a depolarizing agent or galvanic cell of the Leclanché type employed in pocket flashlamps.

1,269,917. Contact Finger; Oscar S. Field, Elizabeth, N. J. App. filed Sept. 30, 1916. Contact finger of clamping plates, a contact spring and means comprising insulating studs.

1,269,919. Railroad Signal; Edgar Foster, Vicksburg, Miss. App. filed Sept. 16, 1916. Means for automatically closing an electric signal circuit.

1,269,926. Rust Prevention; Carlos I. Gesell, Mamaroneck, N. Y. App. filed Jan. 7, 1918. Utilizes the protective agent which an electropositive metal to iron creates.

1,269,954. Electric Lighting System and Control; Omar J. Nigh, Washington, D. C. App. filed March 2, 1916. Provides a duplex electric lighting system for motor-driven vehicles.

1,269,992. Metal Vehicle Wheel; Harry R. Woodrow, New York, N. Y. App. filed Oct. 19, 1917. A method of electrically welding together the spokes and flange plates of a metal vehicle wheel.

1,269,996. Meter and Instrument Support; Percy H. Bartlett, Philadelphia, Pa. App. filed Nov. 14, 1917. Meter support and an inclosing box adaptable to meter casings.

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Making the Most of Interconnection

INTERCONNECTION of energy supply systems is no longer a matter of merely economic importance. In the face of fuel conditions apprehended next fall and winter, it is now essential to take every feasible step to increase territorial load factors and thus to realize the utmost reserve capacity resident in existing plants. In normal times the presence of idle reserve capacity far beyond the minimum necessary for good service often passes almost unnoticed, but to-day and to-morrow the war work of the nation demands and will require that electrical supply companies go the limit in putting their generating, transmission and distribution equipment into essential use. This means sailing closer to the wind as to reserve power than former practice has approved in many individual stations, but the diversity factors of such plants when skillfully interconnected and administered for the common benefit will save the day.

General agreement as to the wisdom of any particular plan is, we believe, a basic feature of any program which can be put through with minimum delay, and without invoking the strong right arm of the already overworked government to bring about co-operation which should be offered as a matter of patriotism among the various interests concerned. It is proper to require that the fuel-saving capabilities of such a plan be made clear to those who are to take part in it and to benefit thereby; but with this done, there should be immediate willingness to go ahead. This is no time in which to oppose interconnection on petty grounds; and if such a scheme in any case is to yield the maximum results, the parties to it must enter upon it in a spirit of give and take, ready to change existing plant routine in the interest of ultimate economic gain.

It will be helpful, also, to fix a certain standard of plant efficiency—say two pounds per kilowatt-hour—as the maximum allowable consumption of coal which an economical station should reach in working in multiple harness; that is, plants above this figure may well be classed as purely reserve stations, and those attaining or bettering it as the truly efficient burden bearers of the plan. So far as practicable, tidewater stations of relatively large capacity should be included in any interconnection program in the seaboard states, and it goes without saying that available water power must be turned to the utmost account.

Finally, one need not wait for the perfection of an elaborated program before making a beginning, in many instances at least, by interconnecting adjacent systems. Even a partial application of intersection tie-line service is already helping in many cases to carry on the war from the fuel standpoint. If the value of each particular plan is made clear, it ought to be no difficult matter to raise the necessary capital, whether with government assistance or otherwise; for in the first place the cost of releasing hitherto unavailable reserve capacity for wider use is generally very moderate in comparison with the cost of new plant construction, and secondly, the saving of fuel, labor and power is absolutely essential to the military program of the nation. Interconnection is now a military necessity and should be pushed with might and main by all having power to develop it for useful service.

The Everlasting Fuel Question

AS SUMMER draws on there appears above the horizon the customary interrogation point regarding next winter's fuel supply. Every week the electric central stations find their load of necessary war work steadily increasing; and if this necessary branch of service is to be maintained, fuel must be forthcoming in reliable quantity, and promptly. To-day the central stations do not know where they stand. The only thing of which they are sure is the reality of that ignorance. Nearly everybody is now getting used to the idea of utilizing whatever in the way of coal can be most readily obtained, and the zone system which has been inaugurated, while sometimes inconvenient, is likely at least to facilitate transportation. The chief trouble is that we have no basis for future plans. First, we are all going to have enough coal; second, we are not going to have enough coal; third, it must be ordered at once and the future so far as possible looked out for; fourth, if everybody orders at once there is going to be grave congestion, and it is better to pursue a waiting policy; fifth, everybody should burn wood; sixth, everybody should burn peat; and so on, to the length of the formal subdivisions of an old-fashioned sermon.

If there is to be any grave shortage of coal in spite of the best efforts of the Railway Administration, the obvious step is to devote the supply to essential and not to inconsequential purposes. The people must be provided with fuel enough to keep them warm, and industries necessary in the prosecution of the war must be kept running at full output. The perpetual attempt to shuffle and compromise in the matter of needless business should be stopped without further procrastination. There is not one man or woman now engaged in producing articles of luxury or of purely fanciful value who cannot find a job, generally at higher wages, in the production of necessities; and their present employers have had ample notice served on them to shift the line of their activities without wasting time about it. Their pocket nerves may suffer serious twinges, but they will sacrifice far less than will the million facing the Hun abroad. War industries must run, and the power stations that are supplying them should never fail them. To-day electric light and power must be ranked squarely as a necessity, and the supply stations must be kept going, with the sole qualification that their useless load should be suspended or transferred to useful purposes. It is time to begin a reform right now, in a definite and systematic program which shall leave no questions of dubious bearing to hinder useful applications. It is the present uncertainty which is the chief source of trouble, a hindrance to every industry that requires power. We need a determined policy, vigorously enforced without respect for the feelings of those who are not actually helping on the war. The electrical supply companies of this country are perfectly willing patriotically to endure their share of whatever sacrifices may be necessary, but they have a right to know the extent of these sacrifices, and that they are made for the benefit of the government's great purpose and not to save the skins of those who are adding nothing to the strength of the country's fighting arm.

Studying Electrical Distributions on Models

AT THE time when copper was cheap and plentiful almost every operating company in the country had considerable amounts of spare copper in its transmission and distributing lines, partly anticipating future expansion and partly as a result of poor or careless engineering. The times have changed, and many an operating engineer is spending sleepless nights figuring out how to redistribute the little available copper to the best advantage. All kinds of tie lines are being projected in order to relieve the overloaded feeders by making other feeders carry part of their load. In this connection a number of interesting theoretical problems arise concerning the distribution of currents in complicated networks. Theoretically speaking, any network problem can be solved by writing a sufficient number of Kirchoff's equations, but when one has to do with alternating currents these equations must be interpreted vectorially and the solutions sometimes lead to complicated equations of higher order. We mentioned such a problem in the Research Section of May 18, and some similar problems have recently come to our attention.

What is needed is some ingenious mechanical device or a slide rule to enable one to determine without much trouble the distribution of currents and voltages in comparatively complicated alternating-current networks. In the meanwhile the easiest solution in the present emergency seems to be to use laboratory models of the actual distribution, with both the currents and the voltages reduced in some convenient ratio. Older electrical engineers will remember that such model distributions were used in the early days of planning of the Edison system in large cities when the designer wanted to be "on the safe side" and did not trust his knowledge of Ohm's law. We are now reckless enough to design plain feeders without checking their performance on a laboratory model, but we need not be ashamed in the present emergency to connect up a few resistors and choke coils in the laboratory and to find out empirically the best place for a tie line or the amount of relief which an available tie line might bring about.

This experimental method seems to possess further possibilities well worth looking into. Take, for example, the case of several banked transformers connected in parallel to a secondary distributing line. The number of such transformers is usually selected in such a way as to give an uninterrupted service to all the customers with one or more transformers out, and it becomes rather a complicated mathematical problem to determine the new distribution of the load under some assumed abnormal conditions. A suitable laboratory model would enable a practical man to try different positions of transformers and different combinations of disabled ones until the most satisfactory and economical arrangement is found. Another case is that of induction motor design. It is well known that an induction motor may be represented by an equivalent electric diagram consisting of resistances and reactances. A designer who has a set of adjustable resistances and choke coils can readily check his design, or he can find by means of a few trial tests the values of these quantities which give him a desired power factor, slip, overload capacity, etc. Taking it altogether, the empirical experimental method of dealing with complicated circuits by means of models deserves more attention than it has received heretofore.

The Use of Iron and Steel Conductors

THE high cost of copper and the increasing amount of long, rather lightly loaded lines have combined greatly to stimulate the use of iron conductors for transmission systems. The sole material objection to this practice is the obvious one that for alternating-current work, the only thing here worth considering, the equivalent resistance of the wire is affected by both frequency and the magnetic properties of the conductor. There is a certain rather small genuine increase of resistance due to the skin effect. There are hysteretic and eddy-current losses and the inconvenience of reactance drop, in part a function of the permeability. The practical properties of iron and steel as electrical conductors are thoroughly discussed in the paper by C. E. Oakes and P. A. B. Sahm of the Bureau of Standards in our current issue, and the information given will be found of material service by those who have occasion to plan extensions with iron or steel wire.

To begin with, the properties of such wire are subject to a good deal of practical variation. The electrical, mechanical and magnetic qualities vary considerably, more widely than any of the standard properties of copper wire, so that extreme precision in calculations cannot be realized from the data usually available. Hence it is practicable to base working data on rather simple formulas. The authors show that within moderate limiting values of the current the effective equivalent resistance of an iron wire may be practically expressed as a linear function of the current, and the tables which they give make the resistance easily available. Likewise, within limits the variations in reactance can be approximately expressed by a simple linear equation easily applied. The data given apply to the usual 60-cycle circuits, which are now practically the only ones likely to be equipped with iron conductors. An additional very convenient table gives the external reactances for iron and steel wires. This external reactance is in no way connected with the material of the wire, but the usual tables give only the data for the standard copper-wire sizes. Going on from this, the writers take up the question of charging currents for the usual iron-wire sizes. These again are independent of the material of the wire, but in an iron line wherein the economical current-carrying capacity is rather low, only about 1 amp. per 10,000 circ. mils, the charging current may be a very appreciable part of the total, even in comparatively short circuits. The data given are quite sufficient for the electrical design of any iron-wire line that is likely to be encountered in practice, and their assembling into this compact and convenient form should be of great service to the increasing number of engineers who have to consider iron-wire construction as a necessary part of minor distribution.

Motors in the Newburgh Shipyards

SOME notes elsewhere in our columns will prove useful to the many engineers who have to struggle with emergency conditions due to the war. The Newburgh shipyard is one of the plants pushed into service within the last year and about to launch its first ships. The question of power in such a plant is a very serious one, and the designers were fortunate in having central-station power on which to fall back, thus getting rid of all the uncomfortable problems of an isolated plant, to say nothing of saving money. The notable thing about the equipment is that it is a rather complete adaptation of individual motor drive with belted motors. Recent practice has drifted very rapidly in the direction of direct-connected or geared motors, but here there had to be faced the absolute certainty that no prompt deliveries of equipment of this kind could be obtained and the only thing to do was to get thoroughly good and reliable standard motors and use them.

Under stress of the same conditions the entire equipment is with constant-speed motors, save for the furnace blower and the bending rolls. Here installation of variable-speed motors was imperatively necessary. Moreover, the standard motors, in virtue of their being belted to the work, served the purpose for which, except for time of deliveries, special high-starting-torque motors would have been used. It was anticipated and actually found that the belt slip at the start was just enough to ease off the starting conditions, even on heavy machinery with considerable flywheel effect, so that substantially the entire plant is operated by ordinary squirrel-cage motors with auto starters, and the whole outfit has given excellent service. It is a capital example of making good with what one can get, instead of grumbling over the unattainable.

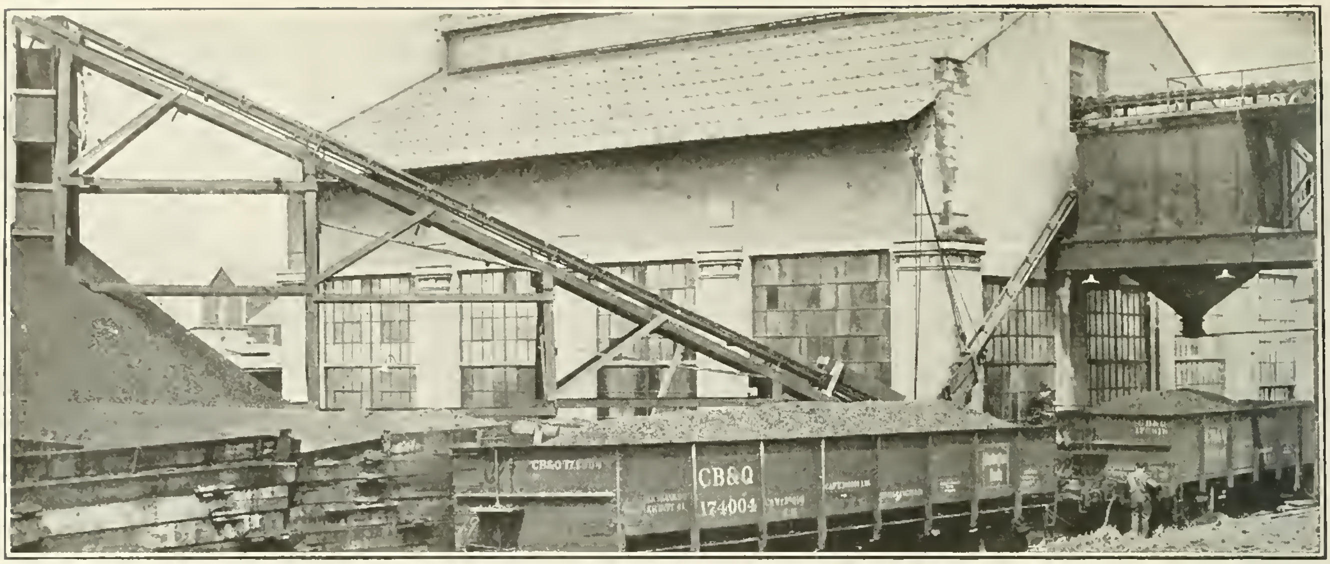
Co-operative Movement on the Pacific Coast

ONE of the latest plans for bringing the industry together is outlined by S. M. Kennedy in this issue. Like much that is done on the Pacific Coast, the scheme is as original as it is frank, for there they call a spade a spade. The essence of the whole campaign is to let each man see the other side of the page, the side the other fellow is familiar with; then, after looking outward at the other man's problems and troubles, each man can better look inward and see where he falls short and where he can help himself by helping the other fellow. Although co-operation is the impelling motive, it is taken for granted that each branch of the industry will sustain itself and not fatten on some other branch's efforts.

A great poet has said, "They also serve who only stand and wait," but that saying most certainly does not apply to the electric business. If the central station builds generating plants and distribution lines and only stands and waits for a load, it never will get it. If a dealer opens a shop and puts in an inconsequential stock, poorly displayed, and only stands and waits for customers, he never will have a paying business. The essence of the electrical business is action. Each of the branches of the industry has its function, but if one branch does not do its whole part, then the work must be carried on by another branch. There was a time when the central station not only generated and distributed energy but also was manufacturer, jobber, contractor and dealer. This condition was not the central station's own seeking, but was the outcome of necessity. Gradually conditions changed, and others took up much of the work the central stations had been compelled to do. To-day the average central station desires only to manufacture the energy it distributes. It is in no sense a jobber or a contractor or a dealer in merchandise. But the central station must have a load, and this load must be sought and built up. It cannot stand and wait for the load to come. The work has been started and must be continued. The central station is not only willing but anxious to pass the work of load-building on to others in so far as it pertains to merchandising, but the others who take it up most demonstrate their ability to do it.

The Coming Issues

ANOTHER article on iron wire will be printed soon in the ELECTRICAL WORLD which should be of interest to engineers who are trying to get along with less expensive line construction. It will dwell on the sags permissible with iron wire and with means of still further decreasing iron-wire construction costs. The second installment of Professor Clewell's article on motor drive in paper and pulp mills (Part I appears in this issue) will refer to adjustable-speed motor applications, the operation of Jordan engines, calenders and platers, and to the control of various machines used in this industry. Features of a recently completed hydroelectric station, plant construction costs and the results of an investigation to determine the heating of conductors under different conditions will form the basis of other articles.



Storing Coal in a Small Plant

Description of Method Used in a Medium-Size Plant Where a Flexible System of Portable Conveyors Is Tied in with Coal-Handling Equipment—Circular System of Piling Adopted—Estimated Cost of Storing and Reclaiming, 20 Cents per Ton

Owing to war conditions coal storage has become of unusual importance, and if instructions are followed, more coal will be stored this summer than ever before in the history of the country. As a war expedient storage has become necessary, and there are reasons why the present movement should continue in normal times. Equalization of the transportation problem—that is, moving as much of the coal as possible in the spring and summer instead of in the fall months, when the railway equipment is needed for handling crops, or in the winter, when the cost of operation is greatest—and the extension of the working mining period from two-thirds to a normal business year should result in a reduction in charges that would practically balance the cost of storage. These are possibilities of the future. To meet the present emergency coal is being stored in numerous ways and by a wide variety of equipment. An account of what has been done at the educational institution conducted by the Loyal Order of Moose at Mooseheart, Ill., and the proposed extensions for the coming summer may be of interest.

About 8500 tons of coal—1¼-in. (3.18-cm.) Franklin County nut and ¾-in. (1.9-cm.) screenings—was burned last year. With the increasing demands on the plant it is expected that the annual coal consumption for the coming year will be approximately 11,000 tons.

Storage was begun in the summer of 1917, as some of the difficulties of obtaining an adequate supply of fuel were already anticipated at that time. Coal was received in a track hopper and elevated by a continuous conveyor, as usual, but, instead of being delivered to a 40-ton overhead bunker in the station, was discharged through a chute into a semi-portable conveyor used to stack the fuel in a pile. The conveyor is of the Barber-Greene type, is 60 ft. (18.3 m.) long, has an 18-in. (45.7-cm.) four-ply canvas belt and is driven by a 5-hp. motor mounted on one end of the frame. When uniformly loaded the conveyor has a capacity of 40 tons per hour and operates at an angle of 25 deg. with the horizontal.

In order to get 3000 tons on one pile the coal was pulled back from the conveyor by an improvised scraper operated by a 7½-hp. gasoline engine through a drum and 200 ft. (61 m.) of ⅝-in. (15.9-mm.) cable. A rope attached to the back of the scraper and passing around a pulley on the opposite side of the pile was used to pull the scraper back to the starting position. The loose end of the rope was brought back to the engine and, with the drum thrown out of gear, was given a half hitch around the capstan, so that the engine did the work. To perform this operation three men were required—one to handle the scraper, one to operate the engine and the third to place the rope on the capstan. During the coming season reclaiming will be effected by laying the semi-portable conveyor flat on the ground, turning it end for end and directing it to discharge the coal shoveled onto it from the pile into the railway track hopper, the plant conveyor then handling the fuel as usual.

With so much rehandling of coal, storage proved rather expensive last summer, the labor cost for storing and reclaiming exceeding 40 cents per ton. In addition, fires developed and a great deal of shifting with the scraper had to be done before they could be brought under control. However, the first summer of storage was profitable in that several things to be avoided were learned by experience. For example, water pockets were left in the pile by using the scraper, thus helping to disintegrate the coal; furthermore, the screenings were stored with the nut coal, producing an ideal condition for spontaneous combustion, since the fine coal fills the interstices beween lumps, shuting off the circulation of air. When piled in alternate layers as the coal would be in this case, conditions are more unfavorable, as the coarse coal would allow sufficient air to get through to feed a fire in the fine coal but not enough to keep down the temperature.

Trouble was also experienced from using a retaining wall of planks around the pile of coal. Fires started in several places around the outside and near the bottom of the pile, first being observed around the boards supporting the retaining wall. Eventually they caught fire and had to be removed. The scraper was used to work over the pile in an effort to remove the burning coal, and it had to be retained in service nearly all summer. To ventilate and cool the coal, perforated iron pipes were driven down into the pile, but the only effect they seemed to have was to furnish enough air to burn the coal immediately surrounding the pipes.

This year the storage piles will be smaller and arranged so that burning coal may be readily removed. There will be no extraneous matter in the coal, such as wood or oily waste, to precipitate a fire, and an effort will be made to pile separately the screenings and the lump or nut coal. The proposed layout is shown here. It may be noticed that a portable conveyor mounted on an adjustable two-wheel truck and a pivoted chute connecting it with the semi-portable conveyor installed in 1917 has been added to the equipment. The portable conveyor has a four-ply endless rubber belt 18 in. (45.7 cm.) wide and 51 ft. (15.5 m.) long between pulley centers. The capacity is the same as that of the other conveyor, and the driving force is supplied by a 5-hp. motor mounted in the frame.

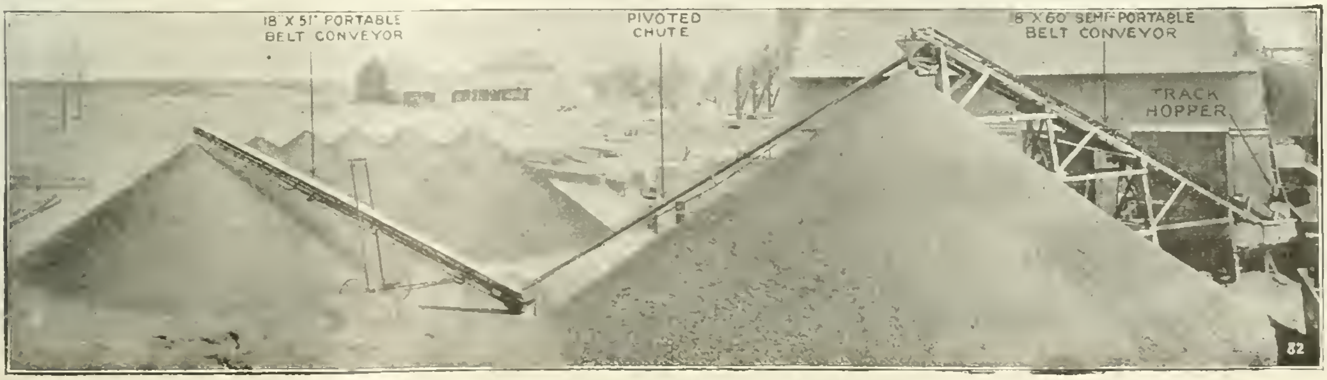
In storing the coal this summer the central pile fed by the semi-portable conveyor will be allowed to assume its natural angle of repose, about 40 deg. There will be no scraping back from the conveyor. With the apex 30 ft. (9.1 m.) above the base the pile will contain approximately 960 tons of coal. With the end of the semi-portable conveyor as a center, the coal will then be stored in a circular pile—or, rather, series of piles—around the central storage by means of the connecting chute and the portable conveyor shown. The limitations of the property allow an arc of 180 deg. for the outside pile. Its dimensions will be about 46 ft. (14 m.) wide and 19 ft. (5.8 m.) high to the apex, and the storage about 3000 tons. With the layout previously described heating of the coal will present no serious difficulty, since burning coal can be removed at any point with facility.

As it is the intention to store as much of the coal consumed annually as it is possible to obtain, a similar system will be started on the opposite side of the coal spur, where there is room for a complete outside circular pile, giving an additional storage of 6000 tons. In this case it will be necessary to lengthen the semi-portable conveyor from 60 ft. to 132 ft. (18.3 m. to 40.2 m.) and use a 7½-hp. motor to drive it. The belt is spliced with alligator lacing so that the additional length can be inserted without cutting the belt, and the required number of sections can be added easily to the frame.

Reclaiming from the central piles will be effected by leveling the semi-portable conveyor, turning it end for end and shoveling coal onto it from the pile. From the circular pile the coal will be shoveled onto the portable conveyor, discharged onto the semi-portable outfit and delivered into the track hopper, from which the power plant equipment will elevate it to the overhead bunkers. A self-loader, in reducing the labor requirements, would lessen the cost of reclaiming the coal, and it is possible that such an apparatus may be used.

Flexibility and comparative cheapness are the outstanding features of the equipment which has been described. The initial cost was close to $2,000. With the equipment out in the open an allowance for depreciation and upkeep of 15 to 20 per cent should be conservative for the frame. A commonly accepted figure chargeable to belt wear is 0.5 cent to 1 cent per ton of coal handled. Interest on the investment may be placed at 6 per cent. The unit fixed cost per year will depend upon the amount of coal stored. An estimate is given below for 6000 tons, although with the present layout and equipment there is room for 10,000 tons of coal. Depreciation and upkeep on the frames of the conveyors at 20 per cent will amount to $200, the belts forming about half of the investment or 3⅓ cents per ton. Belt wear at 1 cent per ton will total $60, and interest at 6 per cent on $2,000 will amount to $120. The total fixed charges per year will then be $380, reducing, on the basis of 6000 tons, to 6⅓ cents per ton.

The operating charges depend upon the power-plant facilities for receiving coal, which are limited to three cars per day of eight hours, or 120 tons. In storing coal two men at $3.50 per day will be required. The labor charge reduces to 6 cents per ton. In reclaiming three men at $3.50 per day will be used, and each can readily shovel 5 tons per day, so that the cost is 7 cents per ton. A self-loader having a capacity of 25 tons per hour and costing about $1,000 would reduce this figure. The cost of power, grease, etc., will be slight, so that storing and reclaiming of the coal should cost close to 20 cents per ton. This figure does not include the cost of running the power-plant conveyor when storing the coal, so that the total cost will be slightly in excess of the above amount. Even then the cost is low considering the tonnage. It is a good indication of what may be done in a small plant.



Characteristics of Iron and Steel Conductors—I

The Use of Iron and Steel for Transmission Conductors Has Been Greatly Stimulated by War Emergencies—Complete Test Data for Calculation of Electrical Characteristics Now Available

BY CHARLES E. OAKES AND P. A. B. SAHM
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THE practice of using iron or steel wire or cable for extensions to electrical supply systems where the load to be connected is small and often comparatively distant has been increasing during the past year. The extent of its use is not generally realized. From time to time short articles have appeared in the technical press giving the characteristics of certain sizes and kinds of wire used in particular cases with which the author concerned has had experience. This article is a symposium of what has appeared on the electrical characteristics of such wire. A second article follows with a large amount of new material on the mechanical characteristics arranged so that it may be either copied or made available in the form of curves to suit the convenience of the reader.

TABLE I—ALTERNATING-CURRENT RESISTANCES OF A SINGLE CONDUCTOR IRON WIRE AT 60 CYCLES IN OHMS PER MILE
$R = a + I_r b$

Size	Range of Current (Amperes)	a	b
Seven-strand nominal diameter:			
⅜-in. ordinary grade steel	0—20	5.0	0.016
$\frac{5}{16}$-in. E. B. B	0—6	4.3	0.066
	6—10	3.4	0.22
$\frac{5}{16}$-in. B. B	0—10	5.25	0.035
	10—15	4.7	0.094
$\frac{5}{16}$-in. ordinary grade steel	0—10	5.5	0.045
	10—14	5.3	0.064
$\frac{5}{16}$-in. Siemens-Martin	0—20	7.1	0.007
¼-in. E. B. B	0—6	7.8	0.07
	6—12	7.2	0.171
	12—16	6.2	0.262
¼-in. ordinary grade steel	0—5	8.82	0.032
	5—16	9.5	0.094
¼-in. Siemens-Martin	0—10	9.2	0.03
	10—16	8.8	0.072
Solid B. W. G.:			
No. 4 E. B. B	0—6	6.2	1.27
	6—10	8.2	1.14
No. 4 B. B	0—2	7.1	6.5
	2—7	6.3	1.06
	7—9	8.5	0.7
No. 6 E. B. B	0—5	8.0	1.88
	5—7	12	1.1
	7—13	20	0
No. 6 B. B	0—7	8.7	1.25

The resistance of a conductor carrying an alternating current is affected by the frequency and by the magnetic properties of the conductor. For iron and steel wires the resistance is increased by the combined action of skin effect and the increase in permeability. Hysteresis and eddy-current losses also contribute to the effective resistance of the wire. The effective resistance is a function of all these factors and has a value such that when multiplied by the square of the current it will give the power loss in the line.

The resistance of a wire of given size and material will vary through a wide range for samples taken as representative for several heats. The processes used in the fabrication of the wire are such that the electrical properties vary over an appreciable range. If curves of current against resistance are plotted for a number of samples of wire of similar physical characteristics, it will be found that there will be a variation in the resistance of the several samples in some cases as great as 5 per cent from the average. For this reason a high degree of accuracy in calculations is not warranted. Such curves follow no simple mathematical law, but for practical purposes averages of a large number of tests will be made available by the following procedure.

Between certain specified limiting values of current the effective resistance of an iron wire may be expressed as a function of the current. This expression will be of the form:

$$R = a + I_r b \qquad (1)$$

where I_r is the load current and R is the alternating-current resistance in ohms per mile of conductor at 60 cycles; a is the intercept of the straight line for the current range under consideration on the R-axis and is given in Table I; b is a constant for the current range under consideration and is given in Table I. It is the tangent of the angle which the assumed straight line makes with the I_r axis. This expression assumes a straight-line law between current and resistance for specified limits of current.

TABLE II—INTERNAL INDUCTIVE REACTANCES OF SINGLE CONDUCTOR AT 60 CYCLES IN OHMS PER MILE
$X_i = c + I_r d$

Size	Range of Current (Amperes)	c	d
Seven-strand, nominal diameter:			
⅜-in. ordinary grade steel	0—5	0	1.2
	5—20	1.1	0.026
$\frac{5}{16}$-in. E. B. B	0—3	0	1.25
	3—6	0.5	0.25
	6—10	1.3	0.12
	10—14	3	—0.05
$\frac{5}{16}$-in. B. B	0—7	0	1.3
	7—16	0.6	0.106
$\frac{5}{16}$-in. ordinary grade steel	0—2	0	0.36
	2—20	0.16	0.055
$\frac{5}{16}$-in. Siemens-Martin	0—20	0	0.04
¼-in. E. B. B	0—5	0	0.45
	5—12	1.2	1.79
	12—18	0.6	2.28
¼-in. ordinary grade steel	0—5	0	1.2
	5—12	0.5	1.44
¼-in. Siemens-Martin	0—1.7	0	1.3
	1.7—8	1.2	0.05
	8—16	0.8	0.1
Solid B. W. G.:			
No. 4 E. B. B	2—10	5.6	0.24
No. 4 B. B	0—1	0	3.4
	1—2	1.6	1.75
	2—3	2.8	1.13
	3—5	3.7	0.82
	5—7	5.2	0.52
	7—10	6.95	0.275
No. 6 E. B. B	0—1	0	6
	1—2	3.4	2.6
	2—4	6.7	0.95
	4—8	10.2	0.01
	8—12	13	—0.266

The power loss, neglecting that due to charging current (in this case the load current becomes the line current), may be expressed as follows:

$$P_l = I_r^2 (a + I_r b) l \qquad (2)$$

The current may be expressed in terms of the power delivered, P, and the voltage at the receiver, E, as follows:

$$I_r = P/(E\cos\theta), \qquad (3)$$

from which

$$P_r = (laP^2)/(E^2\cos^2\theta) + (blP^3)/(E^3\cos^3\theta) \qquad (4)$$

where P_r is the power loss per conductor; P is the power delivered; a and b can be obtained for the wire and current under consideration in Table I; l is the length in miles of one conductor of the line and cos θ is the power factor of the load. The power loss due to the charging current is considered later.

The reactance of a magnetic conductor is made up of two factors—the external reactance, which may be calculated when the physical dimensions of the circuit in air are known, and the internal reactance, which is a function of the permeability. The internal reactance of iron and steel wires of like dimensions and of similar physical properties is subject to variation over a considerable range in much the same manner as the resistance. The internal reactance may be expressed by an equation of the form $X_i = c + I_r d$, where X_i is the internal reactance in ohms per mile of conductor at 60 cycles.

TABLE III—EXTERNAL INDUCTIVE REACTANCE OF A SINGLE CONDUCTOR AT 60 CYCLES IN OHMS PER MILE

From formula $X = 2\pi f \times 740.5 \log 2D/d \times 10^{-6}$ for solid conductors and $X = 2\pi f\,(91.8 + 741.13 \log 2D/d)\,10^{-6}$ for stranded conductors.

Size	Spacing—Inches										
Stranded, Nominal Diameter, In.	12	18	24	36	48	60	72	84	96	108	120
½	0.421	0.470	0.505	0.554	0.589	0.616	0.639	0.657	0.673	0.688	0.701
7/16	0.434	0.483	0.518	0.568	0.599	0.630	0.652	0.670	0.686	0.701	0.710
⅜	0.460	0.509	0.544	0.593	0.628	0.655	0.678	0.696	0.712	0.726	0.739
5/16	0.471	0.521	0.555	0.604	0.639	0.667	0.689	0.708	0.723	0.738	0.751
¼	0.504	0.554	0.589	0.638	0.672	0.700	0.722	0.740	0.754	0.763	0.781
Solid B. W. G.:											
No. 4	0.560	0.609	0.644	0.694	0.728	0.755	0.778	0.796	0.814	0.826	0.840
No. 6	0.579	0.629	0.664	0.713	0.747	0.775	0.798	0.815	0.831	0.846	0.858
No. 8	0.605	0.654	0.688	0.737	0.773	0.801	0.823	0.840	0.857	0.870	0.885
No. 10	0.630	0.679	0.713	0.763	0.798	0.825	0.847	0.865	0.882	0.896	0.909
No. 12	0.654	0.704	0.740	0.787	0.824	0.850	0.873	0.891	0.908	0.92	0.930

As in the case of resistance data a straight-line law is assumed between specified limits of current. In this equation c is the intercept on the X_i axis for the current under consideration and is given in Table II; d is a constant for the current range under consideration and is also given in Table II.

Tables I and II are the result of the assembly in the form indicated above of all the available curves of resistance and internal reactance for iron and steel wires which have appeared in the technical press. Special attention is called to the fact that they apply only to 60-cycle circuits. As the external inductive reactances are not generally available in the sizes of wires which are used in the fabrication of steel and iron wire into cables, Table III has been computed and is similar to tables appearing in the hand books for other sizes of wires. It is perfectly obvious that, since the external reactance is not a function of the material of the wire, this table can be used for all grades (B. B., E. B. B., ordinary steel and Siemens-Martin), whereas for the internal inductive reactance the grades must be distinguished from each other and listed under a given size, as has been done in Table II.

Since the most economical current-carrying capacity which can be used for iron or steel wire is in the neighborhood of 1 amp. per 10,000 circ. mils, transmission of large currents is not economically permissible. The charging current is therefore no mean factor and must be taken account of in the consideration of transmission losses. Even in comparatively short lines the capacity current is an appreciable part of the total current.

If it be assumed that one-half of the capacity current of the line flows to the receiving end, which is usually justified for the transmission distances which will be encountered in practice, the line current becomes:

$$I_l^2 = [I_r \sin\theta - (I_c/2)]^2 + I_r^2\cos^2\theta \qquad (5)$$

where I_l = the line current, corresponding to I_r in equations (1) and (2), I_r = load current, I_c = capacity current, cosθ = load power factor.

TABLE IV—CHARGING CURRENT IN A SINGLE WIRE PER 100,000 VOLTS AT 60 CYCLES IN AMPERES PER MILE, FROM PHASE WIRE TO NEUTRAL

From formula $I = (2\pi f \times 38.88 \times 10^{-9}) / [\log_{10}(2D/d - d/2D)]$

Size	Spacing—Inches										
Stranded, Nominal Diameter, In.	12	18	24	36	48	60	72	84	96	108	120
½	1.041	0.925	0.858	0.775	0.730	0.695	0.67	0.65	0.634	0.621	0.609
7/16	0.83	0.755	0.708	0.652	0.618	0.593	0.574	0.560	0.548	0.537	0.528
⅜	0.948	0.853	0.783	0.724	0.681	0.652	0.63	0.618	0.598	0.586	0.574
5/16	0.772	0.706	0.665	0.615	0.584	0.563	0.546	0.533	0.522	0.512	0.504
¼	0.72	0.662	0.627	0.582	0.555	0.535	0.520	0.508	0.497	0.489	0.482
Solid B. W. G.:											
No. 4	0.730	0.673	0.635	0.590	0.562	0.542	0.526	0.514	0.503	0.496	0.487
No. 6	0.707	0.651	0.618	0.574	0.548	0.528	0.514	0.502	0.492	0.484	0.477
No. 8	0.677	0.627	0.594	0.555	0.530	0.511	0.498	0.487	0.477	0.470	0.463
No. 10	0.650	0.602	0.574	0.536	0.513	0.496	0.483	0.473	0.464	0.456	0.450
No. 12	0.6225	0.578	0.550	0.516	0.4935	0.4778	0.466	0.456	0.448	0.442	0.436

Substituting $P/E\cos\theta$ for I_r, the following is obtained:

$$I_l^2 = [(P/E)\tan\theta - (I_c/2)]^2 + P^2/E^2 \qquad (6)$$

in which P and E have the same significance as above. The power loss is:

$$P_r = I_l^2\,(a + I_l b)\,l \qquad (7)$$

A table of charging currents is given in Table IV for the various sizes of wire concerned herein.

The charging current is of course not dependent on the material of the wire used and is thus identical with the charging current which would be obtained with copper wire of the same cross-section. The fact that the capacity current in the longer lines is necessarily a large per cent of the total current which it is economically feasible to use results in poor voltage regulation.

It is none too early for the American business man to begin thinking of these ships in terms of modern delivery service to foreign customers. And not the business man alone, but the farmer, the consumer, the community—the whole American nation. We must get ships into our thinking and planning and work, just as we have got railroads into the American consciousness. When the war ends, there will be work for ships all over the world.—*Edward N. Hurley, Chairman United States Shipping Board.*

Motor Drive in Paper and Pulp Mills—I

Important Applications, Particularly Beaters and Grinders—Variations in Power Requirements —Examples of Group and Individual Drive, Showing Type of Installation That Has Worked Out Well in These Plants

BY C. E. CLEWELL
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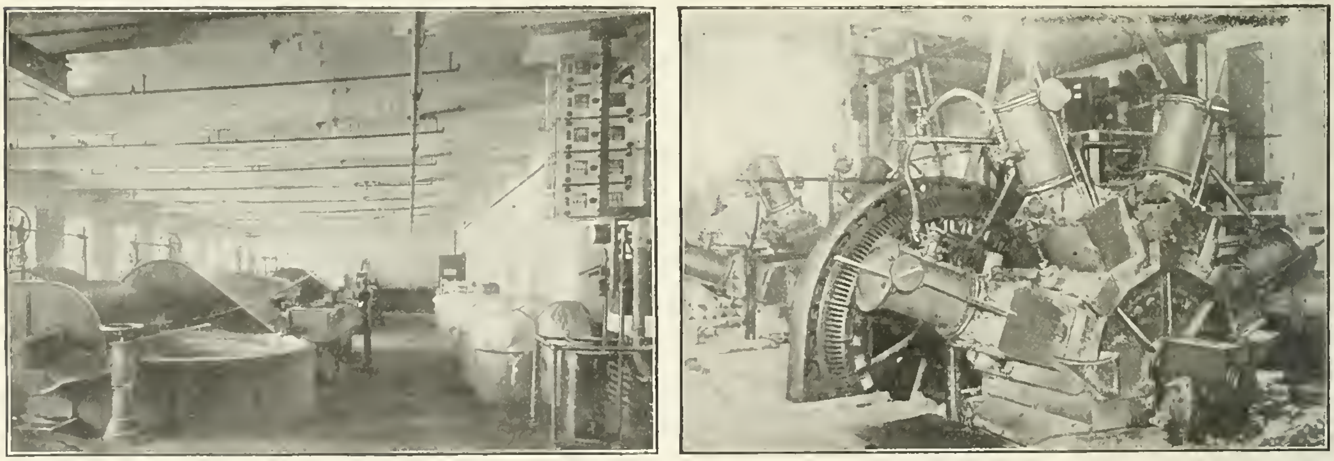
ONE of the most interesting applications of power through the medium of the motor is that of the various machines employed in the manufacture of paper. This is true partly because of the numerous kinds of machinery found in such plants and also on account of the heavy torque requirements imposed on the driving motor by certain classes of the equipment, which have called for the particular attention of motor manufacturers in the design of motors and control apparatus to suit given conditions. It is estimated that roughly 300,000 hp. has been installed in the form of motors in this field alone—a fact which indicates that the motor has satisfactorily filled the operating requirements of a great deal of the pulp and paper mill machinery involved.

Even a casual survey of the reasons for the widespread adoption of motors in these mills shows that the fundamental advantages of electric drive have been largely responsible for its acceptance by the paper industry. Among the prominent benefits afforded by electric drive is the flexible distribution of power which permits arranging the machinery more or less independently from the standpoint of the power supply; furthermore, a distinct opportunity for realizing highly efficient production is permitted through the study of the duty cycle of special machines and the selection and use of a motor best suited to meet their requirements.

One of the obstacles to a good perspective of the operations conducted in paper and pulp mills is the lack of familiarity concerning the manufacturing processes involved. While it is outside of the range of this article to go into the details of these operations, references will be made throughout the discussion to specific machines. As is usually the case in other industries, quite a number of appliances are found in the average paper and pulp mills which are in the nature of auxiliary apparatus and which are suited to operation by the motor. Among these are the elevators, water supply pumps, conveyors and exhaust fans. Other apparatus which is particularly identified with paper making has also been found to be especially adapted to motor drive; for example, beaters, grinders, Jordan engines, calenders, platers, screens (both flat and centrifugal), chippers and shredders, rotary boilers and digesters, pumps of the stuff, suction-box, white-water and effluent types, winders, re-winders and cutters, together with such machines as agitators, mixers, slushers and concentrators.[1]



FIGS. 1 AND 2—SEVEN RAG BEATERS DRIVEN BY A 200-HP. SLIP-RING INDUCTION MOTOR; 1200-HP. INDIVIDUAL DRIVE MOTORS

From the foregoing list it is apparent that the types of machines suited to motor drive are both numerous and widely variable in their characteristics. Perhaps it is best, therefore, in a brief discussion of this kind to limit the treatment to a few representative machines, so it is proposed to confine the explanation of specific applications to beaters and grinders in this installment, with notes on the types of motors most widely used, and to point out characteristic arrangements of driving both for individual and for group methods of applying the motor. A subsequent installment will take up the important subject of control for paper and pulp mill motors and will outline some of the features connected with motor operation of Jordan engines, calenders and platers.

In a general way, the field may be said to include uses for both squirrel-cage and wound-rotor induction motors; for the adjustable-speed direct-current motor in special cases, some of which are described in the second installment of this article, and for the synchronous motor. The accompanying Table I furnishes a convenient basis for a study of the machinery best suited to each type.[2] A glance at this table shows the prominent place held by induction motors of the squirrel-cage and wound-rotor types and the few special cases where the direct-current motor is employed in the ordinary practice.

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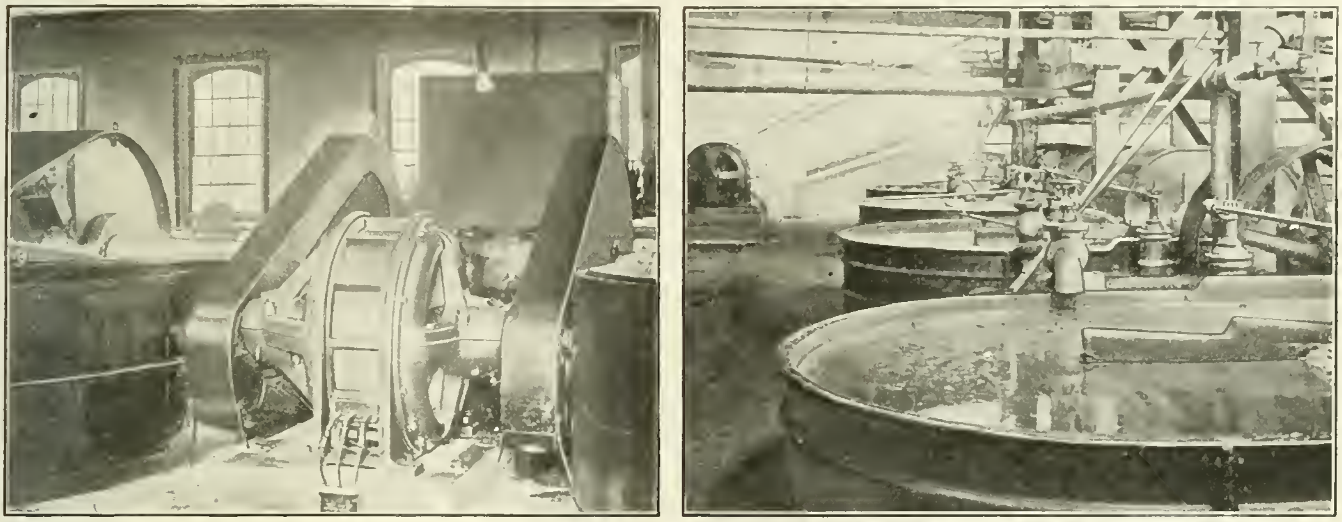
[1] Based on tabulation of paper and pulp mill machinery for motor drive, by Joseph H. Wallace, "Standard Handbook for Electrical Engineers," fourth edition, p. 1271. Some reference has been made to this handbook section; also to a discussion by W. L. Merrill, *Transactions A. I. E. E.*, Vol. 36, Part I, p. 1340, particularly in the discussion of motor types, and to an excellent summary of motor uses throughout this industry in an article by W. W. Cronkhite, *General Electric Review*, May 1917, p. 384, in particular the notes on beaters and grinders.

As a matter of fact Wallace[1] classes the polyphase induction motor as best for all types of paper and pulp machinery which operate at constant speed, but emphasizes the importance of the direct-current adjustable-speed motor in those cases where a number of different speeds are required and where steady acceleration is a necessity for the best results in starting. The lower first cost and operating expense and the greater dependability of the induction motor make it a desirable unit wherever its characteristics are suitable. The synchronous motor is sometimes utilized in a few special cases (see Table I) for purposes of power-factor correction, but only in cases where the starting effort required is within the range for which such motors are designed.

Because of the constant-speed characteristics of the squirrel-cage motor and its tendency to draw an excessive line current at starting, with consequent line voltage fluctuations, it is not practicable to employ this type in paper and pulp mill machines where speed changes are required. Its use is also limited by special starting requirements, as where slow starting and a necessity for coaxing the load are essential. The relatively rigid connection of motor and machinery where chain drive is used may also impose a hammer-blow effect at starting sufficient to make this type of motor objectionable. The utilization of belts will minimize this difficulty.

The two types of auxiliary or extra-resistance induction motors fall either into the class of internal variable-resistance motors or under the collector-ring type. Owing to physical limits to the amount of internal resistance which can be used, the first type of motor is essentially a constant-speed unit. The ability to start gradually is one of its chief advantages. It may be used for low-inertia loads and is recommended for the operation of groups of machinery in certain departments of the mill. (See Table I.)

The collector-ring or standard wound-rotor type has the characteristic of high starting torque, and when the control is properly designed it may be used for coaxing along a jammed load with several starts. This is a feature which is fairly common in certain pulp-mill machines owing to the settling of stock between periods of operation, making it necessary to exert a very heavy effort to loosen the stock preparatory to starting the machine again. Where variable-speed operation is expected from this type of motor, due allowance must be made for the fact that the speed regulation may be poor for any given setting of the adjustable rotor resistance.



FIGS. 3 AND 4—ONE MOTOR DRIVING TWO PULP-MILL BEATERS; WOUND-ROTOR MOTOR DRIVING BEATERS THROUGH BELT AND SHAFT

As previously mentioned, the synchronous motor may be employed for a few special cases where power-factor correction is a desirable feature and where the starting requirements of the machine are low enough to come within the available torque of the motor, and where the starting current, which is similar to that of the induction motor, is given due consideration in its relation to the generating machinery capacity. For a discussion on the use of the synchronous motor in paper and pulp mills in connection with low pressure turbines, see reference to paper by W. L. Merrill in footnote 1.

The characteristics of the direct-current adjustable-speed motor are such as to meet a few special cases successfully. However, it will be apparent that higher voltages, and hence lower cost, for transmission and distribution circuits can be better realized through induction motors than with direct-current operation. Wallace gives 2200 volts as a common pressure for alternating-current motors rated at 75 hp. and more. For smaller alternating-current motors 440 and 550 volts are common. The absence of a commutator is a distinct operating advantage in paper mills.

The "Standard Handbook for Electrical Engineers" contains a summary of some interesting tests of paper and pulp mill machinery which bring out the extreme variations of the power required to operate given machines as the conditions change from time to time. One or two statements based on these tests are included here because of the light they throw upon the difficulty of a determination of exact power requirements of such machinery. For example, three tests were conducted on motor-driven Jordan engines, two on one machine at different times and the third test on a second machine of the same size. These tests show variations of the kilowatt input to the driving motor ranging from about 115 kw. in the first test to 135 in the second and to 240, as a maximum, in the third. A somewhat similar test on a group of so-called wet machines showed variations from 18 kw. to 36 kw. during their operation. The approximate power required for various paper-making machines can best be shown by a table, as in previous articles, this particular tabulation being due to J. H. Wallace.[1]

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[2] Rearranged in alphabetical form, abridged and modified slightly on the basis of a tabulation by W. L. Merrill. See footnote 1.

The arrangement of paper-mill motors with respect to the machinery to be driven depends, as usual in such work, upon a number of factors, one of which is that of local conditions and another the general layout of the plant. Preference for individual motor drive seems to be general for the larger machines such as the grinder in the foreground of Fig. 2. In many cases, however, the machines are driven in groups from a given larger motor, or possibly in pairs of machines from each motor. Fig. 5 is a case of one large motor applied to four pulp-mill beaters, the machinery being arranged in pairs according to the power supply standpoint. Fig. 3 shows another way of driving pulp beaters, two being driven by one motor in this case.

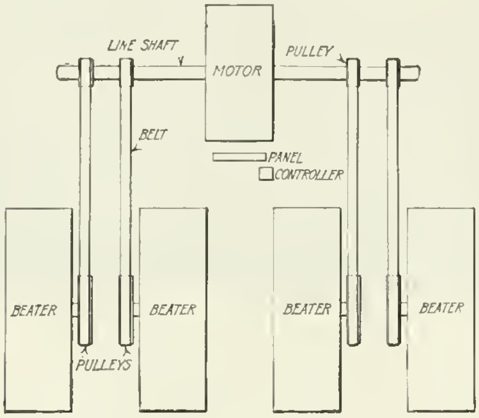

FIG. 5—METHOD OF DRIVING FOUR BEATERS BY ONE MOTOR

An interesting case of group driving is shown in Fig. 1, which refers to a 200-hp. wound-rotor induction motor driving seven rag beaters. The individual method of motor drive is well illustrated by Fig. 2 for large machines, the motor being a 1200-hp. induction motor operating a group of eight pieces of paper and pulp mill machinery.

For purposes of specific discussion, the beater and grinder are selected as examples of motor applications in this industry, with other cases to be treated in the second installment of this article. The induction motor, and preefrably the wound-rotor type, is commonly used for the beaters, as in Figs. 1, 3 and 4. For grinders, one of which is shown in Fig. 2, both slip-ring induction and synchronous motors are employed with good results.

Refinements in the application of the motor to such machinery, aside from the mere determination of horsepower and general type of motor, include consideration of the variations of torque required for various operations of the beater such as occur in washing pulps, beating and dumping, as well as the peaks of torque such as occur when the beater rolls are turned down. Tests under operating conditions show considerable variations of torque from a straight line during the process of beating, the peaks of which may, however, be relatively small in proportion to the average torque involved. The horsepower of beaters is sometimes based on the horsepower per inch width of face of the roll of the beater. Thus one value given is 1 hp. per inch width of beater-roll face. The actual requirements may be more or less than this, depending on the class of stock handled.

TABLE I—TYPES OF MACHINERY AND MOTORS FOR PAPER AND PULP MILLS

Name of Machinery	*Type of Motor for Individual Drive
Agitators	Induction, s.c. or i.r.
Band saws	Induction, s.r. (inclosed rings)
Barkers	Induction, s.c.
Beaters and washers	Induction, s.r. (often in pairs)
Centrifugal screens	Induction, s.r.
Chippers	Induction, s.r.
Circular saws	Induction, s.c., i.r. or s.r.
Deckers	Induction, s.c. or i.r. (in groups)
Flat-bed Screens:	
Groups	Induction, i.r., s.r. or synchronous
Individual	Induction, s.c.
Grinder lines	Induction, s.r. or synchronous
Heavy conveyors and log hauls	Induction, s.r.
Jordans, Marshalls and Clafins	Induction, s.c., i.r., s.r. or synchronous
Platers	Induction, s.c.
Pumps	Induction, s.c. or i.r.
Rag cutters, dusters and threshers	Induction, s.c.
Rotary boilers	Induction, s.c.
Rotary cutters	Induction, s.c. with mechanical speed change or d.-c. a.s.
Rotary furnaces	Induction, s.c.
Rotary screens	(No specific type given)
Sheet-calenders	Induction, s.r.
Shredders	Induction, s.c. or s.r.
Silver screens	Induction, s.c.
Small conveyors	Induction, s.r.
Super-calenders	Induction, s.c. or d.-c. small motor, special large motor
Vertical cutters	Induction, s.c.
Wet machines	Induction, s.r.

* S.c. indicates squirrel cage; i.r., internal resistance; s.r., slip ring; a.s., adjustable speed.

With the grinders (see Fig. 2) some attention is usually given to the lower average power required owing to irregularity in the time for filling pockets with wood. The pressure employed in grinding and the speed employed are also factors which enter into the refinements of the application problem. Thus, there are differences of opinion as to the best speed to use for grinders, ranging approximately from 210 to 257 r.p.m. The importance of this single item is apparent at once when one considers that the rate of production as well as other inherent factors in the operation of such a machine depend, at least in part, upon the speed with which the operation is performed.

TABLE II—APPROXIMATE POWER REQUIREMENTS FOR PAPER-MAKING MACHINERY

Name of Machinery	Approximate Range of Hp. Required
Barkers	10 to 12
Beaters	30 to 75
Centrifugal screens	10 to 15
Chippers	75 to 100
Constand-speed line or pump line on paper machine	40 to 125
Crushers	25
Fourdrinier machines, variable-speed parts	50 to 400
Grinders	250 to 350
Jordan engines	50 to 300
Screens, flat-plate	4 to 6
Stuff pumps	5 to 10
Super-calenders	50 to 100
Wet machines	8 to 12

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[6] Figs. 2, 3 and 4 are shown by courtesy of the General Electric Company; Fig. 5 is based on a somewhat similar diagram found on page 388 of W. W. Cronkhite's paper previously referred to, and Fig. 1 is due to the Westinghouse Electric Manufacturing Company.

California's Electrical Co-operative Campaign

Outline of the First Year's Activities Carried On in That State for the Purpose of Developing Maximum Intelligent Distribution of Electrical Goods Throughout All Branches of the Industry

BY S. M. KENNEDY
General Agent Southern California Edison Company

PERHAPS no word in our language has been more overworked in recent years than the word "co-operation"—in fact, it has been used so much where it did not belong that, in a measure, it has begun to lose its meaning. On the Pacific Coast there have been some genuine efforts made in the past with only limited success to bring about a spirit of co-operation between the various branches of the electrical industry, and some attempts have been made, under the cloak of co-operation, to force through schemes which really spelled coercion. But in the movement in California to-day there is evidenced a spirit of genuine co-operation throughout the various divisions of the great electrical industry which promises to reach momentous and satisfactory proportions.

ORGANIZATION OF THE MOVEMENT

In April, 1917, there was held in Riverside, Cal., the first convention of the Pacific Coast Section of the National Electric Light Association. The Riverside convention went down in history as one which broke new ground in certain directions and did some original work before it adjourned. At that convention a resolution was adopted which read as follows:

"That the member companies of the Pacific Coast Section lend active co-operation and support to the California Association of Electrical Contractors and Dealers, and that a proposed plan be formulated by the commercial committee."

The members of the commercial committee later met representatives of the contractor-dealers and jobbers who stated that they already had formed certain ideas for the campaign and had raised a sum of money as a nucleus. Ultimately the commercial committee submitted a definite constructive and educational plan to the executive committee of the Pacific Coast Section, which plan after some changes and modifications was finally approved.

The first work was the appointing of a body to formulate and carry on the co-operative campaign. This body is called the advisory committee and consists of eight members—three central-station men, three contractor-dealers, one jobber and one manufacturer. This committee has done much constructive work, and its personnel is worthy of note. It is: Chairman, L. H. Newbert, manager commercial department Pacific Gas & Electric Company, San Francisco; vice-chairmen, G. E. Arbogast, F. E. Newberry Company, contractors, Los Angeles; G. B. McLean, assistant superintendent of sales, Southern California Edison Company, Los Angeles; A. E. Wishon, assistant general manager San Joaquin Light & Power Corporation, Fresno; R. M. Alvord, General Electric Company, San Francisco; D. E. Harris, sales manager Pacific States Electric Company, San Francisco; H. C. Reid, president California Association of Electrical Contractors and Dealers, San Francisco, and M. L. Scoby, Home Electrical, San Francisco.

The advisory committee has arranged to hold regular monthly meetings rotating between the three principal cities in the state, San Francisco, Fresno and Los Angeles. Members of the advisory committee hold unofficial weekly meetings in San Francisco and Los Angeles for informal discussion, and to these meetings are invited those interested in the co-operative movement who care to attend. Ideas gained at these discussions have been found invaluable, influencing in many instances the formal actions of the committee.

It was finally decided that a fund of $12,000 would be required to defray the expenses of the campaign for twelve months. This sum of money was cheerfully subscribed by the various interests, and proportioned so that 50 per cent came from central stations, 25 per cent from jobbers, 16⅔ per cent from contractor-dealers and 8⅓ per cent from manufacturers. The campaign expenses consist principally of salaries and traveling expenses of two field men and office expenses in the two cities, San Francisco in the north and Los Angeles in the south, from which offices the field men work. The field representatives selected are men of training who have in the past come in close contact with the contractor-dealer and the central-station officials, and who know something about the real and imaginary difficulties of the various branches of the industry.

OBJECTS OF THE CAMPAIGN

The aims of those in charge of the campaign may be characterized as simple but definite—simple because they do not involve methods that may be termed experimental, freaky or untried, and definite because the end looked for is a better understanding, through consistent and persistent educational endeavors, between the different branches of the electrical industry and between the individuals representing the different branches in various centers throughout the state. No attempts are being made to dictate to any individual or branch of the business what has to be done. No one part of the industry may say to one neighbor, "Thou shalt not!" or to another, "You must not!" and no one is threatened, intimidated or cajoled. On the other hand, every reasonable effort is being made to educate and inform each branch of the industry as to how its own particular business may be more efficiently handled, and a constant effort is made to assist each branch more intelligently to understand some of the problems and perplexities of the other branches. The campaign is not one of aggressive agitation but rather of progressive education. It is an appeal to the intelligence of the individual rather than an appeal to the old-time prejudices of any group. It is the crystallization of a desire to have each branch of the business recognize the responsibilities it owes to the other branches of the industry and to teach the individual that, after all, he may to some extent still be "his brother's keeper."

Two field men have been appointed to carry on this educational work under the immediate direction of the advisory committee. For the more efficient handling of the campaign the state has been divided into two geographical divisions, the north and the south. Each field man confines his work to his particular division and reports regularly to his local committee. The field men are expected to visit the central-station managers and employees in the various towns and endeavor to influence them to closer co-operation with the contractor-dealers and to interest the contractor-dealers in their own particular association. They earnestly endeavor to promote better acquaintance between all the central-station employees and the dealers and contractors and their employees and to induce the central-station manager to indicate to his organization that it is the central station's policy to encourage and support this co-operative campaign.

The greater portion of the field men's time, however, will be spent with dealers and contractors. They will not only encourage harmony with the central-station men in each locality, but will go further with suggestions and advice along lines tending to help the dealer in handling his own particular business. It cannot be denied that a considerable proportion of the dealers and contractors have had little business training and experience. The field men will tactfully point out, where necessary, such modern business methods as will help the dealer to keep up with his work. Suggestions will be made regarding business getting, window dressing, store appearance, sales advertising, cost accounting, general accounting and other matters of like nature, always keeping in mind the fixed idea that every branch of the industry is directly interested in the increased sale, installation and use of all kinds of energy-consuming devices and appliances.

Intimate records will be kept by field men regarding dealers and contractors, their stores, business and personal character, and these records will be scrutinized by the advisory committee in order to gather intelligent ideas of the results of the field men's work and the permanent progress which has been made.

The advisory committee handles the larger problems affecting the industry, particularly in the relations of the different branches to each other. It successfully presents proposals to the several interests and serves as a common medium of intercourse in smoothing out local or general difficulties and misunderstandings for all parties. It is, in fact, the court of appeal in reconciling difficulties and passing on all suggestions made.

Results Achieved

It is an axiom that "the best test of all work is results," and before considering the results realized and expected it is well to consider the conditions heretofore existing. Perhaps California does not differ very much in electrical family relations when compared with other states in the Union, but at any rate there have been some more or less serious differences of opinion as to methods and responsibilities between various branches of the industry in the Golden State. The central stations as a rule have done everything reasonable to promote a greater use of electricity and increase the development of their business as rapidly as possible. In many parts of the state large blocks of hydroelectric energy have been developed and had to be marketed. The central station has had to find the market and create the demand. In carrying on this important work the central station has had to sell appliances, not only the larger appliances but also the smaller lamp-socket devices. However, in doing this necessary work the majority of central stations have been carrying out a policy of load building rather than a campaign of merchandising.

The manufacturer naturally wants an outlet for his products, and he is pleased to have the central station purchase and sell as many appliances and devices as it can. The manufacturer also wants the jobber, and through him the dealer and contractor, to handle his wares to as great an extent as possible. In other words, the manufacturer wants to sell through any and every channel. The jobber sells some electrical goods, including appliances, to the central station, but his larger and more profitable field is with the dealer and contractor.

The Appliance Business

Now some of the dealers and contractors have felt that all the appliance business should be sold by dealers and contractors only, and that the manufacturers should not sell to the central stations, and the central stations should not sell to their consumers.

The central stations know that it has cost them much money to develop the appliance load. They also know that if some branch of the industry had not done the development work which has created the demand large quantities of appliances would not have been sold and this important load would not have been obtained nor the income which automatically goes with it. The central stations also feel that the dealer and contractor have been reaping the benefit of the promotion work constantly carried on by the central station, and that instead of taking bread out of the dealer's mouth the central station has really been putting bread into his mouth and money into his pocket.

Those in charge of the California electrical co-operative campaign have felt that there are no differences existing between the various branches of the electrical industry which cannot be satisfactorily adjusted. With each branch having a better and clearer understanding of the responsibilities, necessities and ambitions of the other branches, all are better qualified to negotiate, reciprocate and co-operate.

In order that a satisfactory basis might be attained for future efforts it was first considered necessary to get all branches of the industry together, and with this object in mind two big get-together dinners were held, one in March in Los Angeles and the other in June in San Francisco. Each was attended by about 400 earnest men, all meeting on a common ground, with a well-defined common interest at heart.

To many men who have been engaged in the electrical business in the state for some years these dinners were revelations because of the enthusiasm and good-comradeship displayed. Through the excellent work of the field men large attendances were assured, and those who did attend went back to their work feeling that their time had been well spent. One of the field men, in a weekly report written some time after one of these big dinners, said: "Everywhere I have been since the meeting I have heard favorable comments on it, and many have asked when we are going to have another. It has given valuable assistance to our efforts. There are specific cases where it has been reported by dealers that an appreciably improved co-operation on the part of the central-station district agents has resulted from this meeting."

BENEFITS DERIVED AND ANTICIPATED

It is evident from the reports of the field men that the dealers and contractors are not only interested in the campaign but each one is anxious to get some benefit from it. Suggestions regarding window dressing are welcomed and acted upon at once; hints as to the appearance and arrangement of the store are willingly received, and questions are freely asked and cheerfully answered. The contractor-dealer is learning that there is a present benefit to be derived from an attractive place of business as well as a prospective advantage. The work of the field men in bringing together all the electrical heads in each community to discuss over a dinner table the general plans of the campaign and their local application will undoubtedly produce great results. It is plainly seen that such meetings have already done much to remove needless differences and old prejudices, and are really promoting a friendly feeling, based upon a realization that there is a community of interest in the business and that all may benefit by a better understanding and a closer co-operation. Some of the benefits already realized in certain towns and districts as a result of these meetings are:

1. The central stations and dealers agree to sell all lamps and appliances at manufacturers' list prices.

2. Central stations and dealers agree to sell on the same terms and conditions where sales are made upon deferred-payment plans.

3. Dealers and central stations agree upon the same scale of charges for repairs to electrical appliances.

4. Central stations are offering dealers the privilege of displaying in the central-station offices and showrooms special lines which they (the dealers) control. Dealers place neatly printed cards on these displays, giving what information they desire, and the central-station employees send inquirers to the dealers making such displays, or even make sales for the dealers without charge of any kind.

5. Central stations are offering to advertise the names and addresses of local dealers in their newspaper advertisements where dealers handle similar appliances to those advertised by the central station.

6. Some important central stations have agreed to withdraw their outdoor salesmen entirely from any district as soon as the advisory committee reports that the contractor-dealers in that district are in a position to handle properly the appliance sales and do the necessary work to continue the development of the business.

7. There seems to be a gradual awakening of electrical contractor-dealers to the possibilities of the retail side of their business, and they are surprised and pleased to find that the central-station men are fair and reasonable and are glad to meet them more than half way.

Considering the relatively short time that the active work of the campaign has been in operation, those in charge have a right to feel pleased with the results already attained. The ground has been broken, interest has been awakened, and advantages in getting together have been realized, in many instances, even before they were pointed out. The field now must be cultivated by careful, intelligent work and irrigated with the waters of courtesy, frankness and good feeling, pumped from the wells of experience and wisdom.

The California electrical co-operative campaign is educational and constructive It is pointing out to the contractor-dealer the promised land—the green vista of orders, sales and profits, not in the far distant future, but close at hand. The educational work prepares the contractor-dealer for what is coming to him if he only qualifies, and also prepares the central station for accepting the dealer's qualifications and gradually transferring the merchandising business where it belongs. The contractor-dealer must learn that he accepts added responsibilities which he must live up to if his ambitions are to be realized, and the central station must not forget that Rome was not built in a day and that the contractor-dealer will need constant assistance and co-operation to enable him to rise to the plane he is expected to reach. The California electrical co-operative campaign is now approaching the period when its work will be more clearly defined and really constructive in its character, and this work should soon lead up to the period when tangible results may be expected. The campaign was planned and financed for one year, but one year will only demonstrate how much it may be possible to accomplish. It seems evident, therefore, that the results of the first year's work will justify the continuation of the co-operative campaign along the same broad lines for some time to come.

Great men represent investments to their nations which cannot be counted even in millions of dollars. This nation must not become dependent altogether upon the scientific thought of others. Without the realization of the importance of original thought and investigation, the cultivation of science and the theory of its application, solely for the fascination and interest they exercise inherently upon some minds; without the realization of the importance of the modification of the department-store system of university education, of the fallacy of expecting great results from men "told" to make discoveries rather than creating an atmosphere in which those especially gifted may devote themselves to investigation; without the appreciation of such almost obvious premises, we cannot attain the scientific eminence which is the glory of England and of France and the source of human industry, and which we should covet for the greatness of America, our country.—*B. A. Behrend, Transactions A. I. E. E.*, Vol. 36 (1917), page 888.

What Commissions Are Doing on Rates

Careful Review of Conditions in California, Where the Applications So Far Cover More Than 50 per Cent of the Electric Utility Business—Action in Other States

Dealing with the general ideas underlying the attitude of state commissions on the question of electric rate advances, this article supplements similar articles in the issues of June 8 and June 29, 1918. It will be followed by other articles on the same vital subject.

IN ANALYZING and weighing the rate increases of electric central stations under war conditions the state regulating commissions are doing a public service which is highly important in the war program. They have had such large powers with respect to the companies that they are very familiar with operating conditions. They know that before the war began the companies generally had been regulated or keenly observed with respect to earnings on the capital investment. They are also accurately posted in regard to the heavy burden of extra cost which has grown with the progress of the war. The commissions appreciate that remedial measures are necessary.

Steps Taken by California Commission

Lester S. Ready, gas and electric engineer California Railroad Commission, says to the Electrical World:

"The commission is authorizing electric utilities to increase rates on a definite showing of increased costs of operation where such increased costs of operation have reduced the net return below that which may be considered as a reasonable return under the conditions as they exist. In doing this the commission is giving special consideration to the preservation of the utilities' financial integrity.

"Three important applications for increase of electric rates, due to increased costs and emergency conditions, have been decided, as follows:

"Application 3531, San Joaquin Light & Power Corporation.—In the decision in this application the commission authorized the addition of a definite surcharge of 10 per cent to be added to all bills for service in accordance with the regular filed schedules. In the case of the San Joaquin Light & Power Corporation the commission had definitely fixed all of the schedules of rates for this company in 1916, and a reasonable division of costs had been made so that a percentage surcharge appeared equitable.

"Application 3459, Pacific Gas & Electric Company.—In this application the Pacific Gas & Electric Company requested an increase of 20 per cent on all commercial and industrial rates. Following the application and prior to the decision, a number of increases in costs of operations and conditions affecting the return of the company made it necessary that considerable additional increased revenue be allowed in order to meet the emergency conditions. The applications were amended to request of the commission such relief as it deemed necessary. In the decision of this application (Decision 5519) the commission first ordered the removal of all deviations and discriminatory contracts, then authorized the addition of the following surcharges: For energy sold for lighting service, including domestic, commercial and municipal metered service, 1 cent per kilowatt-hour; for energy sold for power service, including heating and cooking, 2 mills per kilowatt-hour; for energy sold for municipal street lighting, 10 per cent of monthly bills; for energy sold to electric railways, 1 mill per kilowatt-hour; for energy sold to other electric corporations, 1 mill per kilowatt-hour. The result of the application of these surcharges and the removal of deviations will be an increased gross revenue of approximately $2,000,000 per annum.

"Application 3460, Great Western Power Company System.—This application was filed at approximately the same time as that of the Pacific Gas & Electric Company and requested the same relief. Hearings were held in conjunction, and decision was issued on the same date. The relief granted was, in general, of the same character as that of the Pacific Gas & Electric Company, except that no surcharge was applied to street railway service or other electric corporations.

"To date the following companies have filed applications with the commission for increase in electric rates: Pacific Gas & Electric Company, Great Western Power Company System, San Joaquin Light & Power Corporation, California Telephone & Light Company, Needles Gas & Electric Company, Coast Counties Gas & Electric Company and Southern Sierras Power Company.

[Since this was written the Southern California Edison Company and Western States Gas & Electric Company have applied.—Eds.]

"All applications at present submitted have been decided.

"So far only about 25 per cent of the number of utilities have applied for increases in electric rates, but the applications so far cover over 50 per cent of the electric utility business in the state.

"It is difficult to state with any degree of certainty at the present time whether or not the conditions are permanent or temporary. One of the main causes for application for increase in rates is the shortage of hydroelectric power this year, caused by the low precipitation, with a resultant abnormal use of steam plants. This cause will to a large extent be removed upon the return of normal years of rainfall.

"A second cause which is material in its effect is the increased price of oil, which since 1916 has increased at least 100 per cent.

"A third cause which is of considerable importance is the need of the maintenance of the utilities' financial credit in order that they may extend to meet the increasing demand and supply adequate service.

"A fourth cause, which may affect the electric utilities in the northern part of the state more or less seriously during this year, is the possible necessity of discontinuance of less essential service: at least a material curtailment of same, due to the shortage of power."

Advances in Georgia

J. Prince Webster, rate expert of the Railroad Commission of Georgia, states:

"This commission has granted to the electric utilities in this state in specific instances increased rates based on showing of increased costs of operations and other considerations entering into such questions.

"The laws of this state prevent unjust and undue discriminations. The Railroad Commission of Georgia in all rate increases referred to has made the same applicable to all classes of consumers.

"Within the last year the commission has received quite a number of applications for rate increases, and in the majority of instances certain advances have been allowed, though not in every case conforming to the petition of the utility."

POSITION OF CONNECTICUT COMMISSION

The Connecticut Public Utilities Commission gave information bearing upon its attitude to a representative of the ELECTRICAL WORLD.

Companies do not have to get the approval of the commission to rate advances unless rates are declared unreasonable. In case of a hearing on a rate increase the commission, of course, considers operating cost as an important factor.

Whether the application of rate advances is approved for all classes of consumers or only for special classes, upon a showing of increased cost of operation, depends entirely upon each case and the merits thereof.

No electric rate cases have been heard because no advances have been protested during the last year.

The commission has no means of knowing what proportion of the electric utilities are seeking higher rates because in Connecticut companies are not required even to file new rates with the commission. It is a fair assumption that not a few companies have increased rates.

As evidenced by its decision in the New London gas case, the commission holds that "the present abnormally high and constantly increasing cost of labor and material, especially oil used in the production of water gas, makes impracticable the establishment of a standard or scientific rate at this time, and any rate fixed to meet present unusual conditions should be only temporary and subject to prompt readjustment to meet changed or normal conditions." In that case the commission decided that "the rates complained of are not unreasonable under existing war emergency conditions."

The commission does not attempt to forecast the extent of rate changes after the war.

OKLAHOMA COMMISSION IS ACTING

The Corporation Commission of Oklahoma advises the ELECTRICAL WORLD that it is authorizing electric utilities to increase rates on a showing of increased cost of operation.

In such cases the application of the higher rates is approved to all classes of consumers.

Approximately eight authorizations for increases have been issued to electric utilities, no applications have been rejected, and four were pending when the commission's letter to this publication was written.

The situation is regarded by the commission as merely one of war emergency.

NORTH DAKOTA SITUATION

J. A. Little, rate expert and statistician Board of Railroad Commissioners of North Dakota, writes:

"The board has no power under our statutes to authorize or to interfere with advances in rates by public utility companies with the exception of telephones.

"The commission therefore has no policy with reference to the facts upon which the commission would grant an increase. We do know, however, that the utilities of this state have made some increases in their rates which in most cases take the form of a 10 per cent or 15 per cent surcharge which the company imposes for the duration of the war only.

"The board has power to fix maximum rates for public utilities upon the complaint of common consent of the city in which the utility operates, but, as stated above, the commission has no power to control increases in rates."

HYDROELECTRIC PROPERTIES IN MAINE

Benjamin F. Cleaves, chairman of the Public Utilities Commission of Maine, states:

"We have not yet finally passed upon the only application for increase of the rates of an electric utility, although we have the same under advisement. The application of the Penobscot Bay Electric Company for an increase in its rates at Guilford is the one pending, and the advance asked for is from 10 cents per kilowatt-hour to 15 cents per kilowatt-hour.

"As above stated, the Penobscot Bay application is the only one we have had, although it is not at all improbable that if present conditions prevail for any considerable length of time there will be a quite general request for permission to advance.

"I believe that here in Maine facts which may perhaps authorize an advance will be occasioned entirely by war conditions, and the necessity for increases will last no longer than the period during which the higher prices of labor and materials, other than coal, continue. Our companies are practically all hydroelectric companies, and the quantity of coal consumed is very small and used only in auxiliary service."

IN STATE OF WASHINGTON

Answering an inquiry from the ELECTRICAL WORLD, the Washington Public Service Commission writes that where the return is insufficient it is authorizing electric utilities to increase rates on a showing of increased cost of operation. In such cases the application of the higher rates is approved generally to all classes of consumers rather than only to special classes.

No applications of this character have been rejected and none were pending when the letter of the commission was written.

About 5 per cent of the electric utilities in the state were seeking higher rates, the commission wrote.

Whether the general conditions and results of electric utility operation will be altered permanently or the situation is merely one of war emergency is regarded as problematical by the commission.

REPORTS FROM OTHER STATES

E. G. Gallet, secretary Idaho Public Utilities Commission, writes that no applications for authority to increase rates had been filed by electric utilities during the year commencing July 1, 1917.

T. A. Browne, secretary Nebraska State Railway Commission, and George L. McCaughan, secretary Iowa Board of Railroad Commissioners, wrote that these bodies do not have rate-making authority over electric utilities.

Motor Drive in Newburgh Shipyard

Standard Types Chosen to Insure Prompt Delivery—Individual Motor Drive Selected for Speeding Output—Foolproof Equipment Permits Use of Unskilled Labor

BY W. H. EASTON
Westinghouse Electric & Manufacturing Company

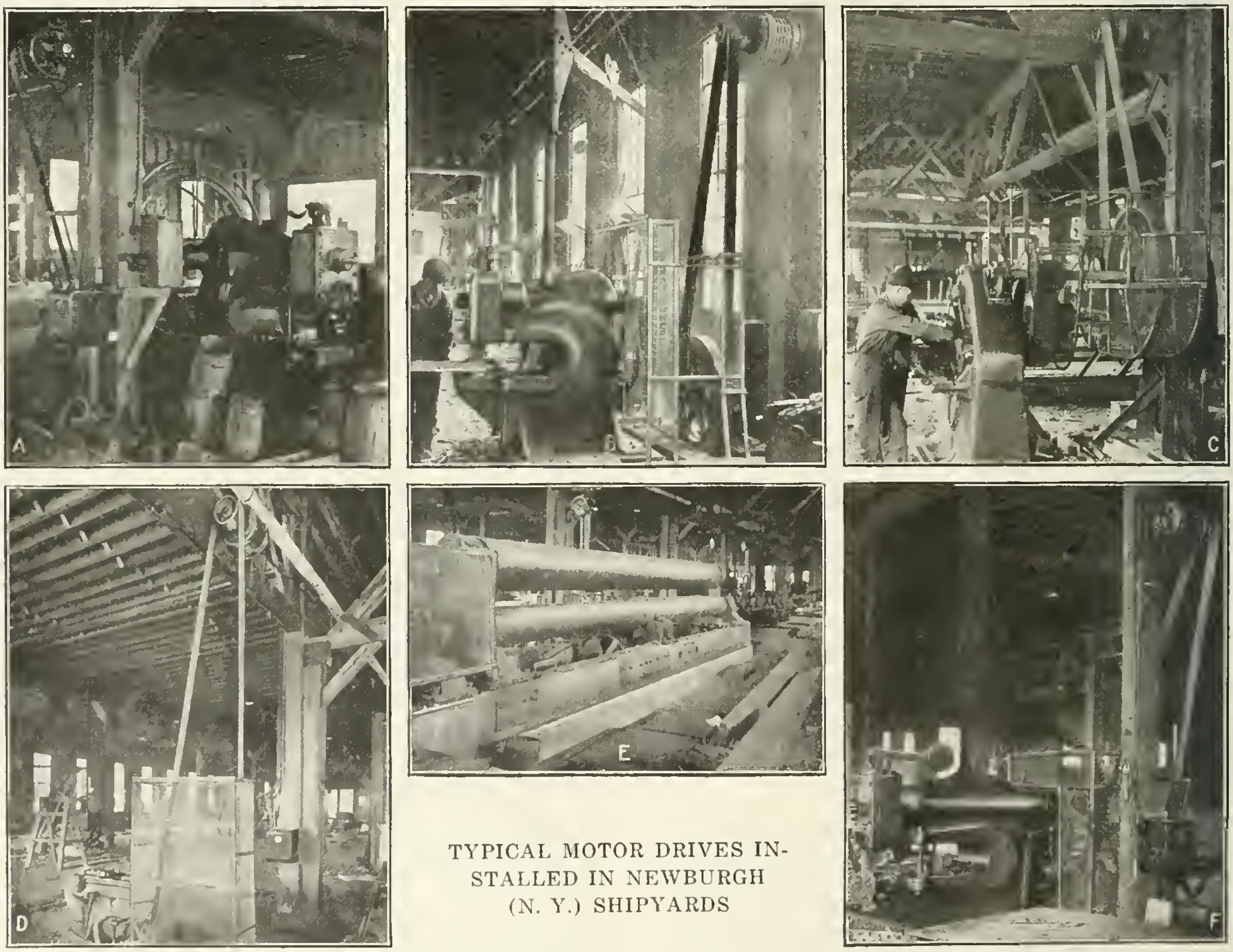
THE Newburgh shipyard is one of the shipbuilding plants that have been called into being by the war. A year ago its site was a marshland. To-day, on made ground that required thousands of cubic yards of fill, there are numerous buildings, four shipways and four large steel ships already under construction. The launching of the first of the standard 9000-ton steel cargo vessels on which this yard will specialize during the war will take place in August, and the other three will follow rapidly thereafter.

Of the various departments the structural-steel shop is the one at present in most active operation, though all the others will begin work in the near future. The system of motor drive employed in this shop is of special interest at this time because it is a typical example of an emergency war installation.

Some of the conditions that had to be taken into consideration in laying out this drive were the following: (1) The machinery had to be arranged to permit rapid and economical production. (2) The machines have to be handled by relatively unskilled men and hence must be safeguarded as thoroughly as possible. (3) Time is a vital factor, and as deliveries of special apparatus are nowadays very slow, the best possible use must be made of such equipment as can be obtained within a reasonable period of time.

As central-station power from the Central Hudson Gas & Electric Company was available, it was of course used, thus avoiding the erection of an isolated plant, saving the labor to run it, eliminating the handling of fuel and ashes, and helping to economize coal.

Alternating current only is supplied by the central station, and as practically all the machines in the shop (such as punchers and shears) are of the constant-speed type, squirrel-cage motors are used almost exclusively. The only exceptions are the furnace blower and the



TYPICAL MOTOR DRIVES INSTALLED IN NEWBURGH (N. Y.) SHIPYARDS

A—Vertical punching machine driven by squirrel-cage motor; operation is foolproof. B—Belt driving shearing machine will slip if torque requirement is too high for motor. C—Moving parts of angle shearing machine are inclosed in wire cage. D—Individual drive for horizontal punch giving maximum output. E—Bending rolls requiring variable-speed motor drive. F—Vertical punch geared to flywheel, which in turn is belted to the motor mounted overhead on the post.

bending rolls, both of which require speed variation. The furnace blower, supplying air for the crude-oil plate and angle furnaces, is driven by a slip-ring motor with a drum-type speed controller. The bending rolls were originally driven by a direct-current crane-type motor, which was supplied with current by a motor-generator set, but as this equipment was decidedly antiquated (war conditions making it impossible to secure modern apparatus at the time when it was wanted), a variable-speed alternating-current motor was installed in its place.

TYPICAL MOTOR DRIVES USED IN STRUCTURAL-STEEL SHOP OF THE NEWBURGH (N. Y.) SHIPYARD

Machine	Size	Motor*	Hp.	Type
Sturtevant blower... ..	No. 10	Slip-ring†	50	C. W.
Hilles & Jones angle shears	6x6x¾ in.	Squirrel-cage‡	5	C. S.
Hilles & Jones horizontal punch............	⅞-in. holes ¾-in. plates	Squirrel-cage	5	C. S.
Hilles & Jones shears......	30 in.	Squirrel-cage	7	C. S.
Cleveland vertical punch...	¾x¾x36 in.	Squirrel-cage	5	C. S.
Hilles & Jones vertical punch	¾x¾x30 in.	Squirrel-cage	5	C. S

* All of the motors are Westinghouse. † Equipped with type MF control. ‡ All of the squirrel-cage motors referred to in table are started with type A autostarters.

Individual motor drive was adopted throughout the shop in order to insure maximum output from each machine and to provide complete flexibility as to the arrangement of the machines.

As can be seen from the illustrations, all the machines are belt-driven. This is not the best possible practice, since for such machines as punches or shears engineers usually favor mounting the motor on the machine and driving by means of gears. But this type of drive requires special machine work and a special, high starting-torque motor, and its adoption would have added months to the delivery date of the equipment. Hence standard motors with belts were used instead.

High-starting-torque motors would have been desirable, however, for driving these ponderous machines with their considerable flywheel effect, but it was thought that the belts would slip enough in starting to relieve the motors of the excessive stresses that occur at this time, and experience has proved this to be the case, since none of the motors has given trouble. This good record has been especially gratifying to the engineers in charge of the installation inasmuch as time did not permit a power test to be made of each machine, and the motors were selected largely by judgment and the supply of motors available for early delivery.

All belts, pulleys and gears are carefully protected by wire-metal screens, and all motors that are started and stopped by the steel workers are controlled by means of auto starters or oil switches which have no exposed live parts and cannot be improperly manipulated by even the most careless person. Automatic protection against overloads and failure of power is also provided.

The energy from the central station is received at 5700 volts. A small substation in the shipyard, consisting of a bank of transformers and a panel carrying the necessary switches and meters, reduces the voltage to 220 for use around the plant.

In the table printed above some typical data on the motor drive selected for this shop are presented.

Book Reviews

THE CALORIFIC POWER OF FUELS. With a Collection of Auxiliary Tables and Tables Showing the Heat of Combustion of Fuels, Solid, Liquid and Gaseous. By Herman Poole. New York: John Wiley & Sons. 267 pages, illustrated. Price, $3.

The original work by this author was published twenty years ago and the second edition a couple of years later, but since that time the knowledge of the value and utilization of fuels has so increased that the third edition is practically a new work on the subject. The rewriting was done by Robert Thurston Kent, M.E., and the book now covers the entire range of commercial fuels. Four chapters of the eleven deal with calorimeters and calorimetric calculations. The three chapters dealing with the various kinds of fuels are replete with tables giving the analyses and heating values of solid, liquid and gaseous fuels in all parts of the globe. The admirable work of the Bureau of Mines has been drawn upon freely in the compilation of these tables. The concluding chapters are devoted to a consideration of the calorific power of coal burned under a steam boiler and to the analysis and measurement of the products of combustion. The book contains in small compass a vast amount of valuable information, all of which is so well classified and arranged as to be available with little effort or loss of time.

THEORY AND OPERATION OF DIRECT-CURRENT MACHINERY. Prepared in the Extension Division of the University of Wisconsin. By C. M. Jansky. New York: McGraw-Hill Book Company, Inc. 285 pages, 214 illustrations. Price, $2.50.

This excellent elementary textbook on direct-current machinery is addressed particularly to the needs of students who have not had a preliminary mathematical or physical training such as is given by technical colleges to their engineering students. Consequently the scope of the treatise is necessarily limited to the more elementary considerations. Nevertheless, it is remarkable how much of the practical construction and operation of direct-current machines is clearly presented in the book; or, to state the same idea in other terms, it is remarkable how much of the essential elements of dynamo construction and operation can be expressed in simple language, without more than the simplest mathematical aid, as this book demonstrates. The treatment is clear and logical. The illustrations are excellent. There are sixteen chapters, relating to the following topics: Fundamental magnetic principles, electromagnetism, electromagnetic induction, units of measurement, transformation of energy, the continuous-current generator and motor, magnetic circuits, armatures, uses of electrical energy, types of dynamos, commutation, operating characteristics, operation and care of generators, characteristics of motors, operation of three-wire systems, selection and installation of dynamos. The book will be very serviceable to central-station operating men and to all who desire to acquaint themselves with the elementary principles of direct-current machines in construction and operation, and who are not interested in the more mathematical aspects of the subject.

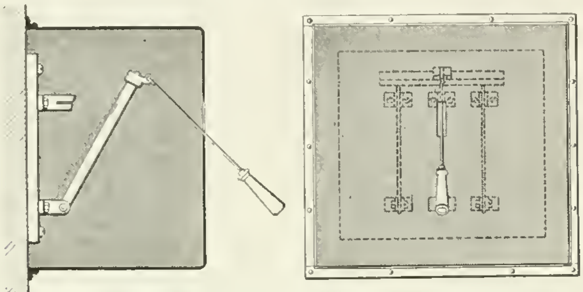
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

SAFETY SWITCH THAT IS SIMPLE AND EASILY MADE

Device Can Be Constructed in the Shop from an Ordinary Knife Switch and a Metal Box—Danger to Operator Reduced

For controlling small motors and secondary circuits it is sometimes desirable to have a switch that will not endanger the operator and one that is not expensive to construct. The accompanying illustration shows a safety-switch constructed in the shop from an ordinary knife switch and a metal-box. The box is lined with asbestos and has a small slot cut in the front side. Passing through this slot is a rod which has a fiber handle on the end outside the box, the other end being connected to the knife switch inside the box. The connection between the rod and switch is made with a hook attached to the bar of insulating material joining the switch blades. The hook is fastened to the bolt provided for the ordinary handle of the switch.


END VIEW
FRONT COVER

SAFETY SWITCH THAT CAN BE MADE IN SHOP

TESTING FOR FIRES IN PILES OF STORED COAL

Temperature of Pile Should Be Watched Closely and Coal Moved If It Rises to 175 Deg. Fahr. —Methods of Testing

Common methods for testing coal piles for heat are as follows: Watching when the pile begins to steam; observing the odor, which is that of either burning bituminous matter or burning sulphur; inserting an iron rod into the pile and when drawn out testing it with the hand; inserting a thermometer into a pipe driven into the pile; observing spots of melted snow on the pile. These methods were named by H. H. Stoek of the University of Illinois in a paper recently presented before the Western Society of Engineers.

He said further that opinions differ in regard to the critical temperature in piles of coal. Professor Parr of the University of Illinois is of the opinion that bituminous coal can be stored without appreciable loss of heat value, provided that the temperature is not allowed to rise above 180 deg. Fahr. How close to this temperature a pile should be allowed to heat is largely a matter of judgment, for if the rise in temperature appears to be decreasing rather rapidly it may be safe to allow it to approach 180 deg. Fahr., whereas if the rise is steady and regular it is wise to load out the pile before the danger point is reached. The time also depends upon the means available for loading out the coal, for at a plant equipped with large grab buckets and means for rapidly handling the coal a higher temperature can be permitted than where a considerable time may be required to load out the coal. A person in charge of a certain kind of coal under certain climatic conditions will soon learn what the danger point is, and it is impossible to set any critical temperature that will apply to all coals under varying storage conditions. The only safe rule is to watch the pile closely and get ready to load out the coal when the temperature reaches 150 deg. Fahr. and to move the coal if the temperature reaches 175 deg. Fahr.

DEVICE FOR WINDING A COIL OF ANY SHAPE

Simple Iron Frame That Can Be Easily Constructed in Any Shop Eliminates Delay in Waiting for Coils to Be Wound

By Frank Huskinson

A device for forming coils of practically any shape is shown in the accompanying illustration. It consists merely of an iron framework fitted with several flat disks. By loosening the nuts (*B*) in Fig. 1, the two long rods can be adjusted vertically to give any width of coil within the limits of the device. Flat disks attached to the ends of each member of framework, as shown in Fig. 2, may be adjusted along the length of the rods to give the longitudinal dimensions of the coil to be wound. The wire is then wound around these disks.

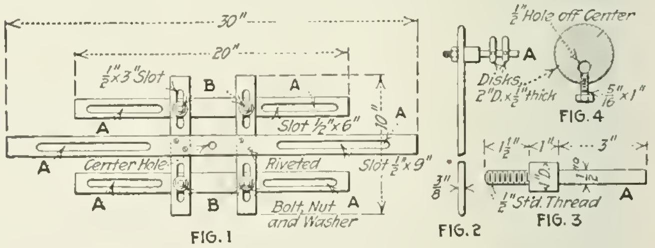


FIG. 1
FIG. 2
FIG. 3
FIG. 4

FRAMEWORK FOR WINDING DIFFERENT SHAPE COILS

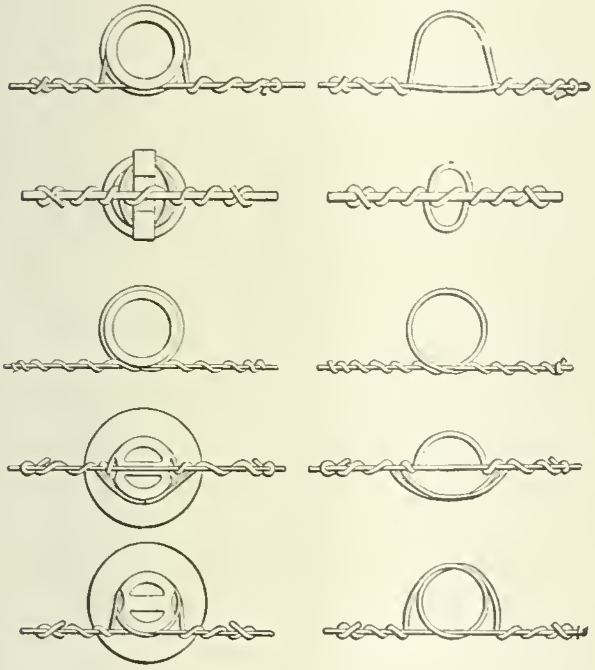
The device can thus be arranged for nearly all shapes of coils and can be made in permanent form for winding a number of the same size coil. The coils can be easily removed by loosening several of the disks.

STANDARDIZING THE TYING OF WIRES TO INSULATORS

Best Methods Used Universally Throughout System—Rules Issued to Linemen Facilitate Using the Same Kind of Tie When Possible

Having decided to standardize its method of making ties, a Western company issued instructions to its foremen to make sample ties with various sizes of wire and types of insulators so that each type could be examined and standards selected. With some insulators foremen were practically unanimous as to the method of tying; in other cases several methods were proposed. From these the best were chosen with a view to maintaining strength, flexibility and ease of application. The economy of material and labor due to standardization is obvious.

This company uses copper wire of medium hard-drawn grade, and experience shows that while good ties can be made with a medium hard-drawn weatherproof tie on a weatherproof line wire, medium hard-drawn bare ties cannot be used to the best advantage on bare lines, as the bending radius is too small for these stiff wires. For this reason annealed bare wire is used for bare conductors. These are made by either purchasing annealed copper or by burning the insulation from scrap weatherproof wire. Care must be taken not to overheat the wire because this will cause the metal to lose its strength.



METHODS OF TYING USED WITH DIFFERENT INSULATORS

The accompanying diagrams show that the end wraps are not wound so closely as is usually done. The ties apply to moderate-sized conductors which are used in ordinary distribution systems and are not designed to supersede the various types of armored ties required for large aluminum or copper cables on transmission lines.

Experience indicates that with medium hard-drawn conductors a certain flexibility is desirable between the point where the line leaves the insulator and the last point of contact of the tie. In long-span work too rigid a support may result in breakage due to repeated bending just beyond the point of support. This occurs whether the wire be held by a tie or a clamp. Stranding the wire apparently obviates this trouble.

SCHEDULE OF TIES

Size of Line Wire (in Gage or In.)	Insulator	Top or Side	Tie Material	Tie Length (In.)	Type of Tie	Fig
			COPPER			
6 or 4 w.p.	D.G.D.P.	Side	6 w.p.-m.h.d.	25	Western Union	1
2 w.p.	D.G.D.P.	Side	4 w.p.-m.h.d.	27	Western Union	1
1/0 to 4/0 w.p.	Cable	Top	4 w.p.-m.h.d.	36	Cross-top	2
1/0 to 4/0 w.p.	Cable	Side	4 w.p. m.h.d.	30	Western Union	1
6 or 4 bare	D.G.D.P.	Side	6 bare ann.	27	Double	3
6 or 4 bare	11 kv.	Top	6 bare ann.	40	High-tension	4
2 bare	11 kv.	Top	4 bare ann.	40	High-tension	4
1/0 to 4/0 bare	11 kv.	Top	2 bare ann.	44	High-tension	4
6 to 4 bare	11 kv.	Side	6 bare ann.	40	Looped W.U.	5
2 bare	11 kv.	Side	4 bare ann.	40	Looped W.U.	5
1/0 to 4/0 bare	11 kv.	Side	2 bare ann.	48	Looped W.U.	5
			STEEL			
$\frac{1}{4}$ and $\frac{5}{16}$	D.G.D.P.	Side	1 strand of $\frac{5}{16}$ in.	27	Double	3
$\frac{1}{4}$ and $\frac{5}{16}$	11 kv.	Top	1 strand of $\frac{5}{16}$ in.	44	High-tension	4
$\frac{3}{8}$	11 kv.	Top	1 strand of $\frac{3}{8}$ in.	44	High-tension	4
$\frac{1}{4}$ and $\frac{5}{16}$	11 kv.	Side	1 strand of $\frac{5}{16}$ in.	48	Looped W.U.	5
$\frac{3}{8}$	11 kv.	Side	1 strand of $\frac{3}{8}$ in.	48	Looped W.U.	5

Instructions to line foremen are issued as follows:

On straight lines all wires shall be tied in the top groove of insulators having top grooves. On insulators having side grooves only tie on the pole side. Those on the pole pins should be tied on the outside. At curves and corners all wires should be tied away from the strain so that the line wire shall bear against the insulator.

Weatherproof ties should be cut from scrap pieces in the field, either new or second hand, if of good quality. Annealed weatherproof may be used if available. Old ties should not be straightened and reinstalled, as they are too hard and brittle after repeated bending.

Bare copper ties cut to length are supplied by the storeroom. They should be made from annealed, but not overheated, scrap, or from new annealed wire.

METHODS OF INCREASING POWER-PLANT EFFICIENCY

Reasons Why Power-Plant Owners May Expect Reductions in Losses of Modern Stations Are Outlined

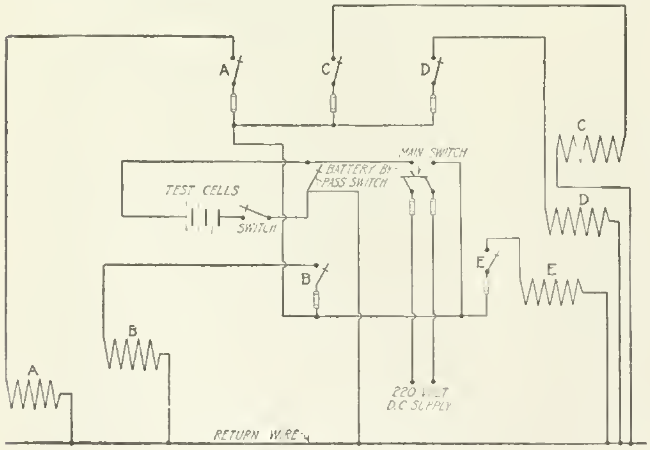
Higher boiler pressures, higher temperatures of superheat, higher vacua, the use of powdered coal, the installation of boiler efficiency instruments and the introduction of bonus systems are six means which an operating engineer in the Middle West considers as most likely to produce important coal savings. Boiler pressures higher than the standard are considered the most important source of saving. While the general impression now is that no saving can be made by going to higher pressures on account of the high cost of the equipment, it is the belief of some engineers that when development charges have been somewhat reduced it will be possible to make high-pressure equipment at less cost than apparatus for 200 lb. (14 kg.) pressure. This opinion is based upon the belief that the boilers for higher pressures will contain smaller tubes, which will give more area with the use of less metal. While the theoretical saving which can be made by the use of higher superheat is small, the actual saving is really greater than the theoretical saving, owing to the fact that the elimination of moisture from the steam throughout a large part of the duty cycle of the steam very largely reduces friction losses. As is well known, many experimenters are working on the problem of powdered coal, and although a number of attempts have been made to promote fraudulent schemes in this field, a real and legitimate work is being done. Sooner or later it will bring about successful means to release for active work more of the heat units in coal.

The saving which can be made through the use of higher vacua is probably one that demands attention in every plant at the present time. All operators do not thoroughly realize that an increase in the vacuum from 28 in. to 29 in. (71 cm. to 74 cm.) effects a 4 per cent saving on the coal pile, the engineer referred to says. It is usually practicable to make such an increase, although it sometimes entails the installation of better air-pump equipment. Installing boiler-room efficiency instruments and adopting bonus systems should be considered together. They assume increased importance daily as the shortage of power-plant labor becomes more apparent. It is altogether possible that the tendency of the coming year will be to employ more intelligent help for the boiler room, even to the partial neglect of the turbine room, so that the investment in boiler-room efficiency instruments and the bonus-paid employees may be capitalized to the fullest extent.

ELECTRIC HEATERS CAN SERVE A DUAL PURPOSE

Apparatus for Heating Meter Laboratory Arranged So that Storage Battery Can Be Placed in Circuit for Charging

During the coal shortage last winter electric heating was used with much success in the meter laboratory of the Cumberland County Power & Light Company, Portland, Me., energy being supplied from the company's hydroelectric transmission system. Five units rated at 220 volts and 20 amp. each were provided, but two were found sufficient to maintain a temperature of 70 deg. Fahr. even in zero weather. The room is about 50 ft. (15.2 m.) long, 40 ft. (12.2 m.) wide and 12 ft. (3.7 m.) high and has four windows in one wall and one in another. The resistors were connected so that any number could be placed in parallel to charge a storage battery used for test purposes.



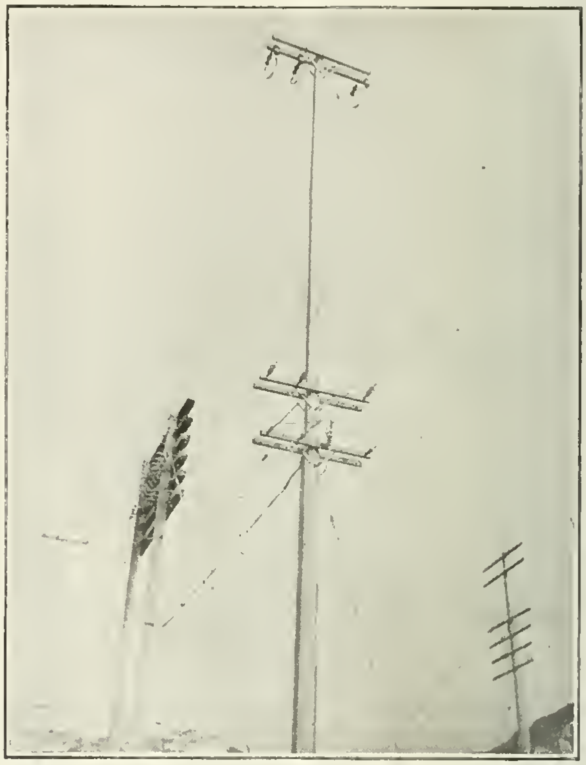
CONNECTIONS THAT PERMIT HEATING AND BATTERY CHARGING

The connections are shown in the accompanying diagram.

POWER-LINE CROSSING OVER TELEPHONE-LINE ANCHOR POLE

Accomplished Economically by Raising the Span Crossing Over the Telephone Pole and Using Aerial Cable for Lower Voltage Circuit

After a river had changed its course during a flood, a telephone company found it necessary to relocate a river crossing span on an important intercity toll line. It so happened that the only feasible location for the anchor tower at one side of the crossing was immediately under a power supply line carrying an 11,000-volt and a 2300-volt circuit on 40-ft. (12.2-m.) poles. To secure proper clearances over the telephone tower for both supply lines would have required 80-ft. (24.4-m.) poles and grading down to the 40-ft. (12.2-m.) poles on each side by 10-ft. (3-m.) steps. This would have required the changing of eight poles, four on each side of the crossing. By using the method shown in the accompanying illustration only the poles adjacent to the crossing were changed, these being made 75 ft. (22.9 m.) high.



METHOD OF CROSSING OVER TELEPHONE LINE WITH 2300-VOLT AND 11,000-VOLT CIRCUITS

The 11,000-volt line was connected to the poles shown at the standard level and jumpers connected with the upper level which was held by appropriate strain insulators.

Stranded medium hard-drawn copper was used in the crossing span, the rest of the line being solid. The stress in the spans adjacent to the crossing was balanced by means of a well-insulated guy across the span and by anchor guys which were connected to the pole tops. In order to simplify the vertical circuits the 2300-volt circuit was run under the telephone lines by using a three-conductor lead-covered aërial cable with suitable pot-heads at the ends.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

DISCUSSION OF CENTRAL WEST RATE SITUATION

Necessity for Higher Rates—20 per Cent Increase in Small Towns Does Not Bring Proportionate Increase in Revenue

Discussion of the rate situation at the convention of the Iowa Section, National Electric Light Association, was led by W. A. Warfield of Peoria, who pointed out that public utility commissions and courts are giving utilities a square deal in the cases asking increased rates which are now before them. Ninety-two per cent of the cases presented have been acted upon favorably. In all cases before courts and commissions utilities should emphasize the necessity for a larger rate of return, otherwise the industry will be unable to get the money which it needs to carry on its operations.

In reply to questions during the discussion Mr. Warfield stated that the Illinois Traction Company had asked for increases in electric service rates in nearly every community in which it operates. Where emergency increases were asked for these have been granted almost in total. Where permanent increases were sought an evaluation was necessary. In most cases it has been found expedient to apply for emergency increases. Action on rate cases is much more prompt in states where commissions are in existence than in states where rate increases must be taken up with the local city council. Where it has been necessary to go to customers directly to gain increases in revenue the company has found the public very fair and willing to allow it a fair profit.

In the State of Illinois the company's plan of asking for an increase was to survey the needs in each city and to ask for a percentage of increase in accordance with the needs of each town. Mr. Warfield pointed out that the Public Service Company of Northern Illinois had tried a different method, namely, that of grouping towns of similar character and applying for a 15 per cent increase on the power schedule then in effect The commission in respect to this case instructed the company to file a schedule that would give 15 per cent increase on the power rate, and then granted that schedule.

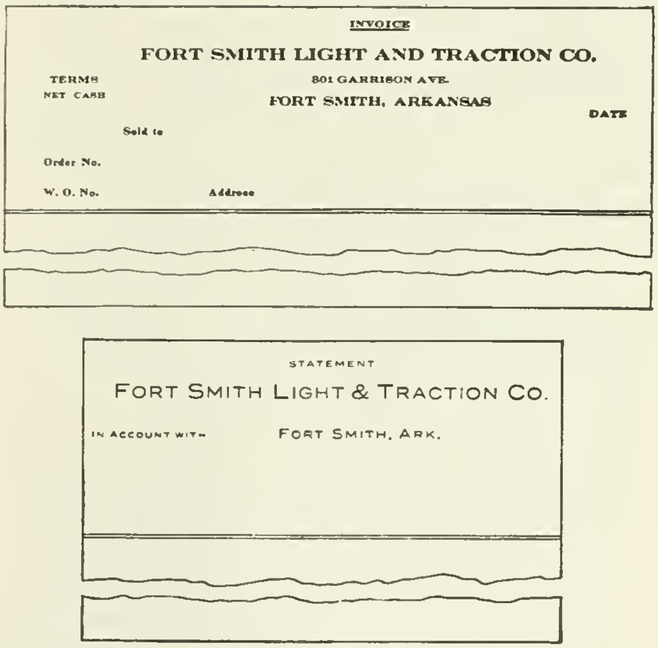
W. H. Abbott of Omaha stated that two-thirds of the properties of the Continental Gas & Electric Corporation in Iowa and Nebraska had been granted increases which averaged around 20 per cent. In some cases it was necessary to increase residential lighting rates which were at 15 cents to 20 cents. No trouble was experienced in the cities in which increases had been asked for, but some difficulty was expected in other cities. In reply to a question, Mr. Abbott said that the 20 per cent increase which had been granted had shown only a 5 per cent increase in the revenue, because of the curtailment of service following the adoption of the daylight-saving law and the natural curtailment following increases in prices.

Further discussion resulted in bringing out the fact that in small towns of about 750 population the best method of getting additional revenue was to raise the minimum charge from $1 to $1.25. It was also thought that many power rates are too low. It was held in this connection that the demand charge should not be changed but that energy rates should be increased. An increase of 0.5 cent per kilowatt-hour in the case of a 15-hp. customer was not thought to be too much.

A BILL FORM THAT CONTAINS MINIMUM OF PRINTED MATTER

Clean Appearance on Invoices and Statements Obtained and Convenience Achieved by Eliminating Sentences Not Always Useful

In an effort to arrive at a clean-looking and convenient form for bills and statements other than those for energy consumption, the Fort Smith (Ark.) Light & Traction Company has adopted the kind shown in the accompanying illustration. The feature of these records is that neither of them has the usual amount of reading. In drawing them up this plan was strictly adhered to, it being thought that printed matter which is not used in every instance on a statement or invoice is confusing and hurts the appearance of the sheet, while a statement or invoice that has no extraneous matter is very much more legible and understandable.



INVOICE

FORT SMITH LIGHT AND TRACTION CO.

TERMS
NET CASH

801 GARRISON AVE.
FORT SMITH, ARKANSAS

DATE

Sold to

Order No.

W. O. No.

Address

STATEMENT

FORT SMITH LIGHT & TRACTION CO.

IN ACCOUNT WITH

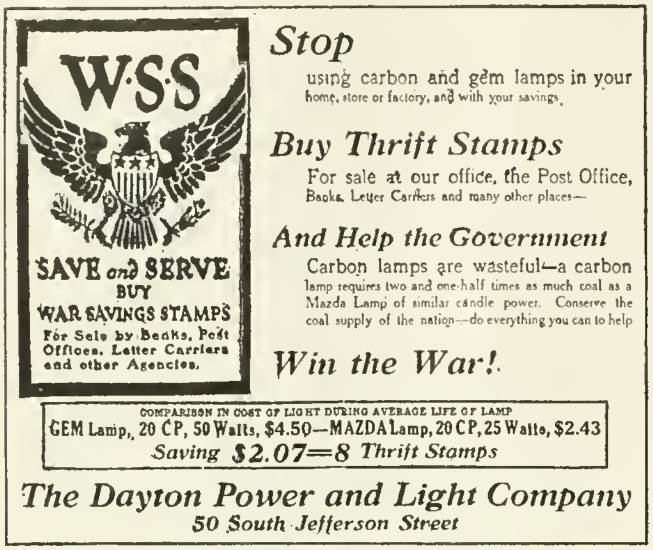
FORT SMITH, ARK.

SIMPLE BILL HEADINGS USED BY ARKANSAS COMPANY

TUNGSTEN LAMPS HELP SELL WAR SAVINGS STAMPS

Dayton Company Advertises Wastefulness of Carbon-Filament Lamps and Suggests Change to Tungsten to Help Government Loans

"Win-the-war," advertising recently published by the Dayton (Ohio) Power & Light Company is of interesting character. A typical piece of copy, here reproduced, points out the wastefulness of carbon lamps and shows how many thrift stamps can be bought by the savings made by changing from carbon to tungsten-filament lamps.



W·S·S

SAVE and SERVE
BUY
WAR SAVINGS STAMPS
For Sale by Banks, Post Offices, Letter Carriers and other Agencies.

Stop

using carbon and gem lamps in your home, store or factory, and with your savings,

Buy Thrift Stamps

For sale at our office, the Post Office, Banks, Letter Carriers and many other places—

And Help the Government

Carbon lamps are wasteful—a carbon lamp requires two and one-half times as much coal as a Mazda Lamp of similar candle power. Conserve the coal supply of the nation—do everything you can to help

Win the War!

COMPARISON IN COST OF LIGHT DURING AVERAGE LIFE OF LAMP
GEM Lamp, 20 CP, 50 Watts, $4.50—MAZDA Lamp, 20 CP, 25 Watts, $2.43
Saving $2.07=8 Thrift Stamps

The Dayton Power and Light Company
50 South Jefferson Street

RESULTS FROM THOROUGH TRAINING OF SALESMEN

New York Company Disposes of 260 Vacuum Cleaners in Forty-One Days with an Average Net Profit of $11.73 per Machine

A recent and very successful suction-cleaner campaign conducted by the Schenectady (N. Y.) Illuminating Company emphasizes the importance of the thorough schooling of the salesman in the demonstration of his appliance. The Schenectady campaign began last November with a twenty-three-day sale of Hoover suction cleaners, in which 110 machines were placed on circuit. This was followed by continuous follow-up selling until January, when another short campaign was featured for a period of eighteen days, in which 150 cleaners were disposed of. This made a total of 260 cleaners sold in the two campaigns at an average net profit of $11.73 per cleaner. a most satisfactory operation, both from the standpoint of profit and of service to the consumer in these days of servant shortage. The sales were made for cash or on the easy payment plan for $3 down and $6 a month, as the customer preferred.

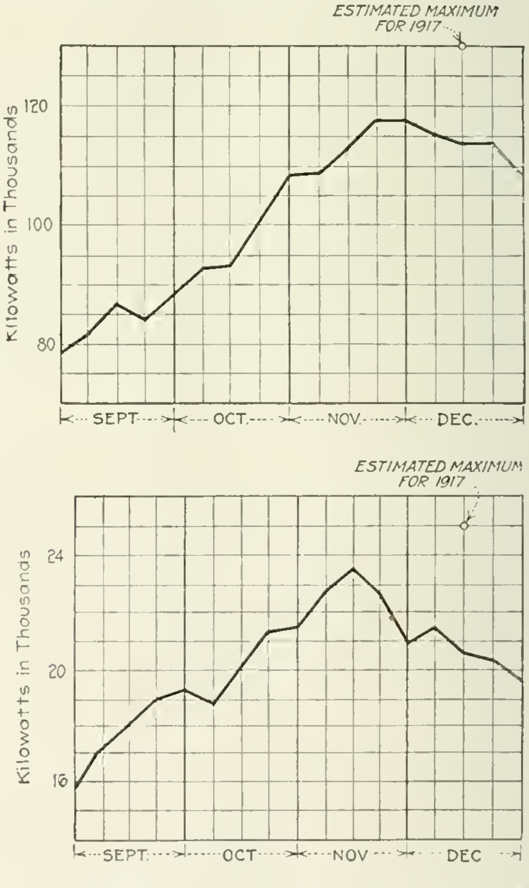
This campaign was planned and directed by Sales Manager C. E. Cass of the Schenectady Illuminating Company, and it is interesting to note that he attributes its success largely to the fact that each salesman who participated was "thoroughly sold on the cleaner" by personal use of a machine at home before he was sent out to talk about it.

Each employee of the sales department was given an opportunity to take a sweeper home for a month and become thoroughly familiar with it by actual use in his home. The company sent a sweeper also to the home of each head of department and foreman who did not already have one. The enthusiasm and confidence thus secured proved to be one of the large factors in the success of the campaign. Incidentally the wives of these employees were so well pleased with the cleaner that about 90 per cent of them were purchased. The result was a degree of enthusiasm among the salesmen enlisted in this campaign that developed ingenuity of a high order in overcoming obstacles to individual sales.

CENTRAL-STATION CUSTOMERS' PEAK-LOAD DISTRIBUTION

New Jersey Company Has Plan Whereby 5.5 per Cent Relief Was Obtained Without Any Reduction in Kilowatt-Hour Output

Equalization of the peak loads of customers in order that existing station capacity can be utilized more fully is of unusual importance at the present time. At the recent N. E. L. A. convention at Atlantic City, N. J., R. R. Young presented a paper telling how this plan was worked out and of the results obtained by the Public Service Electric Company of New Jersey.



PEAK-LOAD DISTRIBUTION OF NEW JERSEY ELECTRIC COMPANY; NORTHERN ZONE ABOVE, SOUTHERN ZONE BELOW

The territory of this company in so far as generation and distribution is concerned is divided into two zones, designated as northern and southern zones, the southern zone comprising Trenton, Burlington and Camden with adjacent territory, the northern zone comprising all north of and including New Brunswick and its adjacent territory.

Late in the summer of 1917 the company found that it would be unable to start a 35,000-kw. turbine and a 12,500-kw. turbine which were under erection in two of the largest generating stations. It was decided, therefore, that, beginning with November, a systematic canvass of power customers should be made, asking the co-operation of the manufacturers using 50 hp. and more in redistributing their load throughout the day so that heavy demands which ordinarily might occur between the hours of 4.30 p.m. and 9 p.m. would be changed to some other hour during the twenty-four-hour day.

RESULTS OF CAMPAIGN TO EQUALIZE CUSTOMERS' PEAK LOAD

Division	Total Kw. Connected Load in Power	Promised Kw. Relief	Promised Percentage Relief	Actual Relief Obtained	
				Kw.	Percentage
Essex	73,000	4,360	5.9	.....	....
Hudson	40,000	5,245	13.1	.....	....
Passaic	20,000	1,852	9.2	.....	....
Central	41,500	3,909	9.4	.....	....
Bergen	9,700	1,050	10.8	.....	....
Total	184,200	16,416	8.9	10,000	5.4
Southern Zone	23,900	2,931	12.2	1,500	6.3
Grand total	208,100	19,347	9.3	11,500	5.5

Blueprints showing a typical twenty-four-hour composite load curve of the generating stations for December, 1916, were prepared for the power representatives and agents, and a mock interview was held to illustrate the methods to be used in presenting the case to the manufacturers.

REPORT ON REDUCTION OF PEAK

Customer ....

Business ....

Address ....

Town ....

Substation from which customer is fed.............

....

Connected load ....hp...............kw.

Maximum demand ....kw.

Demand 4 to 9 p.m...........................kw.

Promised relief at peak.......................kw.

Remarks:

Interviewed by:

....

Signed:

....

After the company's organization had been thoroughly prepared, the men began about Nov. 1 to visit the power customers, the campaign continuing throughout the month of November. Report forms were prepared and results of the calls upon individual customers were reported daily, these reports being tabulated by the general office. Weekly meetings of the power representatives in the state were held to discuss difficulties encountered and methods of overcoming objections.

Inasmuch as the rate schedule includes no off-peak provisions, the only advantage the manufacturer was to derive was the possible reduction of his average demand, thus reducing his demand charge somewhat, besides giving him greater insurance against interruptions in service.

The result of this campaign in promises from the customers is shown in the table.

Owing to the fact that customers were probably not able fully to live up to their promises, and there being some diversity in the peak loads, it is estimated that the result of the off-peak canvass was the securing of approximately 10,000 kw. reduction in demand in the northern zone and 1500 kw. reduction in demand in the southern zone. In fact, the maximum peak occurred in the last week in November in the northern zone, whereas, the peak of former years had been occurring in December.

Kilowatt-hours sold during November and December indicated that no curtailment of use resulted from reduction of peak. In other words, the maximum capacity required was reduced by 11,500 kw. without reduction in output on the part of the manufacturer.

The daylight-saving law as now effective will not help the fall peak. If the period is extended to cover the entire year, the saving in necessary capacity by the central station will be considerable.

WHERE COMMISSION HAS NO RATE JURISDICTION

Successful Method That Has Been Followed in Iowa Might Find Application in Other States

In Iowa, where the Public Utilities Commission has no jurisdiction over rates, all applications for increases in electric-service rates must be taken up with the local city council. One company which has had considerable experience in this work has adopted the following plan in connection with all of its rate increases:

The necessity for more revenue is made the topic of discussion at a meeting of the city council, where the company explains its point of view. Following this, the rate which has been decided upon is put into effect. In case the city council should take definite action against the company to prevent application of the increased rate, the company files an injunction in the federal court which prohibits the city council from interfering with the new rate schedule which the company has filed. If the legal department of the city should continue the case in federal court, the company feels that this court is removed from the influence of politics and therefore less liable to give a biased decision.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Graphical Method of Predetermining the Heating of Electric Machines.—G. GUT.—The various analytical and graphical methods of calculating the temperature-rise curves for a machine from the exponential equation are reviewed. A new graphical method is then described in which "nomographic" diagrams are employed. These diagrams, devised by the French mathematician d'Ocagne, have the object of evaluating expressions in which relations appear between more than two variables. The process is applied to the case of machines that are intermittently loaded and enables measurements below the maximum permissible load of the machine to be used to predetermine the parameters, the direct measurement of which would necessitate overloading the machines.—*Science Abstracts, Section B,* May 31, 1918 (abstracted from *Schweiz. Elektrot. Verein,* February, 1918).

The Essentials of Transformer Practice, Part XI.—E. G. REED.—General design relations are considered in particular, the subject being treated mathematically in the following order: Relation between the output, dimensions, weight and cost; relation between the output and the sum of the iron and copper losses; relation between the total equivalent loss and the dimensions, weight and cost of a transformer, and variation of the cost with the space factor of the winding section.—*Electric Journal,* June, 1918.

New Commonwealth Edison Turbine.—J. F. JOHNSON.—Details regarding the mechanical and electrical features of the new tandem-compound turbine installed by the Commonwealth Edison Company, Chicago, are given: Axial ventilation is used for the stator. Cooling air is passed through openings in the iron parallel to the shaft and discharged from an annular central duct into the frame casing. This arrangement allows the use of the shortest possible rotor, increasing the stiffness of construction and hence insuring freedom from vibration. Further, from a cooling standpoint, it permits of the most intimate contact of the air with the iron, and since the heat conduction is greatest along the plane of the laminations, any tendency toward hot spots in the iron is reduced to a minimum. The rotor construction is of the so-called plate type, in which disks approximately 2 in. (5.08 cm.) thick are rabbeted into each other and threaded upon through-bolts at their outer periphery. The insulation of both stator and rotor, which is of mica, is intended for a temperature of 150 deg. C. continuously. The temperature of the stator is measured by embedded detectors, and that of the rotor by the increase in resistance of the field coils. One reason for using mica is its ability to withstand corona or static discharges without injury. To withstand direct short-circuits without injury to the stator winding they are very rigidly braced.—*Electric Journal,* June, 1918.

Lamps and Lighting

Electric Lamps and Lighting.—J. ONDRACEK.—Proposes the use of the Fourier series for the determination of the polar curve of a light-source radiating symmetrically about its axis The intensity is measured in, say, five different directions, viz., at 0, 30, 45, 60 and 90 deg. with the horizontal, and from these values the first five coefficients of the Fourier series are calculated, and hence the mean spherical or mean hemispherical candlepower deduced.—*Science Abstracts, Section B,* May 31, 1918 (abstracted from *Elektrot. u. Maschinenbau,* Feb. 17, 1918).

Filaments of Crystal Wire.—O. ELY.—A general article on metal filaments with special reference to the tungsten wires. The wires proved mechanically strong after 1200 hours' burning, and there was no black deposit on the inside of the bulbs.—*Science Abstracts, Section B,* May 31, 1918 (abstracted from *Zeits. Vereines Deutsch.,* Jan. 12, 1918).

Better Lighting of Machine Shops.—F. H. BERNHARD.—The imperative need for improved lighting, the numerous benefits resulting therefrom, its low cost, how poor lighting can be quickly recognized and the requirements of a good system are some of the points discussed in this article. The resulting benefits are given as follows: (1) Reduction of accidents, (2) greater accuracy in workmanship, (3) increased production for the same labor cost, (4) less eye strain, (5) better working and living conditions, (6) greater contentment of workmen, (7) more order and neatness about the plant, and (8) supervision of the men made easier. Examples of lighting, including cost data and a chart of illumination intensities, are embodied in the article.—*Electrical Review,* Chicago, June 1, 1918

Generation, Transmission and Distribution

Voltage Variations in Three-Wire Alternating-Current Transmissions.—J. TEICHMUELLER.—The locus of the vector representing the voltage drop on a three-phase circuit is shown to be a parallelogram. The shape of this parallelogram is investigated for various sections and arrangements of the line conductors. New formulas are obtained for the variations of voltage in terms of the relative voltage drop, the power factor of the line and receiving apparatus.—*Science Abstracts, Section B,* May 31, 1918 (abstracted from *Elektrotechnische Zeitschrift,* Nov. 8, 15 and 22, 1917).

Electric Power Supply.—A synopsis is given of an address before the Incorporated Municipal Electrical Association at Manchester by S. J. Watson. It is pointed out that in the great industrial district about Manchester, England, electrical energy is not used to the extent it should be. One reason for the under-development of electric drive is its high cost in this locality, due principally to the existence of eighteen generating stations with a total capacity of 185,000 kw. Mr. Watson pointed out the enormous operating costs and lack of efficiency in such a system and advised the construction of large plants of about 100,000 kw. rating to replace the many smaller ones.—London *Engineering*, July 21, 1918.

World Records in Water-Power Development.—Seventeen notable hydraulic developments in the states west of the Rockies are described, showing wherein each one has set a world's record for its class. An illustration of each development is given.—*Journal of Electricity, Power and Gas*, July 1, 1918

Coal Consumption in Large Generating Stations.—ALFRED S. L. BARNES.—By means of data obtained from plants in the United States and Canada the author plots a curve between station capacity and coal economy, showing that there is not a great gain in economy by increasing station sizes above 75,000 kw. This point was brought out in connection with a discussion as to the advisability of installing stations of great size in England for the purpose of increasing economy.—*Electrical Review* (London), June 21, 1918.

Rotary Converter and Transformer Connections.—Three methods of starting rotary converters from the alternating-current side by means of a separate starting motor and from the direct-current side are explained.—*Southern Engineer*, June, 1918.

Traction

Dynamic Braking of Electric Motors.—E. M. BOUTON.—It has been shown that while dynamic braking does not eliminate the use of a friction brake, it has some very distinct advantages over the friction brake for reducing the speed of a motor. These are: (1) The stored energy of the armature is largely dissipated in an external resistance, which may be so located as not to affect the motor. In the case of a friction brake this energy must be dissipated by the brakeshoes and wheel, which are close to the motor. (2) A quicker stop can be made with dynamic braking owing to the time element of the friction brake in setting. The quickest stop, however, can be made with a combination of the two. (3) The kinetic energy of the revolving armature is delivered directly to an external circuit and does not have to be transmitted through the shaft to the brake wheel, thus relieving the shaft of considerable strain. (4) In cases where an accurate stop is not necessary the equipment for dynamic braking takes up less room and will have a lower maintenance cost than a friction brake. (5) In cases where a friction brake is necessary to hold the load, it is desirable to use dynamic braking for slowing down. This relieves the friction brake of much wear and tear and consequent expense in upkeep. Disadvantages of dynamic braking are: (1) The motor cannot be brought to a complete stop unless the driven load has considerable friction. (2) Dynamic braking cannot be obtained in case of voltage failure without the use of a series winding. (3) A controller for dynamic braking requires an additional contact and resistance, which adds to the cost. (4) If the motor is stopped very frequently by dynamic braking, its capacity must be greater to take care of the heating. (5) Dynamic braking is not generally applicable to alternating-current motors.—*Electric Journal*, May, 1918.

Installations, Systems and Appliances

Self-Restoring Properties of Lightning Arresters.—H. G. BRINTON.—The author first reviews the principles underlying all lightning arresters and then discusses in particular the restoration of the lightning arrester to normal conditions following the dynamic discharge. Only General Electric arresters are considered, among these being the magnetic blow-out arrester, the horn gap, the aluminum-cell arrester for alternating as well as direct currents and the vacuum-tube arrester for low-voltage telephone systems. Attention is called to the fact that in the operation of the horn-gap arrester the rise of the arc takes several seconds, so that a series resistance must be used which will stand the discharge current for a considerable period of time. Thus the horn-gap arrester is most useful in connection with constant-current circuits such as are used in street-lighting systems where the current is limited by a regulator to a small value.—*General Electric Review*, July, 1918.

Electrical Propulsion of Ships.—WILLIAM R. L. EMMET.—Relates to the propulsion of warships and dwells on the flexibility of electric drive. One advantage of electric drive is that a turbine can be stopped without having to stop the propellers. Furthermore, the going-astern turbine is eliminated, making it possible to develop as much power going in one direction as in the other and permitting higher superheat and consequently increased fuel economy. For efficient propulsion it is advisable to maintain a very low turn speed at the propeller, which usually requires the use of a reducing gear between the screw and motor if the size, weight and cost of the latter are to be kept at a minimum. This reducing gear cuts down the mechanical efficiency of transmission, of course, but it still remains relatively high. Electric drive is particularly desirable under cruising conditions because it permits shutting down part of the turbines, leaving the others to work under favorable conditions. The use of three-phase equipment required by reason of the great motive power employed has a very unfortunate characteristic in that it does not facilitate maneuvering. If it were possible to use direct-current apparatus, the reversals of movement as well as the simpler and more gradual regulation of speed could be accomplished by simply controlling the exciting current without varying the turbine speed or breaking the main currents.—London *Engineer*, May 17, 1918.

Electrophysics and Magnetism

Relation Between Electrical and Thermal Conductivities of Metals.—S. WEBER.—An application of Knudsen's method to the determination of the relationship between the electrical and thermal conductivities of a metal. Experiments on a tungsten filament in vacuo gave for the thermal conductivity the value 0.383 gm. cal. per cm. deg. From this the value of $k/\varkappa$ is found to be 786×10^{-3}, where k is the thermal and x the electrical conductivity. According to the Lorenz law the ratio $k/\varkappa T$ should be constant, but a comparison of the above value with that found by Langmuir at 2200° K. shows that this function possesses a temperature coefficient which approximately agrees with that found by Jaeger and Diesselhorst. Further experiments are described relating to the physical constants of tungsten and platinum filaments at low temperatures.—*Science Abstracts, Section A*, May 31, 1918 (abstracted from *Annalen der Physik*, Feb. 22, 1918.)

Influence of Magnetic Field and Mechanical Stirring on Potential Difference of Electrolytic Cell.—Toshikazu Mashimo.—With platinum electrodes immersed in a dilute iron trichloride solution, the effect of a magnetic field on the potential difference between the electrodes is especially noticeable when it is applied to the cathode, according to investigation made by the author. The diminution of the potential difference between the electrodes was less when a cobalt-salt or nickel-salt solution was employed. With the iron electrodes the effect was more complex. When a weak magnetic field was applied to the anode the potential difference between the electrodes increased, and when it was applied to the cathode it diminished. But with a strong magnetic field, whether applied to the anode or cathode, a decrement of the potential differences was always observed. With a relatively strong electric current in the battery circuit, the magnetic field caused the diminution of the potential difference between the electrodes when it was applied to either of the electrodes. But with a weak current a small increment of the potential difference was observed in the case of the anode Mechanical stirring of the electrolyte near one electrode affected the potential difference between the electrodes like the application of a magnetic field to that electrode. With a weak current in the battery circuit the potential difference diminished when the electrolyte near the cathode was stirred and increased when the electrolyte near the anode was stirred. When the current in the battery circuit was made stronger the effect at the cathode was especially noticeable compared with that at the anode. Agitating the electrolyte near one electrode established a new electromotive force between the electrodes of the same metal immersed in its own or other salt solutions. When the electrolyte in proximity to the metal was stirred the latter became anode or cathode, according to the nature of the metal and the solution used.—*Memoirs of the College of Science*, Kyoto Imperial University, October, 1917.

Effect of Electric Field on Spectrum of Helium.—Toshio Takamine and Usaburo Yoshida.—Employing Lo Surdo's method, the effect of an electric field on the spectrum lines of helium has been investigated. Relying on Stark's data, the intensity of the electric field has been calculated from the amount of separation of the outer components of H_γ. In the fields ranging from 3000 volts to 70,000 volts per centimeter in strength, the manner of decomposition of the following seven lines has been examined: λ in A.°U. 5048, 5016, 4922, 4472, 4388, 4121. The results of the measurements have been compared with those of Stark, Brunetti and Koch. In each of the p— and s— components of the three lines 4922, 4472 and 4388 A.°U., an isolated component appeared on the violet side at a certain electric field, and in the case of 4472 line the component was further decomposed into three as the field strength was increased. Besides the lines mentioned, the separation of the p— component of the line 4686 has been observed. One of the new lines found by Koch has also been observed. Excepting the line 4686, the mode of decomposition of all the helium lines examined has been found to be dissymmetrical with respect to the initial line.—*Memoirs of the College of Science*, Kyoto Imperial University, October, 1917.

Selenium Rectifier.—H. Greinacher.—If a direct current is sent through a selenium cell, and an alternating current is then superimposed upon the direct current, the latter is increased. An alternating current only produces a direct component when it ceases to be sinusoidal. The author attributes both effects to the variation of resistance of selenium with the voltage, which he assumes to be a linear relation. He gives a theory of the rectification and deduces the value $KV^3/W(1 - KP)^2$ for the rectified current, where V is the effective alternating-current voltage, P the original direct-current voltage, K the coefficient of the voltage effect, and W the resistance of the selenium cell at voltage P. The author showed a battery capable of impressing a continuous voltage of 6000 when fed by an alternating current.—*Science Abstracts, Section A*, May 31, 1918 (abstracted from *Archives des Sciences*, December, 1917.)

Miscellaneous

The Electrically Equipped Tractor.—George B. Stone.—The article gives a description of an electric tractor for farm work.—*Tractor and Gas Engine Review*, June, 1918.

A Self-Adjusting Spring-Thrust Bearing.—H. G. Reist.—Bearing troubles are usually due to the fact that the oil film is broken in spots by uneven contact, the film of oil being only two or three ten-thousandths of an inch in thickness for a pressure of about 100 lb. per square inch (7 kg. per sq. cm.). A careful study of bearing difficulties led to the design of a flexible bearing surface pressed against the runner by springs. It appears that this would prevent the possibility of undue pressure at any point and compel each element of the surface to carry the load. Under test this solution has proved satisfactory. The pressure usually allowed for these flexible bearings is from 300 lb. to 400 lb. per square inch (21 kg. to 28 kg. per sq. cm.), the design permitting a very thin oil film without metallic contact. It is of course desirable to operate bearings at high pressure, for the parts are smaller and the friction is very much reduced. Tests to show the advantage of higher pressure in bearing designs are presented by the author as follows: By cutting the bearing surface in half, thus doubling the pressure per unit area, the bearing friction loss was reduced from 38 kw. to 16.7 kw. It is suggested that the principle described, although applied to thrust bearings, is applicable also to journal bearings and to bearing surfaces having a reciprocating motion.—*General Electric Review*, July, 1918.

Insulating Material from Fish Offal.—A new Danish process by which certain by-products valuable for electrical insulation may be made out of fish offal is soon to be put to a practical test in Skagen, Denmark. The most important of the new products is called "cornimit." It is claimed that this material has less water-absorbing capacity than galalith and greater insulating resistance. The price of the finished product is calculated at 11d. per kilogram (10 cents per pound). —London *Electrical Review*, June 7, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

CURTAILING ELECTRICITY IN PARTS OF CALIFORNIA

Signs and Breweries Come First in Order for Reduction Issued by the State Power Administrator

To cut down the use of the drought-depleted supply of electricity in northern and central California, and to save electric power for war industries, Power Administrator H. G. Butler on July 18 issued an order eliminating during the months of August and September, except Saturdays, Sundays and legal holidays, the use of electricity for signs or displays of any kind. Breweries, beginning Aug. 1, are to be furnished with only half their average monthly consumption of electricity for power. Street railroads are to reduce their mileage to bare necessity and to make skip stops instead of at every crossing. Interurban electric lines are to reduce consumption as much as possible. City officials are asked to reduce street and other lighting to the minimum compatible with public safety.

GOVERNMENT TO CONTROL THE TURBINE SITUATION

Meetings in Washington This Week to Perfect Details—War Industries Board to Commandeer All Large Units

Representatives of the large turbine producers of the United States like the General Electric Company, the Westinghouse Electric & Manufacturing Company, the Allis-Chalmers Manufacturing Company, etc., have been and are still meeting in Washington with the electrical division of the War Industries Board, Walter Robbins chairman, for the purpose of arranging certain details under which the government has commandeered all large turbines in sight and will take control of the turbine situation.

Under the arrangement being made, any one in the market in the future for turbines must apply to the War Industries Board for permission before a purchase can be made. This is made necessary by the shortage in turbines and in power, particularly in what is known as the restricted power district of the East, and it is the intention of the War Industries Board to see that turbines in future are placed where they will do the most good in furnishing power.

Steam turbines are badly needed, especially to meet the requirements of the Emergency Fleet Corporation and the Navy Department.

It is said in Washington that twenty-one manufacturers of turbines will be affected by the order and that manufacturers of turbines under 700 hp. will not come under the control of the War Industries Board. When this issue of the ELECTRICAL WORLD went to press, it was expected in Washington that a formal announcement by the board would be made public almost immediately.

L. K. COMSTOCK IS NOW IN GOVERNMENT SERVICE

New York Man Giving All of His Time to Work on the Priorities Committee of the War Industries Board

L. K. Comstock of L. K. Comstock & Company, New York, is at present devoting all of his time to work on the priorities committee of the War Industries Board and is devoting particular attention to work in connection with the non-ferrous tube section of the finished products division.

The work in this section is intended to control and at the same time increase the supply of seamless brass and copper tube, in which there is a distressing shortage, particularly in that kind of tube required for vessels of the navy and Emergency Fleet Corporation.

SUPPLY JOBBERS APPOINT WAR SERVICE COMMITTEE

Executive Committee of the National Association Has Drawn Up Distribution Pledge Subject to Revision

On Wednesday and Thursday the executive committee of the Electric Supply Jobbers' Association met at the Hotel Belmont, New York City, to ascertain the position of the electric supply jobber with respect to the war service pledge of the manufacturers. At this time a jobber's pledge, which accomplishes the same thing for the government as the manufacturer's pledge, was drawn up subject to revision. A war service committee of the E. S. J. A. was appointed, consisting of W. E. Robertson, Buffalo, N. Y., chairman; F. M. Bernardin, Kansas City, Mo.; W. R. Herstein, Memphis, Tenn.; F. S. Price, Boston, and N. G. Harvey, Chicago.

If it be true that no asset of a public service company to-day is more valuable to it than the good will of the community it serves, I am sure it is equally true that no public service company can perform its duties unless there is not only loyal service on the part of its employees but mutual confidence on the part of men and officials, together with adequate opportunities for direct approach by the men to officials in whom true authority is vested.—*Henry B. Endicott, executive manager Massachusetts Public Safety Committee.*

THE ENGINEER'S RELATION TO SALES DISTRIBUTION

Conference Club of Contractors Discusses Broad Commercial Problems with Representatives of Consulting Engineers, Manufacturers and Contractors

The functions of the engineering contractor, the consulting engineer, the jobber and the manufacturer's sales engineer were discussed at the eighth meeting of the Conference Club, held at Schenectady, July 21, 22 and 23. Representatives of the Westinghouse Electric & Manufacturing Company, General Electric Company. Electric Cable Company, American Conduit Company and National Metal Molding Company were present, in addition to members of the Conference Club.

A paper by Sullivan Jones, "A Functional Reorganization of the Electrical Industry," presented the basis for prepared discussions which were read by J. M. Curtin, manager industrial department Westinghouse Electric & Manufacturing Company; by A. R. Bush, manager power and mining department General Electric Company, and by C. E. Knox, presenting the viewpoint of a group of consulting engineers from New York.

Mr. Jones' paper proposed a plan by the Conference Club for effecting a readjustment of the engineering functions of the manufacturer, the contractor and the consulting engineer and suggested that the electrical contractor is really a constructing engineer.

Mr. Jones pointed out that the whole philosophy of business is changing and that men are giving up traditional viewpoints of their relations with each other in industry. Mr. Jones' paper was a plea for a better recognition, on the part of each branch of the industry concerned, of the problems of the others, leading toward the elimination of certain difficulties which arise when one group in the industry performs the work of another.

A broad discussion developed around several questions. Can the consulting engineer take the place of the sales engineer of the manufacturer? What service does the contractor-engineer render which should be performed by the consulting engineer? What should be the relation between the sales engineer, the consulting engineer and the engineering service performed by the contractor?

The paper aroused a broad discussion and brought out particularly two main points—first, that there are two classes of engineering business—development engineering, in which the manufacturer creates business, and the consulting service, which is the pure engineering side of the work for the user. The second general point is that a distinction should be made as to volume of work done in each of these classes of engineering. The larger proportion of the work handled by the manufacturers through the sales engineers is standard or semi-standard in character, and the applications of electricity are made according to well-established and generally understood good engineering practice. It was stated, therefore, in discussing this question, that there was a difference between the consulting work of a pure engineering character and standard engineering practice as defined above.

Mr. Curtin opened the discussion and said that no plan will succeed unless it provides that the final buyer shall get his wants supplied easily and satisfactorily at lowest costs. He outlined the classes of expert engineering service which the manufacturer had developed in order to apply electricity to the many arts and industries. He questioned the practicability of the consulting engineer knowing enough about the lines of the manufacturer to function as completely as the paper suggested.

Mr. Bush called attention to the difference in volume and also indicated that there were wide differences in the distribution of supplies and heavy equipment. He made the general point that in discussing these problems care should be taken not to introduce extra men between producers and final buyers and to assure that essential service be the basis for a development of the engineering functions.

James R. Strong, in the general discussion, accepted the point of view of the paper in so far as it set up high standards for discussion. He expressed the opinion that it was not practicable, because of the wide variation in trade practices and standards, to outline and define the function of the different groups with relation to each other. He made the point that in addition to the sales engineer of the manufacturer and of the consulting engineer and of the engineering service department of the contractor, the central station also in many communities has sales engineers whose function in helping the manufacturer to apply electricity is not greatly different from that of the consulting engineer.

Mr. Strong expressed his belief that the broad way to approach the problem was through the general suggestion made in the so-called Goodwin plan. He believed that if each of the groups in the industry that had a relation to this problem would intelligently analyze what it is doing and make a charge for the service which it is rendering, the problem would in general take care of itself because of the natural competition. If a man understood intelligently that he was rendering engi-

BETWEEN SESSIONS AT THE CONFERENCE CLUB MEETING AT SCHENECTADY, N. Y.

neering service and charged for it, he would not compete unfairly in the open market with the engineer who sold service only and was not a constructing engineer.

Representatives of the Consulting Electrical Engineers' Council of New York were present and presented a written discussion read by C. E. Knox. They expressed the conviction that the Conference Club plan was fundamental in character, and that while the plan seemed idealistic it must not therefore be thought impracticable. They suggested the appointment of a committee of manufacturers, consulting engineers and contractors to discuss the many questions involved and to forward the general movement.

A paper by E. Ellinger of L. K. Comstock & Company, New York, on "Credits" was read. The details of this paper and further discussion by other members of the conference will be presented in a later issue of the Electrical World.

The Conference Club voted to appoint the necessary committees to discuss the many phases of the questions brought out by the paper, and it was voted to hold the next meeting of the Conference Club on Oct. 17, 18 and 19 at Pittsburgh.

On Tuesday evening an informal dinner was given by the General Electric Company to the Conference Club and their guests, at which J. R. Geary, a representative of the General Electric Company in Japan, presented a most interesting talk on the soundness of the relations between this country and Japan, saying that, after fifteen years of personal experience, he felt that the Japanese were in accord with the war policies of the United States and that there was no basis for the wrong thinking with regard to Japan which he had heard expressed from time to time in this country.

The General Electric Company presented a cup for a golf trophy which was competed for, with the president's cup, by members of the Conference Club and guests. The General Electric cup was won by T. H. Hatfield of Indianapolis and the president's cup by G. E. Stuart of L. K. Comstock & Company.

PROBLEM OF ENEMY SUBMARINE

Information from the Naval Consulting Board and the War Committee of Technical Societies

"The Enemy Submarine" is the title of Bulletin No. 2, compiled by the Naval Consulting Board and the war committee of technical societies. Prepared from information already published and other information released recently, the publication has been examined and authorized by Secretary of the Navy Daniels.

CLOSING MEETING OF THE CONTRACTORS AND DEALERS

Last Session of Cleveland Convention—Discussion of Executive Committee on Relations with the Jobber

At the closing meeting of the eighteenth annual convention of the National Association of Electrical Contractors and Dealers at Cleveland, Ohio, papers on credit and accounting, retail merchandising and farm lighting were read, and a talk on "The Real Causes of Prosperity and Depression" by George E. MacIlwain, of Babson's Statistical Organization, was given. A report of the early sessions was published in last week's issue of the Electrical World.

The association voted to hold its next annual convention in Milwaukee, and the executive committee accepted the invitation of the Toronto contractor-dealers to hold its meeting in that city in October.

Roy Woolley of the Society for Electrical Development presented the plans of the society for promoting an outlet campaign. Much informal discussion by the contractor-dealers present indicated their interest and their belief in the value of this campaign at this time.

At a meeting of the executive committee with a committee from the Electrical Supply Jobbers' Association composed of W. E. Robertson of Buffalo, Frank S. Price of Boston and Fred Bissell of Toledo there was a discussion of the relation between the jobber and the contractor-dealer. The discussion was led by W. K. Tuohey, chairman of the co-operation and harmony committee formed at the request of the National Association of Electrical Contractors and Dealers with the Electrical Supply Jobbers' Association on May 19. Another member of the contractors' committee, James R. Strong of New York, also discussed the question, and a general discussion by members of the contractors and dealers' association followed.

In the resolution of co-operation which was drawn up as a result of the first meeting of the committee it was stated that the members of the association personally and through their salesmen urge all electrical contractors and contractor-dealers to become members of the contractors' association and urge all electrical dealers and all other merchants operating retail electrical departments to become associate members.

To help clear up any misunderstanding as to the meaning of the terms "retail department" and "retail business," the resolution defined "retail department" as follows:

"By retail departments operated by jobbers your committee understands departments that sell at retail prices,

DELEGATES AND GUESTS AT CLEVELAND MEETING OF CONTRACTORS AND DEALERS in retail quantities, to the consumer, and expressly excludes sales to isolated plants, central stations and power companies, philanthropic, educational, health or corrective institutions or enterprises related thereto, industrial firms or corporations of every kind engaged in commerce or in undertakings relating thereto, or the government, or any political subdivision thereof or agency in connection therewith."

The discussion on the resolution hinged on the definition of what was understood by retail business. The general basis for further agreement on the question was established in the discussion along the lines of the idea that decisions with regard to who shall handle business ought to be based upon the general platform of who creates business. In his remarks Mr. Robertson made the point that profit comes from sales effort and that it is not possible arbitrarily to classify men in groups without regard for the ability of the men in those groups to perform the functions of the groups. It was pointed out that both jobbers and contractor-dealers could agree at once to the platform laid down that the field for household appliances was a primary retail field. Mr. Robertson and others discussing the question made it clear that the volume of business possible in this market was not generally realized and that there existed a very real opportunity, particularly in the labor-saving appliance field, for the contractor-dealer to go out and create business locally which would return to him a real profit.

In the discussion of the papers on retail merchandising and farm lighting the fact was brought out that contractor-dealers who have taken advantage of the possibilities of the sales offered by appliances have profited. It was pointed out that the traditional point of view that there was no money in the retail business was a mistaken one, and examples were given showing large volumes of sales profitably made with several of the motor-driven appliances.

Another point made in the discussion was the possibility of developing local effort along the line of securing a better understanding locally of the relation between the different forces for building good retail business. References were made to the success of this plan of co-operation on the Pacific Coast, and to the success of the general ideas laid down by W. L. Goodwin in many cities since the New Orleans convention of the contractor-dealers' association. Opportunity was given the contractor-dealers' association to have contributing members on the basis of the resolution passed at the convention, and at the final executive meeting the plans and methods of financing the association were taken up.

> It is good business at all times to use as little power as possible. It is patriotism to do so now, as war industries must be protected against any hindrance to full operation. A considerable voluntary reduction in the consumption of electric energy made at this time will certainly reduce the extent to which priorities may be applied. It may make a priority list unnecessary in the future and assuredly will postpone the evil day in any event.—*H. G. Butler, Power Administrator under the California Railroad Commission.*

STRIKE AT LYNN WORKS OF GENERAL ELECTRIC COMPANY

Still "On" Officially, but Employees Are Returning and Sentiment Is Against Curtailment of Production in War Time

Although the strike of employees at the Lynn (Mass.) Works of the General Electric Company was still "on" Wednesday and the production of war material and other essential equipment correspondingly retarded, men were returning to work and sentiment was setting strongly against remaining out of the factory at this vital time in the country's history.

The walk-out occurred without notification to the company's officials on Monday of last week, and without the presentation of any reasons or requests by employees. About 75 to 80 per cent of the employees at the Lynn Works stopped work. The company is manufacturing much important war material for the government. Public sentiment clearly opposes a continuance of the strike and has, in fact, not favored the walk-out at any time.

Several days after the walk-out the strike committee addressed a letter to W. C. Fish, general manager of the Lynn Works, in which various demands were framed. These included a basic eight-hour day, double time for Sunday, holiday and after-midnight work, the elimination of physical examinations of applicants for employment, and the establishment of various wage and working conditions along lines in force elsewhere. The strike leaders wired President Wilson last week that they desired to have the National War Labor Board act as arbitrator.

General Manager Fish also telegraphed the President, calling attention to the violation by the strike leaders of the first principle of the National War Labor Board, promulgated by the President's proclamation of April 8, 1918, to wit: "There should be no strikes or lock-outs during the war," pointing out that this principle is the fundamental basis of the agreement between the employers and the workers, and recognized as vital to the successful prosecution of the government's war work; that the employees left without notice or presenting reasons or requests, and production stopped.

Mr. Fish emphasized that this was expressly contrary to the war policies of the government and urged that the men should go back in compliance with such a policy. The telegram stated further that when the men are back and present their requests these will be carefully considered with the employees, and if an agreement is not reached, it will be in accordance with the principles of the War Labor Board to submit the matter. Mr. Fish expressed his firm belief in the loyalty of the employees and stated that he would be their stout defender on this point, no matter how unwisely they may be advised.

On Tuesday the State Board of Conciliation and Arbitration announced that by request of President Wilson it would order public investigations of existing strikes in Lynn and other industrial centers of New England unless all the existing strikes were settled within twenty-four hours.

There appeared to be no disposition on the part of the federal authorities at the beginning of the week to undertake the arbitration of the Lynn strike, in view of the false position which the strikers took at the outset and which they have since maintained. The employees have begun to go back in considerable numbers, although the excessively hot weather has doubtless led many of them to prolong their absence from work.

TELEGRAPH AND TELEPHONE TAKEN BY THE GOVERNMENT

President Wilson by Proclamation Takes Over Systems for Operation During the War Postmaster-General Burleson in Charge

President Wilson's proclamation of July 23 recites that "it is deemed necessary for the national security and defence to supervise and to take possession and assume control of all telegraph and telephone systems and to operate the same in such manner as may be needful or desirable."

By his sweeping proclamation effective at midnight on July 31, the President takes possession and assumes "control and supervision of each and every telegraph and telephone system, and every part thereof, within the jurisdiction of the United States, including all equipment thereof and appurtenances thereto whatsoever, and all materials and supplies."

The supervision, possession, control and operation undertaken by the President shall be exercised by and through Postmaster-General Burleson, who "may perform the duties hereby and hereunder imposed upon him, so long and to such extent and in such manner as he shall determine, through the owners, managers, boards of directors, receivers, officers and employees of such telegraph and telephone systems."

Until and except so far as the Postmaster-General shall by orders otherwise provide, the owners, managers, boards of directors, receivers, officers and employees of the various systems shall continue operation in the names of their respective companies, associations, organizations, owners or managers.

Regular dividends hitherto declared and maturing interest upon bonds, debentures and other obligations may be paid in due course; and such regular dividends and interest may continue until and unless the Postmaster-General shall otherwise by order determine. Subject to the approval of the Postmaster-General, the various systems may determine upon and arrange for the renewal and extension of maturing obligations.

Postmaster-General Burleson announced that John C. Koons, First Assistant Postmaster-General; David J. Lewis, Commissioner United States Tariff Commission, and William H. Lamar, solicitor for the Post Office Department, are appointed a committee for the governmental management, operation and control of the telegraph and telephone systems, of which committee the Postmaster-General shall be chairman.

In a formal statement Mr. Burleson said in part:

> The telegraph and telephone service, as conducted by those who have had the responsibility under conditions heretofore existing, has been remarkably successful considering the unusual additions to their task and the unprecedented difficulties in the way of its full performance which have arisen out of the war—difficulties which could be overcome only by a unity of administration, particularly a unification of the use of the telephone and telegraph lines, which could not be realized without the aid of the government
>
> Under the President's order conditions are changed and greater opportunity is afforded to effect improvements and economies and a larger use by the people of these facilities which have become an imperative need in their everyday life. Whether advantage can be taken of these opportunities to improve this service to the public remains to be disclosed by experience. Every effort of the department will be directed to the accomplishment of this end.
>
> It will be the purpose of the Post Office Department to broaden the use of the service at the least cost to the people, keeping in mind that a high standard of efficiency must be maintained. I shall avail myself of an early opportunity to consult with those who have heretofore had the responsibility of directing the affairs of the various wire systems taken over, and I doubt not will be greatly benefited by suggestions they may be kind enough to offer me.

Cable and radio systems are not covered by the proclamation, but it is reported that they will be taken later.

WAR ORGANIZATION OF THE ELECTRIC FURNACE MAKERS

Electric Furnace Industries War Service Committee Organized to Assist the Government War Program

A meeting was held recently at the Yale Club, New York, of certain electric furnace manufacturers of the United States at the request of the General War Service Committee of the Electrical Manufacturing Industry. C. L. Collens, 2d, representing the General War Service Committee, presided.

A temporary committee composed of John G. Bergquist of the Hamilton & Hansell Company, John A. Dixon of the John A. Crowley Company and F. J. Ryan of the Electric Furnace Construction Company was appointed to notify all of the manufacturers of the intention to form such an organization. F. J. Ryan was nominated as chairman of this committee.

As a result a final meeting was held on June 26 at a luncheon at the Bankers' Club, New York, and the movement was firmly ratified and a permanent committee organized, the members of which are: G. H. Clamer, chairman; John G. Bergquist, C. B. Fletcher, S. N. Castle, and F. J. Ryan, secretary.

The concerns that so far have joined this organization, which is to be known as the Electric Furnace Industries War Service Committee, are as follows: Hamilton & Hansell Company, New York; John A. Crowley Company, New York; Ajax Metal Company, Philadelphia; American Metallurgical Corporation, Philadelphia; Electric Furnace Construction Company, Philadelphia; Pittsburgh Furnace Company, Pittsburgh; Booth-Hall Furnace Company, Chicago; Industrial Electric Furnace Company, Chicago; C. W. Leavitt & Company, New York; Ludlam Electric Furnace Company, New York; T. W. Price Engineering Company, New York, and Beekman & Linden Corporation, San Francisco.

The object of the Electric Furnace Industries War Service Committee as formulated by its members is the formation of an organization for the duration of the war, or for such a length of time as it is apparent that there is a necessity for it by the government, to compile and detail information pertaining to the electric furnace industries in connection with steel, non-ferrous alloys and metals in general where the melting problem is concerned.

"LIGHTLESS NIGHTS" ARE ORDERED AGAIN

Eastern Manufacturing Zones Have Four Prohibited Nights Weekly, Other Sections Two Nights, in Fuel Administration's Regulations

The United States Fuel Administration made public on July 19 an order, effective July 24, restricting the use of fuel for outdoor illumination.

Light generated or produced by the use or consumption of coal, gas, oil or other fuel for illuminating or displaying advertisements, announcements or signs, or for the external ornamentation of any building, will be discontinued entirely on Monday, Tuesday, Wednesday and Thursday of each week within New England and the States of New York, Pennsylvania, New Jersey, Delaware, Maryland and the District of Columbia, and will be entirely discontinued on Monday and Tuesday of each week in all the remainder of the United States. The order excepts bona-fide roof gardens and outdoor restaurants and outdoor moving-picture theaters.

Street illumination in all cities will be restricted to the hours between sunset and sunrise, and the amount of public lighting in any city will be reduced to that necessary for safety. The order charges local fuel administration officials to arrange with municipal authorities for public lighting regulation.

The use of light for illumination or display in shop windows, store windows or in signs in show windows will be discontinued from sunrise to sunset and will be discontinued entirely on the "lightless nights."

The Bureau of Standards has advised the Fuel Administration that it is estimated that about 500,000 tons of coal per year is used for advertising purposes, including display and show-window lighting, in the United States. Similar estimates fix the amount of coal used in advertising lighting in New York City at 16,000 tons per year.

The order reads:

It appearing to the United States Fuel Administrator that it is essential, in furtherance of the national security and defense, the successful prosecution of the war and the support and maintenance of the army and navy, to lessen and prevent the waste of fuel, and to secure an adequate supply and equitable distribution and prevent, locally and generally, scarcity thereof, and that to these ends it is necessary that the use of fuel shall be limited and restricted in the manner hereinafter set forth,

The United States Fuel Administrator, acting under authority of an executive order of the President of the United States, dated Aug. 23, 1917, appointing said administrator, and of subsequent executive orders, and in furtherance of the purpose of said orders and of the act of Congress therein referred to and approved Aug. 10, 1917,

Hereby adjudges that in his opinion the use of fuel or of light generated or produced by the use or consumption of fuel for any of the purposes hereinafter described, except as hereinafter provided, is wasteful, and that any person using fuel or light for such purposes, except as aforesaid, is engaging in a wasteful practice or device in handling or dealing with fuel, and that the use of fuel or light for such purposes except as aforesaid is prejudicial and injurious to the national security and defense, and a cause of scarcity locally and generally, and said United States Fuel Administrator hereby orders and directs that, until further or other order of the United States Fuel Administrator, and subject to modification hereafter from time to time and at any time:

1. No city, village or town, and no person, firm or corporation under any contract with any city, village or town, shall use or consume any coal, oil, gas or other fuel for the maintenance of lights in the streets, parks or other public places of such city, village or town, except under the following restrictions and limitations:

(a) Street illumination automatically lighted, maintained by or for any such city, village or town, in the streets, parks or other public places thereof, shall not be lighted before sunset and shall be turned out not later than sunrise.

(b) Street illumination lighted by hand in any such city, village or town shall conform as nearly as may be to the requirements hereinabove prescribed for automatic lights.

(c) The amount of public lighting in any city, village or town shall be only so much as may be necessary for safety, and the use of lights commonly known as cluster lights for purposes of display or decoration shall be reduced to such portion only of the cluster as is necessary for safety.

2. The local fuel administration for the territory within which any city, village or town is located shall arrange with the proper municipal or town authorities of such city, village or town for the regulation of public lighting in accordance with the provisions of paragraph 1 of this order. Regulations for public lighting so arranged shall in each case be subject to the approval of the proper state fuel administrator, and in case regulations in accordance with said paragraph 1 for the public lighting of any city, village or town satisfactory to the state fuel administrator of the state within which the same is located shall not have been arranged between the local fuel administration and the proper municipal or town authorities, as hereinafter provided, within ten days from and after the effective date of this order, said state fuel administrator is hereby authorized and directed to prescribe such regulations for such city, village or town, and the same shall be valid and binding.

3. Out-door lights within a city, village or town, other than those mentioned in paragraph 1 of this order, which involve, directly or indirectly, the use or consumption of coal, oil, gas or other fuel shall not be lighted until thirty minutes after sunset.

4. (a) The use of light generated or produced by the use or consumption of coal, gas, oil or other fuel, for illuminating or displaying advertisements, announcements or signs, or for the external ornamentation of any building, shall be entirely discontinued on Monday, Tuesday, Wednesday and Thursday of each week within New England and the States of New York, Pennsylvania, New Jersey, Delaware, Maryland and the District of Columbia, and shall be entirely discontinued on Monday and Tuesday of each week in all the remainder of the United States.

Exception: Bona-fide roof gardens where meals are served and out-door restaurants, also establishments devoted exclusively to the exhibition of out-door moving pictures at which admission is charged, are exempt from this section.

(b) The use of light generated or produced by the use or consumption of fuel for illuminating or displaying any shop windows, store windows or any signs in show windows shall be discontinued from sunrise to sunset and shall also be discontinued on the nights specified in paragraph 4 (a).

5. The state fuel administrators within the several states are hereby directed and authorized to see that the provisions of this order are observed and carried out within their several states, to report violations thereof to the United States Fuel Administrator, and to recommend to him action to be taken with respect to such violations.

This order shall be effective on and after July 24, 1918.

Lamps Under Consideration

It is understood that the Fuel Administration has under consideration some measures providing for the possible curtailment of production and distribution of the less efficient types of incandescent lamps. It is also proposed to take steps to discourage the wasteful and unnecessary use of electrical energy for lighting purposes.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

N. E. L. A., Philadelphia Section.—At a recent meeting officers for the Philadelphia Section, N. E. L. A., were elected for the ensuing year, W. K. Kerford becoming chairman and F. X. Monville secretary.

Jovian Electric League, St. Louis.—The election of officers of the St. Louis Jovians for next year resulted as follows: President, E. H. Waddington, Western Electric Company; secretary, G. McD. Johns.

A. I. E. E., Indianapolis-Lafayette Section.—The annual election of officers, held July 3, resulted as follows: Chairman, G. B. Schley, and secretary, C. F. Harding. Mr. Harding's address is Purdue University, West Lafayette, Ind.

Oregon Association of Electrical Contractors and Dealers.—Secretary-treasurer J. W. Oberender, 302 Dekun Building, Portland, Ore., reports that the annual meeting of the association will be held Sept. 12, 13 and 14, 1918.

Electric Hoist Manufacturers' Association.—The June meeting of this association was held at Montour Falls, N. Y. The general topic was war service, along lines for co-ordinating the facilities of electric hoist manufacturers so as to be of most direct service to the government.

A. I. E. E., Philadelphia Section.—An interesting summary of the work of the A. I. E. E. in connection with the war was given by F. L. Hutchinson, national secretary, at the Philadelphia Section meeting, June 10. W. F. James was elected chairman and E. B. Tuttle secretary for the year 1918-19.

A. S. M. E., New Orleans Section.—At a joint meeting of the local section of the A. S. M. E. and the Louisiana Engineering Society recently a paper was read by Howard Egleston, civil and industrial engineer for the New Orleans Association of Commerce, entitled "The Present Situation as Relates to Introduction and Use of Natural Gas in New Orleans." J. M. Morris is secretary of the Louisiana Engineering Society.

Central Electric Railway Association.—The annual summer meeting of the Central Electric Railway Association was held at Cedar Point, near Sandusky, Ohio, on July 17 and 18. G. Dorticus, General Electric Company, outlined the history of automatic substation developments. Other papers on general business policy were discussed. It was announced that the next meeting of the association would be held at Indianapolis, Nov. 21.

A. I. E. E., Pittsburgh Section.—On June 11 officers were chosen for the ensuing year as follows: W. R. Work, chairman, and J. G. Carrol, secretary. Major Lyle read a paper on "The Development Organization of a Modern Army," and S. Q. Hayes spoke on "Some Recent European Experiences."

Indiana Electric Light Association.—The annual convention of the association will be held at the Claypool Hotel, Indianapolis, on Wednesday, Aug. 7, 1918. Instead of having the usual three days' session, all business and papers will be confined to one day in the interest of economy appropriate to the times.

United States Independent Telephone Association.—War problems of telephone companies formed the chief theme for discussion at the annual convention of the independent telephone men held in Chicago, June 25 to 28. Officers were re-elected for the following year. G. H. Robinson of St. Paul is president.

A. I. E. E., Toledo Section. — The meeting of June 28 was attended by eighty members of the Toledo University detachment of gas-motor experts to listen to a paper by Captain Arthur Boor, R. A. F., on "Development of Aviation Motors." The speaker traced the development of motors up to the present types.

Society for the Promotion of Engineering Education.—The twenty-sixth annual meeting of the Society for the Promotion of Engineering Education was held at Northwestern University, Evanston, Ill., June 26-29, with an attendance of 125, representing forty institutions. The subject of the meeting was "Engineering Education and the War." The War Department was represented by Dr. J. R. Angell, C. R. Mann and S. P. Capan. Dr. Angell spoke at length on the committee of education and special training and emphasized the excellent relations which have been established between the engineering schools and the War Department. There were three papers describing this type of work which caused a great deal of interest. One of the most important subjects before this convention was the question of attendance at engineering schools next year. This was discussed at length by Dr. Mann, representing the committee on education and special training of the War Department, under the title "Students' Army Training Corps." Dr. Capen read a paper on the "Relation of the Bureau to the War and to Engineering Schools." The report of the standing committees occupied practically one day. The joint session of the Western Society of Engineers, the Chicago Sections of the A. S. M. E. and A. I. E. E. and the S. P. E. E. on Thursday night was a success in every way. A. S. Baldwin, chief engineer Illinois Central Railroad, presided. The presidential address, "Essentials in Engineering Education," was read by Vice-president John F. Hayford in the absence of President Milo S. Ketchum.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Act Done Prior to Court Order Not Contempt.—A charge that defendant was maintaining electric wires within a stated distance from plaintiff's wires, in violation of an order enjoining defendant from trespassing upon poles or wires of plaintiff and from constructing lines within such distance therefrom, does not constitute a charge of contempt, since the wires may have been so placed prior to the promulgation of the order, the Court of Appeals for the Second District of California held (173 P. 110).

Complaint for Damages for Line Maintenance.—A complaint by an abutting property owner against a telephone company for damages for the maintenance of a telephone line erected over such property before plaintiff became the owner thereof is demurable where it merely states that plaintiff had not given his consent but does not allege that consent to the maintenance of the lines was not given by plaintiff's predecessor in title, in view of the laws requiring the approval of the Public Utilities Commission where the consent of the adjoining owner cannot be obtained and providing for a committee to appraise damages for the maintenance of the lines, the Supreme Court of Errors of Connecticut held (103 A. 754).

Negligence in Distributing Energy Over Uninsulated Wire on Premises of User.—Where an electric company knew that the insulation was burned off a wire on the premises of a user beyond its meter, and sent a current over the same of such voltage as to cause death to a person coming in contact therewith, the jury was authorized to find that it was negligent, the Court of Civil Appeals of Texas held in International Electric Company versus Sanchez (203 S. W. 1164). The fact that the owners of the building knew of the uninsulated condition of a wire and failed to remedy the defect cannot be held such an intervening cause of the death of one coming in contact therewith as to require a finding that the negligent act of the electric company in sending a high-voltage current over the wire after knowledge of its condition was too remote. Where deceased had no knowledge of the existence of an uninsulated wire and stepped upon a parapet in a building, which act would have involved no danger had the wire not been there, and where he was not then trespassing to any appreciable extent on the rights of any other person, he was not guilty of contributory negligence as a matter of law.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Commission Upheld in Missouri Rate Case.—The Supreme Court of Missouri has decided in favor of the Kansas City Light & Power Company the suit of the Kansas City Bolt & Nut Company attacking the increased rates put into effect on May 1, 1917. These rates were established by the Missouri Public Service Commission, the decision being an indorsement of the commission's authority to fix the rates.

French Celebrate Fourth of July.—Le Carbone company, a French concern with wide American affiliations, manufacturing carbon brushes, has sent the following cable to its representative in the United States, W. J. Jeandron, New York City, showing the great ties of friendship which bind the French and American republics together: "Advise all our friends what admiration and gratitude France is feeling for the gigantic effort of sister republic. Thursday, July 4, was also our national day."

The Cincinnati Rate Case.—An article on Cincinnati rates, published in the ELECTRICAL WORLD of July 6, 1918, page 34, may serve to give an unintentional erroneous impression as to the facts. The recent decision of the Ohio Supreme Court does not in effect serve to deny the right of the Union Gas & Electric Company to increase its rates for natural-gas service, but, on the contrary, will, in the opinion of counsel, serve to put into effect the ordinance passed in 1916 increasing the net rate for natural gas to 35 cents per 1000 cu. ft. from 30 cents as formerly charged. This 35-cent ordinance was voted down in a referendum election by the Cincinnati voters, and, following such action, a new ordinance fixing a rate of 30 cents was passed by the Cincinnati City Council with the avowed purpose of transferring the fixing of the rate to the Public Utilities Commission of Ohio under appeal to be taken by the company. The decision of the Ohio Supreme Court, referred to in the article, holds that the utilities commission has no jurisdiction in this case because in the franchise of the company relating to natural-gas service the fixing of rates rests with the city, and the court holds that this franchise constitutes a contract obligation between the city and the company which is not affected by subsequent legislation, and that therefore the authority of the Public Utilities Commission, which commission was created under subsequent legislation, does not apply during the life of the twenty-five-year contract between the company and the city. This ruling of the court will serve also, in the opinion of counsel, to set aside the referendum election in which the 35-cent rate ordinance was rejected because such election was held under legislation also subsequent to the making of the twenty-five-year contract. If this interpretation of the court's decision is correct, the first effect will be to sustain the company's present rate of 35 cents for natural gas for a further period of three years against the attempt on the part of the city to enforce a maximum rate of 30 cents. The effect of the decision secondarily will be to take away from the Ohio Public Utilities Commission any jurisdiction over the gas rates of the company until the year 1930. As to electric rates, the statement in the article is correct as applied to the present maximum rate of 8½ cents per kilowatt-hour, but it will be interesting to note that a surcharge of 20 per cent on the company's wholesale lighting and power schedules became effective March 6 last with the approval of the Ohio commission, and such rates are in no way affected by the recent court decision. The contentions of counsel for the company in respect to the effect of the court decision have been sustained in the federal court by temporary injunction pending formal argument which will not be heard before October.

Southern California Edison Seeks Rate Increase.—The Southern California Edison Company has filed with the California Railroad Commission an application for authority to increase its rates for electricity to general consumers. No definite raise is asked, the request being simply that the commission authorize such increase in electric rate as the commission may deem proper. A statement attached to the application sets forth that as the result of the high operating cost, the shortage of water power and other reasons the company's revenues are not adequate at existing rates to maintain service at maximum efficiency and enable it to perform the public service required of it. The Southern California Edison company makes a statement by its president, W. A. Brackenridge, as follows: "Practically every utility in the state has found it necessary to apply to the Railroad Commission for increases in its rates, owing to conditions brought about by the war. The Southern California Edison Company has not made application before this, having waited until such time as it could definitely determine what effect the shortage of water and the increased cost of fuel oil, labor and supplies would have upon its finances. Notwithstanding the fact that the Southern company by interconnection with the San Joaquin Light & Power Company, the Mount Whitney Power & Electric Company and the Southern Sierras Power Company has used water which during other years had not been used, the war-time increases in production and distribution have accumulated in so much greater proportion that additional revenues are essential."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Cost of Competing Service.—A decision of the Oregon Public Service Commission granting authority to the Oregon Gas & Electric Company to increase gas rates says in part: "From a study of the cost of gas with cost of competing products such as wood, coal and electricity, and considering the relative convenience in the application of these various classes of fuel, we are inclined to the belief that the rates for which application is made are reasonable for the consumer from the standpoint both of the value of the service to be rendered under them and the cost of that service to its producer."

Higher Coal Cost.—Permitting the Public Service Company of Northern Illinois to advance rates regardless of the claim of certain power consumers that, relying on unexpired power contracts, they had entered into contracts for the sale of their manufactured products which would involve heavy loss if the petition of the company should be granted, the Illinois Public Utilities Commission decided several controversial points. It held that comparison of rates between territories served by the petitioning utility and those served by other utilities would be considered for what it is worth as indicative of the general trend of rates for such service. The commission authorized a 15 per cent emergency surcharge on all rates irrespective of existing contracts for service. The decision referred to coal as follows: "In 1914 the cost of fuel represented 50.3 per cent of the production cost of electric energy. In 1915 this percentage had increased to 51.1 per cent; in 1916 to 55.1 per cent, and in 1917 the cost of fuel represented 70.3 per cent of the cost of production. This is particularly significant as applicable to the issues which are raised herein, since electric power business is of the character of a competitive business, which necessarily has been taken upon a narrow margin of profit and in many cases has but slightly exceeded the cost of production. It appears that the amount of increased revenue which will be realized under the rates which are herein proposed will be $129,147 per annum, based upon the amounts of energy consumed under these rates for the year 1917. It further appears that the increased cost of coal consumed for generating the energy sold under this rate for the year 1917 over the cost of a similar amount of coal at the prices prevailing in 1914 is $187,918. It thus appears that the increased revenue derivable from the surcharge will not equal the increased cost of coal."

James C. Legg, Centerville, Md., has been appointed by the Governor a member of the Maryland Public Service Commission, succeeding E. Clay Timanns.

George J. Roberts, formerly first vice-president of the Public Service Corporation of New Jersey, has been appointed head of the new ordnance district department for New York.

B. H. Elliott, formerly superintendent of lines of the Birmingham (Ala.) Railway, Light & Power Company, has been appointed superintendent of power houses and substations of the company.

Major E. M. Watts, formerly connected with the Union Electric Light & Power Company, St. Louis, Mo., and now with the British expeditionary forces at the front, has been promoted to a staff position.

Raymond D. Sherman has resigned his position as electrical superintendent of the Schenectady Power Company, Schaghticoke, N. Y., to become superintendent of the Readsboro (Vt.) plant of the New England Power Company.

E. J. Fowler, formerly statistician of the Commonwealth Edison Company of Chicago, has been commissioned a major. He is at present chief of the information and statistics branch for the office of the Quartermaster General of the United States Army.

James E. Carnes, formerly contract agent and advertising manager of the Nashville (Tenn.) Railway & Light Company, has been appointed to the newly created position of sales and new-business manager. Mr. Carnes entered the employ of the company in 1904.

C. O'B. Murphy, who for the past year and a half has been assistant general manager of the American Public Utilities Company, Grand Rapids, Mich., has been transferred as vice-president and general manager to the Merchants' Public Utilities Company and the Merchants' Heat & Light Company, Indianapolis, which are controlled by the American Public Utilities Company.

Thomas F. Hill, of the railway department of the Southern Pacific Utilities Company in Anderson, N. C., has had his authority extended to cover the meter and contract department, as the result of the resignation of A. E. Holman, who has been superintendent of the latter department for some years. Mr. Hill is one of the oldest men in point of service with the company and its predecessors.

L. L. Newman, assistant general manager of the Birmingham (Ala.) Railway, Light & Power Company, has also been elected vice-president of the company. Mr. Newman was appointed assistant general manager of the company early in 1916, prior to which time he was superintendent of way and structures. Previous to his connection with the Birmingham Light & Power Company he was employed in various departments of the Pennsylvania Railroad.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

F. L. Ball, manager of the Haverhill (Mass.) Electric Company, who at the outbreak of the war was commissioned a Captain in the Reserve Corps, Quartermaster's Department, is at present serving as personnel officer somewhere in France.

I. L. Oppenheimer, president-elect of the Ohio Electric Light Association, has been in the public utility business since 1899. In that year he promoted and organized the Ohio River Electric Railway & Power Company. This company later acquired the Pomeroy Middleport Electric Company. Mr. Oppenheimer has been president and general manager of both companies continuously. In the four years from 1909 to 1913 he was also general manager of street railways in Lexington, Frankfort, Paris, Georgetown and Winchester, Ky., and had charge of interurban lines radiating out of Lexington as well as of the electric lighting system and the City Ice Company at Lexington.

I. L. OPPENHEIMER

A. L. Kenyon has resigned as general manager of the Columbia (S. C.) Railway, Gas & Electric Company and is now engaged in war work for the government, manufacturing ammonium nitrate with the Air Nitrates Corporation at Toledo, Ohio. Mr. Kenyon was formerly engaged as chief engineer of the Empresas Electricas Associadas, Lima, Peru. He returned to the United States in the spring of 1910. The following year he was appointed chief of construction for the Georgia Power Company at Tallulah Falls, Ga. In 1915 he became manager of the Anniston (Ala.) Electric & Gas Company, and in the fall of the following year he took up the work at Columbia from which he has just resigned.

Wallace H. Foster, manager of the Marin (Cal.) district of the Pacific Gas & Electric Company, has left the employ of the company for the period of the war to work with the Food Administration. He has been assigned to the Marine Transportation Department, handling exports, including shipments for relief in Belgium.

G. B. Randall, formerly an employee of the county division of the Union Electric Light & Power Company, St. Louis, Mo., has been recently promoted to the rank of lieutenant-colonel in the Engineer Corps. Lieutenant-Colonel Randall attended the officers' training camp at Fort Leavenworth and is now stationed with the Thirty-seventh United States Engineers at Fort Meyer, Va. At the time of going into the army he was with the Curtis Manufacturing Company.

G. O. House, formerly superintendent of the St. Paul (Minn.) municipal water department, has been appointed manager of the Northern States Power Company at St. Paul, succeeding P. T. Glidden, deceased. Mr. House recently was St. Paul superintendent of the St. Paul Railway Company. Fourteen years ago he organized in St. Paul the Northern Heating & Electric Company, which later became the Consumers' Power Company and finally the Northern States Power Company.

Terrell Croft has been called to Washington by the educational committee of the War Department, of which C. R. Dooley is director, and placed in charge of the work of standardizing the electrical courses of training for enlisted men, and has been granted leave of absence by the Luminous Unit Company of St. Louis, with which he was associated as chief engineer. These courses are now being conducted in various schools and universities throughout the country, and the work of standardizing them is for the purpose of rendering the instruction as effective as possible by adapting it to specific war needs. In a majority of the courses being taught Mr. Croft's books on electricity are now being used as textbooks. Upon graduation from Pratt University in 1903 he became connected with the *American Telephone Journal* as assistant editor. Later he entered the service of the New York & New Jersey Telephone Company as an apprentice and worked his way up to the position of chief draftsman. Subsequently he was given charge of the electrical engineering division of the American Brass Company, Waterbury, Conn. In 1910 he became connected with the Westinghouse Electric & Manufacturing Company and was assigned the work of gathering data and writing special articles for the technical and general press. In that capacity he was transferred to St. Louis, and in 1914 he resigned to engage in practice as a consulting electrical engineer and to complete work for which he had data. Since that time he has taught electrical engineering at Washington University and elsewhere.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

SALE OF MOTORS IN EAST LOW DURING PAST FEW WEEKS

Manufacturers at a Loss to Assign Reasons—Restriction of Eastern Factory Expansion Possible Cause—Plants Swamped with Orders

With a single exception, manufacturers of motors state there has been a falling off in the booking of new business on the Eastern seaboard. Factories have not caught up with deliveries, the arrearages on shipments extending from two months to two years, according to the type, size and specifications of the individual requirement. Some of the well informed—close observers of passing events—are inclined to believe that the peak has been reached in this section for the increase of electrical motive power.

Now that a slump has occurred, surprise is expressed at the sudden turn. Whether this is temporary or permanent is puzzling the interests most directly concerned. It is recalled that in June the War Industries Board created a barred industrial zone in the East wherein the establishment of additional plants was prohibited.

The restricted area takes in practically the entire Eastern industrial region out as far as Pittsburgh. It is therefore no special cause for wonder that following the formulation of such a ruling the demand for motors should suffer a setback. It is the intention of the government to divert its industrial activities in the production of war material to the West and South. This means a change of markets only, with the manufacturers of motors and electrical accessories receiving their business from those sections. The East has been the predominating factor where the heretofore heavy business has originated. It remains, however, to be seen if this is a correct diagnosis of the situation.

JOBBER EXPLAINS WAR STATUS OF HOUSE TO HIS EMPLOYEES

Men and Women Belonging to Company Are Earnestly Urged to Exceed Record for Exceptional Service So Far Rendered

Faced with the necessity for handling a considerably greater volume of merchandise and details, the electric supply jobber has been particularly hard hit by the rapid turnover of labor. It is doubtful whether many of the employees who have left jobbing houses have realized the essential character of the electrical jobber in the present crisis.

In a special message to employees of the Pettingell-Andrews Company, Boston, Charles B. Price, chairman of the board of directors, is setting forth the part that the man or woman on the staff of a jobbing house can play in rendering "super-service" to the war work of the country and is outlining the importance of doing, not one's "bit," but one's "best," in striving to bring about victory. The stimulating message is contained in an eight-page folder, and it emphasizes the immense importance of furnishing without delay essential materials to the various departments of the army and navy, to the shipbuilding yards, and to the many industrial plants that are running night and day on government work. The booklet was written to help the employees of this company, the largest electrical jobber in New England, to realize that each and every one in the earnest, faithful performance of individual duties is a vital part of the national fighting machine—a soldier of industry.

A good many persons, even in the electrical trade, have not appreciated the extent of war service work which the electrical supply jobber is performing to-day, or the vital need of the jobber's stock as a mainstay of preparedness and active campaigning. The business of the Pettingell-Andrews Company, like that of other jobbers, is now made up almost entirely of war work. The electrical material required by every ship that is put into the water, by every new government building, cantonment, arsenal, naval base, embarkation station and manufacturing plant engaged in war work, is so varied and produced by so many manufacturers in such widely separated sections of the country that only by the exercise of constant vigilance and untiring effort has the jobber been able to keep his warehouses stocked with the material required, thereby succeeding in giving the service that is absolutely necessary in meeting the war conditions. The booklet urges not only giving the government the exceptional service which has been rendered up to this time, but exceeding the records already made.

CONVERSION TO WAR WORK OF LESS ESSENTIAL INDUSTRY

Regional Organizations Present to Business Men New Requirements in the War Program as They Arise

A great many classes of manufacturers are by their very nature in what might be termed a less essential group. Some of these are automatically suffering a decrease in output owing to decreased demand. Others are having their output curtailed because the government will permit them to use only a limited amount of fuel and is making it difficult for them to obtain raw materials.

In either case it will be of particular interest to a number of electrical manufacturing concerns to note that the government has taken steps through regional organizations in the twenty regions into which the country has been divided to permit plants thus slowed down to continue to operate by diverting their machinery to more essential work.

The object of these regional organizations is to furnish the government with the necessary knowledge of national conditions in providing new resources and converting industries to war work. As the various departments of the government develop new requirements in the war program, they are presented to the business men of the country through these regional organizations.

As an indication of what is possible in the conversion of industry to meet war requirements and of the changes which can be made in the product of a factory, a few radical instances may be related. For instance, a Pennsylvania factory that formerly made linoleum is now machining 4.7-in. shells. A Duluth horseshoe manufacturer is turning out trench picks for the army, and a New Jersey terra-cotta tile concern is making dummy drop bombs. A Milwaukee factory, the former output of which was rowboat motors, is making hand grenades and trench pumps. In Rhode Island a manufacturer of finger rings has turned his activities to making adapter plugs. A Detroit stove concern is producing trench bombs and anchor parts. Instances of this sort might be multiplied indefinitely, and they all serve to show the possibilities in converting to war work factories whose normal business has been curtailed by war conditions.

THE WEEK

IN TRADE

FURTHER evidence of mounting prices is reported this week. The increases generally are in small goods and appliances. Demand appears to be keeping up except for industrial equipment in the East and construction material in the Northwest. This latter, however, is undoubtedly merely temporary. The government is rapidly absorbing more and more of the available electrical equipment and manufacturing facilities, so that ordinary commercial business is of necessity dwindling.

Reports continue to indicate an unusual activity in appliance buying. In some measure covering accounts for this at the present time. Conduit continues scarce and the government priority requirements are gradually making themselves felt.

Some particularly seasonable weather during the latter part of last week and during this week has made an impression on fan stocks that the trade was beginning to believe might have to be carried over. Unless this warm spell, however, is of a long duration it seems doubtful if the entire fan stock of the country will be absorbed this season.

Transportation appears to be getting better, particularly on shipments to the Pacific Coast, but there are no indications that it will be cleared up by winter.

Here and there greater efforts in the matter of collections are resulting in the money coming in faster.

NEW YORK

Prices still show a decided upward tendency in various lines. While jobbers are glad to get goods, there is a perceptible holding off in buying on account of the high prices. If jobbers were able to get goods promptly, which is far from being the case, business would be much better. As it is, the volume of sales is very satisfactory. On other than government orders trade is spoken of as conservative. Several concerns that arrange their buying on a basis of three months' requirements and heretofore have not encountered any difficulty in obtaining goods from the manufacturers now say that the situation is getting precarious. The market is far from stable and is consequently causing buyers to hesitate. Beyond placing orders for a certain average quantity of goods, jobbers state, it is a speculative proposition. The unusual risk attendant upon owning merchandise at the top of the market, combined with carrying a large part of the profits from year to year in the increased value of stock, justifies caution.

Collections are receiving more attention than credits, and the results in settlements are better than for several weeks.

MARINE FIXTURES.—The United States Shipping Board Emergency Fleet Corporation of Philadelphia, under date July 16, called for bids for fifty lots of marine fixtures, and fittings of different kinds, in addition to a quantity of plugs, receptacles and other items, are required.

SWITCHES.—A general advance of 15 per cent, effective July 15, is announced on the general line of switches. These include push-button, rotary flush and rotary surface, and snap, remote-control, automatic door, automobile, battery, door-bolt control, feed-through, heater, lock, momentary contact, panelboard and pendent switches.

LIGHTING FIXTURES.—The demand is very light and commercial sales are at a low level. In the past six months there have been about 20 per cent price advances made. Such transactions as are reported cover replacements and maintenance. Some jobbers who have specialized in the fixture line are closing out their stocks on account of there being no market.

ASBESTOS INSULATION.—Price fluctuations on tapes, yarns and fiber have been so frequent that fixed prices are impossible. Deliveries are back about two months. Quotations are f.o.b. mill. The recent order of the War Industries Board placing asbestos and magnesia coverings (the latter of which advanced 5 per cent—now list net—on July 13) with commodities for preferential treatment in procuring supplies of fuel and transportation service will also permit the production of a normal supply for the manufacture of electrical specialties.

FLASHLAMPS.—List prices have been advanced on certain types of lamps and batteries. Manufacturers report the demand heavy with a limited supply. In fact, in all sizes and types an increase of 25 per cent was made July 15. This is said to be the first revision on a higher scale in ten years.

FRACTIONAL MOTORS.—All sizes from 0.05-hp. to 0.75-hp. rating are reported as short. One of the large producers, it was learned, had a few of each in stock, of some sizes only from two to six, but it has been unable to accumulate any quanity. The number of orders on hand was said to be tremendous, and therefore catching up was out of the question. Deliveries on any quantity of motors could not be made under ten weeks. A number of large plants working on fractional horsepower motors are running on a twenty-four-hour basis in their motor departments. Eighty per cent of the output of one of these plants are washing-machine motors of 1/6-hp., ⅛-hp. and ¼-hp. ratings. This plant turns out 13,000 washing machine motors monthly. A single order from one washing-machine firm was for 40,000 motors deliverable in a year. Iron and steel are difficult to get for these goods.

WIRE.—All kinds of wire are difficult to obtain excepting on priority orders, which are absorbing 80 per cent of the capacity and material of the drawers and finishers. One jobber who had placed a requisition for wire by mail, and after its acceptance the day before, had the order returned and declined. One of the largest manufacturers recently received governmental specifications for 8000 miles of ten-strand, cotton-insulated copper cable, which cannot be placed in the process of manufacture before Sept. 1. A semi-commercial order for 6,000,000 ft. of two-strand copper wire, rubber-covered, was declined as delivery could not be promised. Deliveries are from four to six months in arrears. A number of important civilian requirements are in the market, but manufacturers cannot accept them.

COLLECTIONS AND CREDITS.—For a month collections have improved on an average of about 5 per cent. They are more carefully watched and looked after and tightened in connection with war conditions than credits, which are by no means neglected. It is aimed to keep bills receivable within limited bounds and accounts liquid. Thirty-day bills are being paid in from forty-five to sixty days. Some renewals are being asked.

CONDUIT.—The supply outside of government requirements is short. Reports that some large stocks are being held locally is questioned.

HEATING APPLIANCES.—The Hotpoint division and the "G. E." division of the Edison Electric Company, Inc., have issued new and higher price lists on their respective lines, effective July 15.

FANS.—With the arrival of warm, seasonable weather this week the demand for fans became emphatic. Producers in this territory have been overrun with orders, and it is certain the available supply will fall far short of the trade's requirements. A survey of the jobbing field was undertaken during the week, and the replies were that jobbers have either a scant stock or none at all. The government has been buying heavily for the equipment of medical and naval bases, transports, cantonments, etc., 90 per cent of which are for direct-current. In New York nearly all the fans are said to be direct-current. These calls have therefore upset the market. A local manufacturer's agency taking 15,000 fans, mostly direct-current, for the season has not yet had the order filled. Dealers and department stores are making special selling campaigns in fans.

CHICAGO

In the Middle West the general business situation remains unchanged. The place to look for orders is still in the factories and mines. Central-station companies are buying little. The extensive financing which is being done in the period between the Liberty loans by industrial plants and food-producing companies in this section makes it seem reasonable to predict that this situation will remain as it is for some time to come. This industrial-plant business is of course indirect war business, but manufacturers in this section are beginning more and more to figure their business in two sections, namely, that percentage which is direct war business and that which is indirect war business.

In general, it may be said that all plants are having some difficulty owing to the scarcity of raw material. Occasionally, however, a factory is discovered which has on hand in its warehouses material enough to last it for some time.

There is some activity in the Central West which is attributable to housing employees of plants on government work. One order for $50,000 worth of wire and cable was placed this week by the Ford company of Detroit.

LAMP CORD.—Prices have been increased from 33 cents to 34 cents by Chicago jobbers.

TRANSFORMERS.— Local agents of transformer companies report a considerable volume of business done already for the month of July and that a really enormous amount of business is hanging fire.

FANS.—No fan weather has yet arrived in Chicago. It has not been necessary as yet for the Chicago jobbers to ship into other territories which report good fan sales.

WASHING MACHINES.—The Western Electric Company has increased the price of its washing machines 10 per cent. The prices of other manufacturers had already been advanced.

HEATING DEVICES.—The prices of certain lines of heating devices have been increased this week. Five-dollar flatirons have gone to $6, six-dollar irons have gone to $7.

BATTERIES AND FLASHLAMPS.—"Ever - ready" products have taken a rather marked advance. This is the first time in the memory of some rather experienced electrical people that "Ever-ready" products have been increased in price.

BOSTON

An extremely heavy volume of trade is noted this week in New England. Government work predominates as usual. Stocks vary widely among different jobbers. On the whole, bins are well filled, but in certain lines an increasing scarcity is apparent. Little conduit, for example, enters New England to-day unless scheduled for some form of war work. Occasional shipments ordered many months ago filter in through the freight embargoes. Railroads are swamped with traffic, and no improvement in deliveries is anticipated this year, so far as rail conditions go. This factor tends to increase the size of the jobber's stock beyond normal.

With the exception of the advance of copper to a 34-cent base and an upward movement in conduit, prices of the heavier materials are about the same as when July came in. Effective July 15, an upward price revision was made by the "G. E." division of the Edison Electric Appliance Company, Inc., applying to flatirons, toasters, ranges and other heaters, and averaging about 12 per cent increase. Porcelain advanced 20 to 25 per cent on July 18.

The labor situation is greatly disturbed in New England this week. A serious strike is on at the Lynn (Mass.) plants of the General Electric Company, involving probably at least 12,000 workers and tying up important government production. The principal point at issue appears to be the open-shop question. Other strikes are in progress at Springfield, Mass., and in other munitions centers. Jobbers have been hard hit by the draft, but the "work or fight" order has had little effect upon this branch of the industry. Collections are good for this time of year except in the case of the small contractor.

PORCELAIN.—Stocks are in fairly good shape at present, but are likely to be considerably reduced in the near future by the inability of manufacturers to procure material. The shipyards are buying heavily. Prices increased about 25 per cent maximum the latter part of last week. There is some danger that the jobbers will be caught with low porcelain stocks.

CONDUIT.—Pipe cannot now be successfully ordered for non-essential uses, and deliveries are conditioned upon the materials being used in war work. A two-point advance in price plus 25 per cent for freight has just gone into effect. Stocks are far from satisfactory, generally speaking.

LAMPS.—Little change can be seen in the lamp situation this week. Stocks are in much better shape at this time than a year ago. Warehouses are well prepared to take care of the fall demand, and millions of lamps are now being held in reserve stock, packed and ready for shipment from the factories. The General Electric Company is building an addition to its East Boston lamp factory which will bring the production up to about 120,000 lamps per day when the installation is completed. The government continues to absorb large quantities of lamps of all types in 25, 40, 50 and 60-watt units for use in various buildings in the 100 or more shipyards now working night and day in this country. Miniature lamps are being produced on an immense scale for use in submarines, chasers and the navy in general.

INDUSTRIAL ELECTRIC TRUCKS.—The demand is increasing so fast that dealers are chiefly occupied in attending to inquiries and sales, relatively less energy being put at this time upon exploitation work. Shipment conditions are showing some improvement.

FANS.—Fans are now selling briskly in response to the influx of warm and humid weather, but it looks as though a good many equipments would be carried over.

FLATIRONS.—Manufacturers are far behind on orders, with more to come.

ATLANTA

Business in all lines appears to be well sustained throughout the entire Southeastern section. An appreciable lull in staple lines is noted for Atlanta this week. The slowing up in trade at this point is attributed to the street-railway strike, which is quite a disturbing factor.

The Southeast is again experiencing a protracted drought, which bids fair to be worse than the continued dry spell late in 1917. Already one power company is arranging to cut off secondary power customers, with the possibility of the general power users being affected soon afterward.

The increasing government embargoes on materials used in so-called non-essential buildings has a tendency further to curtail activities in general contracting work. A number of industrial developments have been announced this week, the most important being in connection with government war activities. The Sloss-Sheffield Steel & Iron Company of Birmingham, Ala., is contemplating making an investment of $2,000,000 to build by-product ovens for the manufacture of coke products for war purposes. Chemicals will also be manufactured by the Plough Chemical Company of Memphis, Tenn.

LAMP CORD.—Shipments are coming in better and in ample lots to take care of a slightly decreasing demand.

FANS.—The week has registered temperatures below normal, and the movement of practically all sizes has slowed away down. While a fan shortage existed during the rush weeks jobbers now feel that stocks are sufficient.

CHARGING OUTFITS.—There seems to be an ever-increasing demand for these outfits, and arriving shipments go literally like "hot cakes." Shipments have been good, but they are slowing up a little now.

WIRE.—Jobbers report a steady volume of sales, with no apparent cessation in sight.

LAMPS.—While there is a free movement of lamps of all sizes, the season has not advanced sufficiently to record any material change in the demand of the past few months.

The 60-watt size appears to be the most popular. In general stocks are accumulating and well distributed geographically throughout the Southeast.

SEATTLE

War service plants, especially shipyards and allied industrials, did the major portion of the buying the past week. Specialty sales were featured by a heavy movement of domestic appliances, particularly washing machines. Shipyards are not buying as heavily as heretofore, but as sale volumes fluctuate dealers manifest little concern from week to week. Naturally the heaviest sales are made when ship contracts are awarded. Sales following the initial order consist mainly of pick-ups and extras. Sales in the past week at Bremerton and the cantonments were light. Little buying from the Puget Sound Navy Yard has come to light for the past two weeks, although an order of considerable proportions, particularly for wire, wiring devices, fixtures, etc., to care for the ambitious residence building program starting by the government at the navy yard, in addition to the government shops and industrial buildings, will boost electrical sales. Commercial sales by jobbers to retailers are holding up well. Retailers report an active movement of stocks and counter sales increasing.

Alaska sales are down to a minimum. In fact, this condition has prevailed for the past month. However, considerable equipment for maintenance and small extensions to canneries and mills in southeastern Alaska is going forward.

Stocks show no improvement. They are in a disorganized state owing to heavy demands that Eastern shipments on order have not replaced and to government regulations regarding use of steel, in addition to freight conditions. The larger jobbers are ordering for months ahead in an effort to keep up with demands. Collections are very good, with a slight improvement showing over the past few weeks.

Northwest shipbuilders in Seattle, Tacoma and Portland during the week secured contracts for additional wooden and steel vessels. Recommendations amounting in effect to contracts to seven shipyards in the Portland territory include fourteen steel steamers and sixteen wooden vessels.

The government will not spend money in Seattle to solve the city's housing problem, but expects the city to provide homes for the industrial army. The Housing Bureau, Seattle Branch, is receiving bids for 250 houses, a 400-room concrete hotel and two concrete apartment houses. The Standifer Construction Corporation, Vancouver, Wash., plans immediate erection of a 300-room hotel, 100 cottages and bungalows.

POWER APPARATUS.—Sales for maintenance and extensions show an increase. Big sales are pending for new yards and industrials. Shipments are about keeping pace with demand.

CONDUIT.—Demand exceeds supply. Substitution in size and colors is being practiced generally. Shipments are coming through poorly.

SAN FRANCISCO

The vacations of all the soliciting salesmen of San Francisco electrical jobbers were held simultaneously this year during the first two weeks of July. Business is now approaching normal.

Railroad freight service from Eastern factories has improved, time of transit for carloads now being from three to four weeks, which is an improvement of 50 per cent.

A power administrator for the power situation in the northern section of California has been appointed by the California State Railroad Commission.

The total number of building permits for Los Angeles for the month of July was 509, and their value $778,000. During the same month the building permits of San Francisco totaled 363, with a value of $1,116,000.

Sales of electric railway material are poor, comparatively no new construction work being carried on or in sight. The Pacific Electric Railway Company, operating an extensive system of lines in southern California, will extend its lines to Yucaipa and Redlands as soon as it is possible, although the latter extension will probably have to be postponed until after the war. The city of San Francisco has awarded a forty-thousand-dollar contract to the General Electric Company for furnishing electric locomotives to the Hetch Hetchy water property site.

Plans for the installation of ornamental electric lighting systems for the cities of Orange, Santa Barbara and San Carlos, Cal., are under consideration.

WIRE.—F.o.b. Pacific Coast prices on rubber-covered wire and certain styles of telephone wire have increased about 7½ per cent. The demand still continues at floodtide for rubber-covered wire, with the possibility of an increase in the near future, especially on the circular-mill sizes, which will undoubtedly be required for the considerable extensions to shipbuilding plants already ordered.

APPLIANCES.—Prices on small heating devices have considerably increased, and protecting business has resulted in a great flood of orders.

ELECTRIC RANGES.—There has been no great increase in sales of electric ranges, although the numbers of inquiries predict future results, especially when the power companies are better able to take care of the increased loads.

METAL MARKET SITUATION

War Industries Board Declines to Adjust the Contracts of Commercial Copper Consumers

Advices from Washington state that the War Industries Board has declined to interfere in the settlement of contracts between producers and commercial consumers of copper, or to make any ruling on the price dispute. The commercial consumers are reported as sustaining a heavy loss in consequence of their looking in good faith for orders for their commodities based on the 23.50-cent price.

Manufacturers of finished electrical products in either copper, brass or bronze are disinclined to quote prices, excepting such as prevail at the time of shipment f.o.b. factory. They state that no free copper is available to be delivered by Aug. 15, when the 26-cent rate may be possibly increased. Deliveries are now three and four weeks behind. Even if the current price had been fixed until Jan. 1 next a more active and stabler situation would exist, according to the opinion of many interested. The short supply of platinum is engaging the serious consideration of the government, as its use in certain electrical instruments and other needful war material is indispensable. The visible stock is so curtailed and its demand in essential industries so great that it may become necessary to commandeer the metal in whatever condition it may be found. Tin and lead are firm and in no plentiful supply for anything but government work.

NEW YORK METAL MARKET PRICES

	July 15	July 22
Copper:	£ s d	£ s d
London, standard spot	110 0 0	110 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26.00
Casting	Govt. price 26.00	Govt. price 26 00
Wire base	29.75	29.75
Lead, trust price	8.05	8.05
Antimony	13.12½ to 13.25	13.12½ to 13.37½
Nickel, ingot	40.00	40 00
Sheet zinc, f.o.b. smelter	Govt. price 15 00	Govt. price 15.00
Spelter, spot	8.80 to 8.90	8.65 to 8.75
Tin, Chinese*	$1.00	$1.00
Aluminum, 98 to 99 per cent	Govt. price †33.00	Govt. price †33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	23.50 to 24.00	23.50 to 24 00
Brass, heavy	14.00 to 14.50	14.50 to 15.00
Brass, light	12.00 to 12 25	12.00 to 12.25
Lead, heavy	7.12½ to 7.50	7.12½ to 7.50
Zinc, old scrap	6.50 to 6.75	6 50 to 6.75

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* No Straits offering. † In 50-ton lots or more; carload, 33.10 cents per lb., 1-ton to 14-ton lots, 33.20 cents per lb.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List Per 1000 ft.
No. 14 solid	$61 00
No. 12 solid	71 00
No. 10 solid	90 00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95 00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205 00
No. 2 stranded	266 00
No. 1 stranded	315 00

Twin-Conductor

No. 14 solid	104 00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575 00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	12½%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	12½%

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	12½%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	12½%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20%
Coil to 1000 ft	5%

	No. 12 Solid
Less than coil	+20%
Coil to 1000 ft	5%

Twin-Conductor

	No. 14 Solid
Less than coil	$115.00
Coil to 1000 ft	80.00

	No. 12 Solid
Less than coil	+20%
Coil to 1000 ft	5%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	$24 00
1/5 to std. pkg	19 80
Std. pkg	18 75

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to 12%
1/5 to std pkg	List to 20%
Std. pkg	25% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0 40
12 to 50	.36	.36
50 to barrel	.32	33
Barrel lots	289	299

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	35
50 to barrel	.3220	.3320
Barrel lots	.2920	.3020

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5.00
⅜	250	7.50
½	100	10.00
¾	50	13 00
1	50	21.00
1¼	50	26 00
1½	25–50	35.00
2	25–50	45 00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$82.50	$75.00
⅜-in. double strip	82.50	75 00
½-in. single strip	110.00	100 00
½-in. double strip	110.00	100.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$63.75 to $64.25
⅜-in. double strip	78.75	71.25
½-in. single strip	100 00	85 00
½-in. double strip	105 00	93.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0.05½	1	$0.25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$25 00	$24.00	$23 00
¼-in.—	30 00	28.00	26 00

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$60.00	$30.00	$26.50
¼-in.—	$65.00	$32.50	$29.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0 05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	12%	14%
2500 to 5000 lb	15%	17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb	+5%	+3%
2500 to 5000 lb	+2%	List

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$6.00
Discount	30%

CHICAGO

List price	$5.50
Discount	25%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp	100	$0.25
35-amp. to 60-amp	100	.35
65-amp. to 100-amp	50	.90
110-amp. to 200-amp	25	2.00
225-amp. to 400-amp	25	3.60
450-amp. to 600-amp	10	5.50
600-Volt		
3-amp. to 30-amp	100	$0 40
35-amp. to 60-amp	100	.60
65-amp. to 100-amp	50	1.50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5.50
450-amp. to 600-amp	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$5 50
1/5 to std. pkg	4 75

Standard packages, 500. List, each $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$7 00
1/5 to std. pkg	5.75

Standard packages, 500. List, each, $0 07

LAMPS, MAZDA

105 to 125 Volts

Regular, Clear:	Std Pkg.	List, Each
10 to 40-watt B	100	$0 30
60-watt—B	100	.35
100-watt—B	24	70
75-watt—C	50	70
100-watt—C	24	1 10
200-watt—C	24	2 20
300-watt—C	24	3 25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30	24	.77
Round Bulbs, 4⅜-in., Frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.20
Coil to 1000 ft	27 18

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$35.00
Coil to 1000 ft	26 00

LAMP GUARDS, WIRE

Standard package from 50 to 150

NEW YORK

Net per 100	$24.00

CHICAGO

Net per 100	$30 00

OUTLET BOXES

Nos.	List, Per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20 00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	33%	27%
$10.00 to $50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$15.80
1/5 to std. pkg	14 80

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$15 80
1/5 to std. pkg	14 80

Standard package, 2200. List per 1000, $20.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500 5½ N.C.—Solid	Std. Pkg. 4000 Nail-it—N.C.
Less than 1/5 std. pkg	$11.85	$30 75
1/5 to std. pkg	11 10	24 00

CHICAGO

Per 1000 Net	Std. Pkg. 3500 5½ N.C.—Solid	Std. Pkg 4000 Nail-it—N.C.
Less than 1/5 std. pkg	$11 85	$30 75
1/5 to std. pkg	11 10	24 20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
¼-in cap key and push sockets	500	$0 33
¼-in. cap keyless socket	500	30
¼-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+10%
1/5 to std. pkg	5%

DISCOUNT—CHICAGO

Less than 1/5 std pkg	10%
1/5 std pkg	16⅔%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0 80
60-amp. S. P. S. T	1.20
100-amp. S. P. S. T	2.25
200-amp. S. P. S. T	3.48
300-amp. S. P. S. T	5.34
30-amp. D. P. S. T	1.20
60-amp. D. P. S. T	1.78
100-amp. D. P. S. T	3.38
200-amp. D. P. S. T	5.20
300-amp. D. P. S. T	8.00
30-amp. 3 P. S. T	1.80
60-amp. 3 P. S. T	2.68
100 amp. 3 P. S. T	5.08
200-amp. 3 P. S. T	7.80
300-amp. 3 P. S. T	12.00
Low Grade:	
30-amp. S. P. S. T	0.42
60-amp. S. P. S. T	.74
100-amp. S. P. S. T	1.50
200-amp. S. P. S. T	2.70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T	1.22
100-amp. D. P. S. T	2 50
200-amp. D. P. S. T	4 50
30-amp. 3 P. S. T	1.02
60-amp. 3 P. S. T	1.84
100-amp. 3 P. S. T	3.76
200-amp. 3 P. S. T	6 76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	List
$10 to $25 list	15%
$25 to $50 list	20%
	Low Grade
Less than $10 list	10%
$10 to $25 list	25%
$15 to $50 list	28%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+15%
$10 to $25 list	List
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	16%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole	250	$0 28
5-amp. single-pole, ind	250	.32
10-amp. single-pole	100	.48
10-amp. single pole, ind	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+ 10%
1/5 to std. pkg	5%
Std. pkg	23%

DISCOUNT—CHICAGO

Less than 1/5 std pkg	+10%
1/5 to std pkg	16⅔%
Std. pkg	25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0 34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	List	List
$2.00 to $10.00 list	10%	5%
$10.00 to $50.00 list	20%	10%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25%	15%
$2.00 to $10.00 list	25%	15%
$10.00 to $50.00 list	35%	25%

TOASTERS, UPRIGHT

NEW YORK

List price	$6 00
Discount	30%

CHICAGO

List price	$6 00
Discount	25%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.4625
No. 18, full spools	.4425

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0 69
No. 18, full spools	.575

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15.00	$12.00	$10 50
12	23 22	21.20	17.42
10	29.70	27 00	24 80
8	41 91	38 10	32 58
6	60.30	54 27	51 56

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$..... $21.00	$..... $16 00	$.. .. $13 25
12	27 53– 28.70	23 86– 28.70	22 02– 24 50
10	33.02– 40.10	30 48– 40 10	27 44– 34 23
8	46 09– 56 50	42 54– 48 23	38 99– 41 34
6	61.30– 91.18	61 76– 77 84	52 18– 66 72

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$37 75
25 to 50 lb	37 75
50 to 100 lb	36 75

CHICAGO

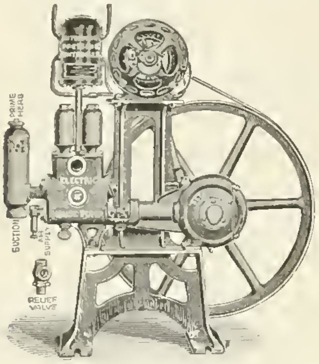
	Per 100 Lb. Net
Less than 25 lb	$39 50
25 to 50 lb	38 50
50 to 100 lb	37 50

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Inclosed "Bulldozer" Electric Power Pump

For general service on farms, plantations, country estates, hotels, etc., or wherever from 500 gal. to 3000 gal. (1892 l. to 11,356 l.) of water per hour is required against 100 lb. pressure (7 kg. per sq. cm.) or 225 ft. (68.5 m.) elevation, F. E. Myers & Brother, Ashland, Ohio, have placed upon the market a self-oiling fully inclosed "bulldozer" power pump. The power end consists of a one-piece casting which forms the base of the pump. The pump is driven by a motor belted to the large pulley wheel of the pump.



PUMP DRIVEN BY MOTOR THROUGH BELT

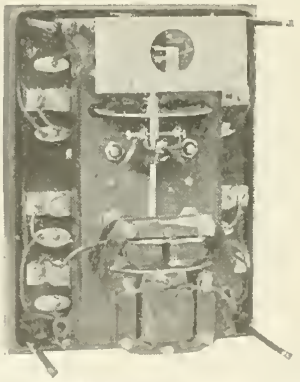
Polyphase Induction Reverse Power Relays

The polyphase induction reverse power relay manufactured by the General Electric Company, Schenectady, N. Y., will operate correctly on practically all single-phase short circuits, even though the voltage between two lines which are short-circuited may fall to zero, on balanced three-phase short circuits giving 10 amp. in the secondary and 1 per cent of normal voltage, and in practically every case for balanced short circuits with a voltage of 0.5 per cent normal. When the voltage falls to such a low value as 0.5 per cent normal, however, system conditions are apt to be so distorted that positive operation cannot be assured in every case with any relay.

The relay is constructed along the lines of a polyphase watt-hour meter, but with three instead of two driving elements. Each of the elements has a current and a potential coil. Two disks connected to a single operating shaft are used, the upper one of which is driven by one element and the lower by two elements, one in front and one in back.

The use of three elements is required for grounded Y circuits and is a distinct advantage even when the relay is used on ungrounded circuits. If only two elements were used, many single-phase troubles would involve one of the elements and the benefit of polyphase action would be lost. Although only one element may be involved in case of a ground on a grounded Y circuit, the voltage triangle will not become so badly distorted as when a single-phase line-to-line short exists. For underground circuits two current and two potential transformers are sufficient. The third current coil carries the resultant current of the two current transformers, and the third potential coil is connected across the open delta of the two potential transformers.

The manufacturers state that the polyphase construction makes the action of the relays more reliable than three single-phase relays because any incorrect tendency on the part of one phase is balanced by a similar but opposite tendency on some other phase. The incorrect tendencies offsetting each other, the true power direction will control the operation.



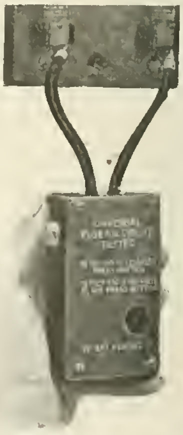
REVERSE POWER RELAY OPERATING ON WATT-HOUR-METER PRINCIPLE

The single-throw or double-throw contacts which are provided for controlling the tripping current of the automatic circuit-opening device carry current for only an instant, because the closing of these main contacts sends the entire tripping current of the breaker being protected through the operating coil of an auxiliary relay, causing its contacts to close and short-circuit the main relay contacts. The auxiliary contacts are sealed closed by the tripping current until the trip circuit has been opened by means of an auxiliary switch on the air or oil circuit breaker. The breaking of the tripping current by this auxiliary switch permits the auxiliary relay to open.

Vibration is practically eliminated even at very heavy currents. The relays are made sensitive in order to operate properly on very low potentials. Thus overload relays must be used in conjunction with the reverse power relays to prevent operation at normal potential until a predetermined current and time are reached. The contacts of the overload and reverse power relays are connected in series so that both must close to trip the breaker. Any type of overload relay can be used, but the plunger type is recommended when instantaneous action is desired. The time and current settings of the overload relay determine the action of the combination.

Fuse and Circuit Tester

For testing fuses while in circuit the Electric Service Auto Company, 391 Oak Street, Portland, Ore., is marketing the Universal fuse and circuit tester for 110 volts to 600 volts. This device can be used for testing all alternating-current or direct-current circuits in these ranges and can also be used for locating open or short circuits, grounds or any other trouble occurring in lighting or power lines or apparatus. It is designed to eliminate the cumbersome and costly "lamp bank" and replace it with an economical, safe and serviceable device that at all times can be carried in the pocket. The manufacturers claim that this tester is "amateur-proof." It is always set for testing 600 volts.



"AMATEUR-PROOF" FUSE AND CIRCUIT TESTER

The device consists of a case of

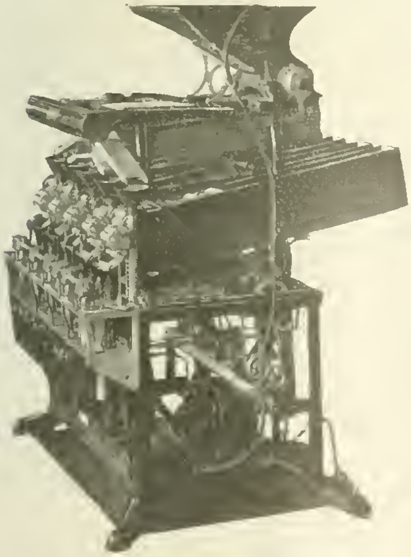
molded insulation 3 in. long by 2 in. wide by 1 in. deep (7.6 cm. by 5.1 cm. by 2.5 cm.), with no current-carrying parts exposed. In this case there is a test bulb of 110-volt potential, a coil of resistance wire and push-button contacts. The push-button is operated from the outside and is so arranged that all of the resistance is ordinarily in circuit with the lamp bulb. This allows the tester to be used in voltages up to 600 volts in this position. When voltages are tested under 400 volts the push-button is pressed so that half the resistance of the coil is short-circuited. The manufacturers claim that if the push-button is accidentally pressed on high voltages, no damage will be done.

Self-Starting Farm-Lighting Plant

The Unilectric Corporation, 235 Mount Elliott Avenue, Detroit, Mich., is manufacturing a 660-watt farm-lighting unit complete with battery and self-starter. Motors totaling ½ hp. rating can be operated, and at the same time 300 watts can be used for illumination with this set. Constant voltage is maintained at all times under varying loads by an electric throttle governor. The plant is started and stopped by a push button.

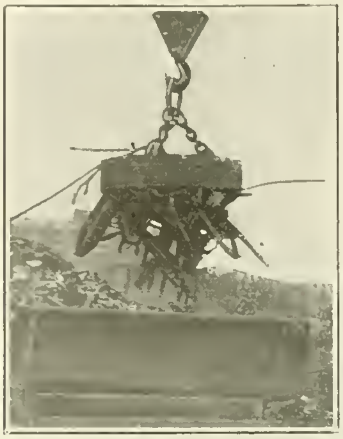
Automatic Coin-Handling Machine

Considerable labor is saved at the offices of the Detroit United Railways Company by automatic coin-handling machines that have been developed by the Sattley Coin Handling Machine Company of Detroit, Mich. These machines, operated by Westinghouse $\frac{1}{3}$-hp. motors, are said to handle an average of 200,000 coins each day. The coins are merely dropped into the hoppers at the top, and the battered and worn pieces are thrown out and the remaining coins are sorted into their respective denominations. They are accurately counted and properly wrapped in rolls of any desired amount.


MACHINE AUTOMATICALLY TAKES COINS, SORTS AND COUNTS THEM

Mill-Type Electric Lifting Magnet

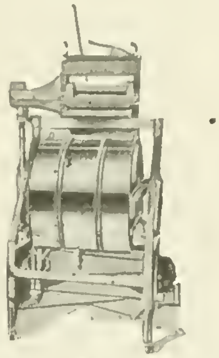
Grounds, open ends and short circuits due to the loosening of internal screw and nut connections caused by the vibration and jolts to which electric lifting magnets are usually subjected are said to be eliminated in a mill-type magnet that is being manufactured by the Ohio Electric & Controller Company, 5900 Maurice Avenue, Cleveland, Ohio. This is accomplished, the manufacturers claim, by the use of welded connections and of all-asbestos insulations. Another serious trouble eliminated is the breakage and loosening of bolts, which leads to the disrupting of outer rings. This result is achieved by using a ring 8 in. (20.3 cm.) or greater in height and secured by heavy chrome-vanadium steel studs. Other features of this magnet are the minimum head room needed, the ample amount of copper in the coil, heat-radiating ribs and flexible armored leads anchored in the case and welded directly to the coil.


MAGNET LIFTING MISCELLANEOUS SCRAP AND 9-IN SHELL

Copper-Tub Washing Machine

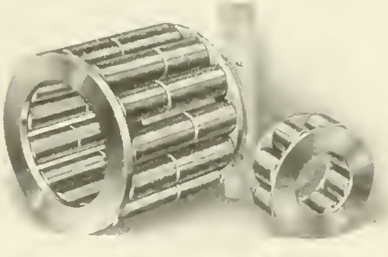
That dirt is removed from a fabric wholly by water agitation and without friction or abrasion is the main feature of a washing machine that is being distributed by Wallace B. Hart, 46 East Forty-first Street, New York City. This machine, which is known as the "1900" Cataract electric washer and wringer, consists of a solid copper tub tin-planished on the inside. It operates on the oscillating principle; that is, the copper tube swings back and forth at the rate of forty strokes in each direction per minute and is so constructed that there is a perfect figure eight movement of water, suds and clothes when the tub is in motion.

There is no cylinder or operating part within the tub—nothing to take out and clean after each washing. The manufacturers claim that washing can be accomplished by this machine with minimum time and effort on part of the operator and with the least amount of wear and tear on the clothes. When in use the washing machine is placed directly in front of the right-hand tub of a pair of stationary tubs. The movable wringer is used for wringing the clothes from the tub of the washing machine into the stationary tub directly back of the washing machine. It may then be moved to a position between the two stationary tubs and used for wringing the clothes from one of these tubs to the other. Thus the washer and wringer may be used simultaneously. The facilities provided make it possible for the operator to wash, rinse, blue, wring and make ready for the line in twelve minutes a batch of clothes consisting of twelve full bedsheets or the equivalent. This machine is also equipped with a mechanical attachment for automatically taking care of overload on the tub and the wringer. This attachment eliminates breakage or damage from misuse or abuse of the machine.


ATTACHMENT ON MACHINE AUTOMATICALLY TAKES CARE OF OVERLOAD

Light-Duty Roller Bearing

The Railway Roller Bearing Company of Syracuse, N. Y., has placed upon the market the "Rollway" light-duty bearing. The rollers of this bearing are spaced by $\frac{3}{16}$-in. (0.5-cm.) cold-rolled pins. These are shouldered and power-riveted to the side plates which assures a smooth surface that will not hinder the bearing from floating should one end bear slightly on the housing. Larger bearing rollers are made in two sections in order to reduce the friction should one end of a roller wear smaller than the other.


BEARING FOR USE IN MOTORS OF COMPARATIVELY LIGHT SIZES

Trade Notes

Government Contracts

The departments at Washington, D. C., since July 10 to July 17, have made purchases and awarded contracts as follows:

ARMY MEDICAL DEPARTMENT—Victor Electric Company, X-ray equipment; Waite & Bartlett Manufacturing Company, X-ray equipment; Campbell Electric Light Company, X-ray apparatus.

ARMY QUARTERMASTER DEPARTMENT—John A. Roebling's Sons' Company, coils; Westinghouse Electric & Manufacturing Company, electric flatirons; Bailey Electric Supply Company, motors; Peerless Light Company, bulbs; Beacon Electric Works of National Carbon Company, flashlamps.

GENERAL ENGINEER DEPOT OF THE WAR DEPARTMENT—Star Electric Motor Company, spares for lathes, shaper and drill presses; Westinghouse Electric & Manufacturing Company, pinions; Cutler Hammer Manufacturing Company, spare parts for compressors and cupola blowers; Winton Company, gasoline-electric generating sets; Robbins & Myers Company, spares for cupola blowers; Simplex Wire & Cable Company, electric wire and cable; Western Electric Company, copper wire bars; Imperial Electric Company, spares for commutating pole for compressors; General Electric Company, transil oil.

NAVY DEPARTMENT, BUREAU OF SUPPLIES AND ACCOUNTS—General Electric Company, ventilating sets, searchlamps, spare globes, electric motors, switches, planer equipment; Westinghouse Electric & Manufacturing Company, fans; Edison Electric Appliance Company, bake ovens; American Electric Company, telephone type sets; Ideal Electric Manufacturing Company, motors; Sprague Electric Works of the General Electric Company, switchboxes; Western Electric Company, switchboards; James Clark, Jr., Electric Company, drills; Carlisle & Finch Company, searchlamps; Case Crane & Engineering Company, electric traveling crane; Electric Tachometer Corporation, transmitters; Russell & Stoll Company, lighting fixtures; Lincoln Electric Company, motors; National Electric Supply Company, mica; United States Electrical Tool Company, grinders; Electric Specialty Company, dynamotors; Hobart Brothers, generators.

DAY NURSERY FOR BALL-BEARING PLANT.—The New Departure Manufacturing Company, of Bristol, Conn., has lately established a day nursery for the children of its women employees. This commendable expression of welfare work on the part of the company is really a new departure. Furniture, fittings and the general game equipment is in diminutive form to accommodate the little folk. In addition, a large playground for the children has been partitioned off on the north side of the engineering building. Here play apparatus will be installed and sand piles provided, so that much of the day can be spent out of doors in good weather. Competent and experienced attendants are a part of the installation.

SPAIN AS A TURBINE MARKET.—Relative to the introduction of turbines in Spain the *Electrical Review* of London, Eng., says: "Circumstances are forcing Spain along the path of progress. There is, however, a serious obstacle in the way, i.e., the construction of large water turbines and electric generators. Hitherto these have been imported, but outside sources are not now available. One of the largest American makers of turbines recently wrote: 'While there is a great need for water-power development in Spain as well as other countries, very little is being done just now, and until conditions change we do not look for an improvement.' The same is true of British makers, and it is a matter for regret that they cannot seize the present opportunity. It is doubtful if Spain, unassisted, can manufacture all the necessary heavy machinery either this year or during the next five years, but assuredly she will try to do so. And after the war, as before, Germany will again be supreme in the Spanish field, while England will lose the greater part of the trade in coal, without any compensating increase in the supply of manufactured goods."

RELATION OF WAR AND TRADE.—The Irving National Bank of New York has published in pamphlet form "Trade and the War," by G. A. O'Reilly, its foreign trade representative, an address delivered before the Cleveland (Ohio) Advertising Club. "The War and Its Effect on World Trade" is published by the National City Bank of New York City and is an address given before the twenty-fifth annual convention of the Virginia Bankers' Association at Old Point Comfort, Va., on June 20, by Stephen H. Voorhees, vice-president of the bank. Copies of both publications may be had free on application.

BONDS FOR SHIPPING CHARGES.—The United States Railroad Administration, division of public service and accounting, on July 11 issued circular No. 16, which deals with the matter of bonds to be required in connection with the extension of credit for transportation charges, as prescribed in general order No. 25, effective Aug. 1. The bonds covering the extension of credit will be of two classes, namely, (1) to cover patrons transacting business at one or more points with one carrier; (2) to cover transactions at one point with two or more carriers. Details applicable to both classes of bonds are furnished.

RED CROSS WORK OF STORAGE BATTERY GIRLS.—Every Monday night 170 girls, members of the Red Cross Auxiliary No. 404, of the Electric Storage Battery Company, Philadelphia, meet in a room devoted to the purpose, where surgical dressings are made under the supervision of Mrs. Ada S. Bull, chairman of the auxiliary and also matron of the Electric Storage Battery Company. All necessary equipment and material are furnished by the company, and the girls volunteer their services, doing the work after business hours. Several of them have completed courses at the Red Cross headquarters, receiving special instructions for the purpose of teaching others. Enthusiasm and adaptability have enabled all to make rapid progress, and many girls who have not already joined the auxiliary are planning to do so.

AMERICAN ELECTRICAL GOODS REPLACE GERMAN IN CHILE.—Of all the countries on the west coast of South America, Chile offers the best opportunity for the immediate sale of electrical goods, and the prospects for the future are bright. Germany dominated the market before the war, but, according to a report issued by the Bureau of Foreign and Domestic Commerce, Department of Commerce, American goods have recently made big gains. German goods had entered the market in the wake of German capital. Chile is a country where the natural resources and the will of the people make for progressive development along industrial and manufacturing lines, which means a steadily growing demand for power. Special Agent Philip S. Smith, author of the government's report, asserts that this should and will be furnished by harnessing the many waterfalls of the Cordillera of the Andes to electric generators and sending the current to all parts of the central section of the republic. One of the things that should not be overlooked in contemplating Chile as a future commercial field is the opportunity of uniting a safe investment with a profitable business. If advantage is taken of this situation, the relations already existing between the two countries can be strengthened to their mutual profit. The report analyzes different phases of the electrical goods business in both Chile and Bolivia and is designed to assist American firms in their efforts to build up and maintain business with the two countries. Under the title "Electrical Goods in Bolivia and Chile," Special Agent Series No. 167, it is sold at the nominal price of 20 cents by the Superintendent of Documents, Washington, D. C., and by all the district and coöperative offices of the Bureau of Foreign and Domestic Commerce.

THE WAR LABOR POLICIES BOARD of Washington, D. C., authorizes the following statement of the position of the production departments of the government concerning child labor and prison labor: All work required in carrying out a contract shall be performed in full compliance with the laws of the state, territory, or District of Columbia, where such labor is performed. A contractor shall not directly or indirectly employ in the performance of this contract any minor under the age of fourteen years or permit any minor between the age of fourteen and sixteen years to work more than eight hours in any one day, more than six days in any one week, or before 6 a. m. or after 7 p. m.; nor shall the contractor directly or indirectly employ any person undergoing sentence of imprisonment at hard labor which may have been imposed by a court of any state, territory or municipality having criminal jurisdiction.

ENGLAND TAKES STEPS TO PRODUCE LAMP BULBS.—At the annual meeting of the Metropolitan Carriage, Wagon & Finance Company, held recently at Birmingham, Eng., F. Dudley Docker, the chairman, said: "At the outbreak of the war the manufacture of glass bulbs for electric lamps had been almost exclusively done abroad. I am glad to say that, in conjunction with the General Electric Company, we have agreed to purchase the British rights in special machines for making these glass bulbs, and we hope soon to have the first machine installed and at work, when Great Britain will be independent, as far, at any rate, as the manufacture of these bulbs is concerned. We do not, however, seek to establish any monopoly, but will be ready to grant licenses on favorable terms to any British firms. The chief object of our developments has been to insure self-support to this country in trade and business that in the past have been, in some degree, controlled by other nations. I want you to lay hold of this fact, and I am happy to say that others, too, are looking ahead in the hope that when our long-delayed victory in the battlefield is crowned by a lasting peace we shall be found ready to take our proper position in the industrial competition that is certain to follow, and hold a winning place."

FEDERAL TRADE COMMISSION ACTS AGAIN TO CURB RESALE PRICE MAINTENANCE.—Acting again to prevent the practice of manufacturers of dictating the prices at which their goods shall be resold by retailers, the Federal Trade Commission has filed formal complaint against four nationally known firms. The commission declared it had reason to believe that resale price maintenance was being practiced by the Goodyear Tire & Rubber Company, Akron, Ohio; the Auto Strop Safety Razor Company, New York; the Kryptok Sales Company, New York, and the D. M. Ferry Seed Company, Detroit. All were charged with refusing to sell to retailers who "cut" prices to the public. Additional allegations were lodged against the Goodyear company, including charges of misleading advertising regarding "Goodyear service stations," exercise of "arbitrary control" over dealers, and other trade methods designed to stifle free competition. It also was charged that, through "an arbitrary control over the business of dealers," the company forces dealers under threat of price discrimination to maintain in stock excessive supplies of Goodyear products, to maintain standard prices for these, to report "underselling" by other dealers, and to specify Goodyear equipment on automobiles, motor trucks and motorcycles they may handle. It further was alleged that the company sells tires at dealers' prices direct to large truck users on condition that a fixed percentage, usually 90 per cent of a concern's monthly requirements, be filled with Goodyear tires and supplies. The cases will be heard in Washington beginning late in August and extending into September.

RALPH KINGERY of Kingery & Marrs, lighting fixtures, Portland, Ore., recently announced that he will retire from business.

THE WAR TRADE BOARD of Washington, D. C., has issued a special circular on partial shipments on export licenses, effective July 10.

I. D. LANDIS has been appointed sales manager of the John D. Godfrey Company of Elkhart, Ind., manufacturer of coal-handling equipment.

H. E. STOCKER, production manager of the Fort Wayne works of the General Electric Company, has tendered his resignation and will become general manager of the International Clay Machinery Company of Dayton, Ohio.

THE UNDER-FEED STOKER COMPANY OF AMERICA, Chicago, has removed its office in Cincinnati, Ohio, from the Union Trust Building to the Union Central Building, Fourth, Vine and Baker Streets, where S. A. Williamson is the company's representative.

THE HENRY R. WORTHINGTON COMPANY of Harrison, N. J., manufacturer of pumping equipment, is said to be considering plans for extensions to its plant on property recently acquired adjoining its works, at Ann Street and Ogden Avenue. The property is about 65 ft. by 225 ft.

THE STANDARD UNDERGROUND CABLE COMPANY of Perth Amboy, N. J., has completed arrangements for the erection of a proposed new local plant at Fords, N. J. It is planned to commence construction work at an early date. The new works, it is said, will give employment to about 2000 men.

THE DEPARTMENT OF COMMERCE of Washington, D. C., has now available, in a single volume, complete foreign trade statistics for 1917, entitled "Commerce and Navigation of the United States, 1917." Copies may be had by applying to the Superintendent of Documents, Government Printing Office, Washington, D. C.

CECIL B. WHITEHURST, specialty sales manager of the Western Electric Company at Richmond, Va., died on July 6 after an illness of nearly a year. He was thirty-two years of age and had been a resident of Richmond for ten years. Mr. Whitehurst was graduated from the Agricultural and Mechanical College of North Carolina.

THE NATIONAL WAR LABOR BOARD of Washington, D. C., announces that the following firms have submitted to arbitration differences with their employees: Bridgeport Brass Company, Connecticut Electrical Manufacturing Company of Bridgeport, Conn.; Bryant Electric Company, Electric Cable Company, Harvey Hubbell, Inc., and Sprague Meter Company.

P. F. APFEL of the Electric Sales Corporation, Seattle, Wash., is establishing a Canadian factory in Toronto, Canada, for the manufacture of Apfel's systems of electrict heating. The company recently received a large order for electric heating apparatus to be installed for the Granby Mining & Smelting Company at Anyox, B. C. The mining company tried out the plan of electric heating for several months before placing the order.

ALFRED O. DICKER will in the future represent the Luminous Unit Company and the St. Louis Brass Manufacturing Company, manufacturer of Brascolite and general lighting fixtures, in the Chicago and Illinois territory. The Brascolite agency in this territory was formerly held by the Electrical Sales Engineers, Inc., of which Alfred O. Dicker was an officer. The new office of Mr. Dicker will be in Room 1109, 108 South La Salle Street, Chicago.

THE DEPARTMENT OF COMMERCE of Washington, D. C., made public recently a complete report on the Australian customs service through the Bureau of Foreign and Domestic Commerce. The bulletin is entitled "Customs Tariff of Australia," tariff series No. 37, and is the work of Louis Domeratzky, tariff expert of the bureau. Copies may be had at the price of 10 cents from the Superintendent of Documents, Government Printing Office, Washington, D. C.

THE BOSCH MAGNETO COMPANY of Springfield, Mass., which was recently taken over by the United States government, will probably be sold in the near future to the highest bidder, if A. Mitchell Palmer, federal custodian of enemy property, consents. The Bosch plant at Plainfield, N. J., has already been sold to the Wright-Martin Aircraft Company. The Springfield plant, which has recently been appraised and found to be in first-class condition, is now handling the largest business in its history. When it was operated by alien owners it was producing only about 50 per cent of the present output. Many thousands of magnetos are now being turned out on government orders for delivery during the present year, and it is expected that additional orders will be received when the present demands are met.

Trade Publications

INDEX TO BULLETINS.—An index to bulletins (July, 1918) is issued by the General Electric Company, Schenectady, N. Y.

DESK OR TABLE LAMPS.—The Rutherford Brothers Company, Muncie, Ind., issues a leaflet covering ornamental and adjustable electric lamps for home or office.

SAFETY SWITCHES.—A leaflet describing a line of knife switches inclosed in steel boxes has been issued by W. A. McCombs & Company, Union Arcade, Pittsburgh, Pa.

PUSH-BUTTONS.—Leaflet C R 2940, describing and illustrating a standard line of push-button stations, is available from the General Electric Company, Schenectady, N. Y.

ELECTRIC APPLIANCES. — "Labor Savers for the Home" is the title of a booklet describing domestic appliances issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

POLYPHASE INDUCTION MOTORS.—Bulletin No. 41,302A, covering construction details of squirrel-cage and slip-ring motors, has recently been sent out by the General Electric Company, Schenectady, N. Y.

HEATING AND COOKING APPLIANCES.—An extensive line of electrical appliances from flatirons to six-plate ranges is described in catalog C, National Electric Heating Company, Ltd., Toronto, Canada.

FLOOR SURFACES.—Machines for surfacing both stone and wooden floors are described in catalogs being distributed by the American Floor Surfacing Machine Company, 520 South St. Clair Street, Toledo, Ohio.

EQUIPMENT FOR MINES.—A four-page pamphlet has just been issued by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., describing battery-charging equipment for mines and, in particular, racks for charging miners' lamps.

LINEMEN'S TOOLS.—The Bush Electric Tool & Manufacturing Works, Redlands, Cal., has just issued a catalog describing safety tools for use on high-tension lines, with illustrations showing how the tools are used in actual practice.

TRIPLEX POWER PUMPS.—Single-acting and double-acting vertical pumps are described in bulletin D-702, sent out by the Worthington Pump & Machinery Corporation, 115 Broadway, New York. Dimensions and capacities are fully set forth.

WIRING ACCESSORIES.—A considerable line of floor boxes and other hardware used in interior conduit work, as well as clamps and supports for wires and cables for outdoor service, is covered in catalog 33, just announced by the Steel City Electric Company, Pittsburgh, Pa.

HEATING DEVICES.—The Hughes Division, 211 West Schiller Street, Chicago, of the Edison Electric Appliance Company has issued a new catalog covering its complete line. This includes ranges, table appliances, bake ovens, hotel equipment, etc. It is ready for distribution now.

INSULATION.—The Redmanol Chemical Products Company, 636 West Twenty-second Street, Chicago, has issued a thirty-two-page illustrated booklet on its molding compounds, impregnating liquids and transparent "Redmanol." The booklet shows pictures of many irregular and small insulating shapes.

GAS AND OIL ENGINES.—Engines sold by the National Transit Pump & Machine Company, 320 Reliance Building, Kansas City, Mo., form the subject matter of a leaflet recently sent out by this company. The company makes oil engines of the Diesel type and both two-cycle and four-cycle gas engines of all sizes.

AIR-COMPRESSOR PLANTS. — The American Floor Surfacing Machine Company, 520 South St. Clair Street, Toledo, Ohio, has issued a catalog of air-compressor units suitable for garage or similar service. Capacities range from 2 cu. ft. to 6 cu. ft. per minute and for pressures up to 125 lb.

ELECTRIC RADIATOR.—The Electro Steam Radiator Company, 125 South Wells Street, Chicago, has issued a 20-in. by 21-in. folder on its electro-steam radiator, which it purposes to push actively in the near future. The folder describes the radiator and gives suggestions for its use. Testimonials as to its efficiency and usefulness are also shown.

SYNCHRONOUS MOTORS.—The Electric Machinery Company, Minneapolis, has issued two bulletins, Nos. 189 and 190, entitled respectively "Let's Make This Matter of Power Factor as Plain as A B C" and "Digest on Power Factor." Both bulletins are designed to show the advantage of synchronous motors in increasing power factor on central-station company lines.

PYROMETRY AND TEMPERATURE CONTROL.—Catalog 87, just issued by the Leeds Northrup Company, 4901 Stenton Avenue, Philadelphia, describes many devices for use in connection with the determination and control of temperature of furnaces. These devices are based on the potentiometer principle. The publication includes a full discussion of the theory of this apparatus and its application to various furnace problems.

STREET LIGHTING.—"The New Era in Street Lighting" is the title of a thirty-six-page book recently published by the Holophane Glass Company, 340 Madison Avenue, New York City. This book describes and illustrates the results of recent scientific research and shows how these results have been practically applied to street lighting. This book should prove of special value at the present time because it explains what is meant by conservation in street lighting and shows how to effect marked economies, such as the reduction of energy consumption by one-half for illumination as effective as that formerly used. A limited number of these books are available for distribution to engineers and city officials and may be obtained by them, in their official capacity, by addressing the Holophane company.

New Incorporations

THE PACIFIC COAST ELECTRICAL & SUPPLY COMPANY of Los Angeles, Cal., has been incorporated with a capital of $25,000 by C. E. Vermilyea, J. Vermilyea, C. J. Harmer, R. E. Harmer and A. D. Pearce.

THE ELECTRICAL PRODUCTS CORPORATION of Richmond, Va., has been chartered with a capital stock of $150,000 to deal in electrical supplies. S. O. Lindeman is president of the company and Harold S. Bloomberg is secretary.

THE HILLSBORO TELEPHONE & TELEGRAPH COMPANY of Waco, Tex., has filed articles of incorporation under the laws of the State of Delaware, with a capital stock of $80,000, for the purpose of manufacturing telephone and telegraph apparatus..

THE STANDARD APPLIANCE COMPANY OF AMERICA of New York, N. Y., has been incorporated by J. L. Volz, E. Goodman and N. Shaw, 32 Cooper Square, New York City. The company is capitalized at $95,000 and purposes to manufacture telephone equipment.

THE AMALGAMATED ENGINEERING COMPANY of Troy, N. Y., has been incorporated with a capital stock of $250,000 to manufacture machines, devices and appliances for generation and use of power. The incorporators are: J. E. Falls, R. Reece and R. C. Hilton of Troy.

THE GLOBE ENGINEERING COMPANY OF CANADA of Winnipeg, Man., has been incorporated by Oliver F. Lightcap, John L. Harrison, Alexander J. Milligan and others. The company is capitalized at $100,000 and purposes to manufacture engines, dynamos, generators, batteries, machinery, etc.

THE AUTOARC WELDING TOOL COMPANY of Brooklyn, N. Y., has been incorporated by W. W. Stockbridge, V. D. Borst and J. E. Zelenko, 41 Park Row, New York, N. Y. The company is capitalized at $1,000,000 and purposes to do a general contracting and electric welding and mechanical engineering business.

THE GEORGE F. ROHN ELECTRIC COMPANY of Milwaukee, Wis., has been chartered with a capital stock of $60,000 to take over the business of George F. Rohn, 524 Jackson Street, manufacturer of electrical equipment and general electrical contractor. The incorporators are George F. Rohn, H. J. Jung and Alfred W. Rohn.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

LEWISTON, ME.—Arrangements are being made by the Lewiston, Augusta & Waterville Street Railway Company for a complete rehabilitation of the service between Lewiston and Bath and improvements to other lines. The United States Shipping Board Emergency Fleet Corporation has agreed to assist the company to the amount of $165,000, by providing new cars, transformers, transmission lines and other equipment. It is also proposed to reinsulate and improve the feed lines and increase the voltage from Lewis to Bath from 10,000 volts to 22,000 volts.

NEWMARKET, N. H.—Work has begun on the construction of an addition, 40 ft. by 45 ft., to the power plant of the Newmarket Manufacturing Company.

PORTSMOUTH, N. H.—Work has begun on laying the cable from the power plant of the Rockingham County Light & Power Company to Badger's Island. This cable when completed will furnish energy to operate the Portsmouth, Dover & York Street Railway.

ROCHESTER, N. H.—The Twin Gas & Electric Company is erecting a new plant on Wallace Street.

RUTLAND, VT.—The Vermont Evaporator Company, it is reported, will locate on Strong Avenue. The Rutland Railway Light & Power Company will furnish all power used by the company.

RUTLAND, VT.—Contract has been awarded by the Rutland Railroad Company to Westinghouse, Church, Kerr & Company, 27 Wall Street, New York, N. Y., for construction of a machine shop, 105 ft. by 263 ft., one-story, and a repair shop, 125 ft. by 175 ft.

FAIRHAVEN, MASS.—Plans are being prepared by the New Bedford (Mass.) Gas & Electric Company for the erection of a transformer station, 20 ft. by 40 ft., in Fairhaven.

MILLBURY, MASS. — The Millbrook Linen Works is reported to have purchased the Atlanta Mill water power and land on South Main Street.

PITTSFIELD, MASS.—Contract has been awarded by J. & E. H. Wilson, Wahconah Street, for the erection of a new turbine plant at its works to D. Herbert Pike, 28 Renne Street, Pittsfield.

WEBSTER, MASS.—Work has started on the construction of a hydroelectric power plant in Farnumsville for the Slater Mills of Webster. E. D. Ward, of Worcester, Mass., is contractor.

WORCESTER, MASS.—The Worcester Electric Light Company has petitioned the city clerk for permission to build conduits and manholes on Grafton, Temple and Franklin Streets.

NEW LONDON, CONN.—The New London Ship & Engine Company has awarded contract for the construction of power house, 50 ft. by 90 ft., one-story, to the J. H. Crozier Company, Hartford, Conn.

Middle Atlantic States

ALBANY, N. Y.—Plans have been prepared by the Municipal Gas Company for an addition to its boiler plant at 71 Trinity Place, to cost about $5,000.

ALBANY, N. Y.—Bids will be received by Dr. H. M. Biggs, commissioner of health, State Department of Health, Capitol, Albany, until July 30 for electric elevator for Laboratory Building, Division of Laboratories, State Department of Health, Albany. Lewis F. Pilcher is state architect.

AUSABLE FORKS, N. Y.—The Ausable Forks Electric Company, recently incorporated with a capital stock of $25,000, proposes to construct and operate an electric lighting system in Ausable Forks. G. Chahoon, J. Rogers and others are interested.

BATAVIA, N. Y.—A 200-hp. electric motor is being installed in the plant of Roberts Brothers to replace the gas engines.

BROOKLYN, N. Y.—Bids, it is reported, are being received by the National Lead Company, 111 Broadway, New York City, for the construction of a five-story building, 50 ft. by 210 ft., at its Atlantic Works, Marshall Street, Brooklyn, to cost about $175,000.

LONG ISLAND CITY, N. Y.—The General Vehicle Company has discontinued the manufacture of motor trucks since its works at Hunters Point, Long Island City, has been taken over by the government for the manufacture of airplane engines. The company, it is understood, will make other arrangements for handling parts and repair works for its motor trucks. The manufacture of motor trucks has been discontinued entirely.

NEW YORK, N. Y.—Plans are being prepared for the erection of a ten-story refrigerating plant for Armour & Company at Tenth Avenue and Marginal Street, to cost about $1,000,000. R. C. Clark, care Armour & Company, Union Stock Yards, Chicago, Ill., is architect. The New York office of the company is at 120 Broadway.

NEW YORK, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 31 for the installation of an electric passenger elevator and two electric coin lifts in the United States Assay Office Building, New York City.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 29 for installation of an electric lighting and power system in shipbuilding slip No. 2, (specification 3136) to cost about $20,000; also for installing mechanical stokers (specification 3124) at the New York Navy Yard.

RICHMONDVILLE, N. Y.—Action has been taken to have the franchise of the Great Bear Light & Power Company of East Worcester annulled. The company, which has not furnished street-lamps since last December, has now discontinued commercial service. Steps will be taken to organize a local lighting company or make arrangements to secure service from some other concern.

SHORTSVILLE, N. Y.—A new 200-hp. semi-Diesel oil engine is being installed in the plant of the Papec Machine Company. Other improvements are contempalted by the company, including the installation of new boilers and a steam engine.

SYRACUSE, N. Y.—Plans are under consideration by the City Council for the construction of a new pumping station (electrically operated) on Fellows Avenue near Dakota Street.

ELIZABETH, N. J.—The Crescent Truck Company, 347 First Avenue, Elizabeth, has purchased from the S. L. Moore & Sons Corporation of Elizabethport all rights to and interest in the Crescent electric industrial truck and will manufacture it in connection with its line of allied equipment.

EWING, N. J.—Bids will be received by the Township Committee until Aug. 3 for furnishing electric street-lighting service for a period of five years, beginning Sept. 1, 1918.

HAMILTON, N. J.—An appropriation of $10,000 has been approved by the Township Committee in its annual budget to provide for various lighting purposes for a period of one year.

JERSEY CITY, N. J.—An appropriation of $10,000 has been approved by the Board of Freeholders to be used by the Boulevard Commission for improvements in the electric street-lighting system on the Boulevard between Bergen Point and the Paterson Plank Road.

NEWARK, N. J.—The Public Service Railway Company is planning to erect a building, 160 ft. by 500 ft., for the car works at Bloomfield Avenue and Lake Street, to cost about $45,000.

ALTOONA, PA.—The Penn Central Light & Power Company has filed notice with the Public Service Commission of an issue of $29,000 in bonds, of which part of the proceeds will be used for extensions and improvements.

COALDALE, PA.—Bids will be received by John R. Doyle, secretary state hospital, until July 25 for construction of dining pavilion and boiler house. Separate bids to be submitted on general contract, steel work, power plant, wiring, plumbing, etc.

EASTON, PA.—Notice has been filed with the Public Service Commission by the Pennsylvania Utilities Company of an issue of $143,000 in securities, the proceeds to be used for extensions and improvements to its system.

HARRISBURG, PA.—Plans have been prepared by the American Telephone & Telegraph Company for improvements in its local system, including the installation of an underground conduit system in Walnut and Third Streets, to replace the overhead lines now in use.

LATTIMER, MINES, PA. — Pardee Brothers & Company, it is reported, are contemplating the installation of electrical equipment in connection with the reopening and development of its Hollywood colliery in the Hazleton district.

MARYSVILLE, PA.—The Juniata Public Service Company has begun work on improvements to its system in the Marysville section.

NICETOWN, PA.—Bids, it is reported, are being received by the Midvale Steel & Ordnance Company, Widener Building, Philadelphia, for the construction of three buildings at its works, consisting of a one-story shop, 114 ft. by 180 ft., to be used for rough machine works; a machine shop, 183 ft. by 560 ft., for finishing work, and a heat-treatment building, 75 ft. by 580 ft.

PHILADELPHIA, PA.—The power plant of the William & Harvey Rowland Company at Lewis and Tacony Streets, Frankford, was recently damaged by fire, causing a loss of about $20,000.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 29 for installing two electric traveling cranes at the air craft factory, under specification 3202, at Philadelphia.

PHILADELPHIA, PA.—Plans are being prepared by the United States government for the erection of new buildings at the Frankford Arsenal, Philadelphia, to cost about $1,000,000. Contract has been awarded for the construction of a shop, 52 ft. by 123 ft., with wing 30 ft. by 30 ft., to cost about $200,000, to William R. Dougherty, 1601 Sansom Street, Philadelphia.

PHILADELPHIA, PA.—Plans are being prepared by the Pennsylvania Railroad Company for improvements to its various yards, including the erection of a new engine house at Pitcairn, Pa., which will also include a machine shop; extension to its engine house at Shire Oaks, and also for an addition to the engine house at Orangeville, near Baltimore, Md. A. C. Shand is chief engineer.

PITTSBURGH, PA.—The Cheat River project, started by the Kuhn banking interests in 1911 and halted when on its way to completion by financial troubles, is understood to be under investigation by government experts with a view of having the power plant completed. It is estimated that the Cheat River dam would provide about 50,000 hp. The plant is planned for an 86-ft. head of water and was built to accommodate four generating units of 12,500 hp. each.

READING, PA.—Notice has been filed with the Public Service Commission by the Metropolitan Edison Company of an issue of $142,500 in bonds, the proceeds to be used for improvements. The company is planning to install a new 25,000-kw. turbo-generator in the near future.

SHARON, PA.—The Savage Arms Corporation of Utica, N. Y., is planning an addition to the power plant at its local works, to cost about $70,000. The work will be done under the supervision of Westinghouse, Church, Kerr & Company, 37 Wall Street, New York City.

ANNAPOLIS, MD.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 29 for ash-handling equipment under specification 3186, to cost about $16,000.

BALTIMORE, MD.—The United Railways & Electric Company is now installing a 20,000-kw. turbo-generator in its Pratt Street power station.

BALTIMORE, MD.—The Washington, Baltimore & Annapolis Electric Railway Company is contemplating the construction of a terminal station and additional tracks in Baltimore, to cost about $300,000. J. J. Doyle is general manager.

HARTLAND, W. VA.—Extensions are being made by the Hartland Power Company in its transmission system to Beechy Creek for furnishing power to the Elkland Mining Company. Plans are under consideration by the company for the erection of an electric transmission line to Dorfee for the purpose of furnishing service to the mines of the Big Block Coal Company, the Elkhurst Coal Mining Company, the Thompson Block Coal Company and the Fov Splint Company. The Hartland company is operated by W. S. Barstow & Company, 50 Pine Street, New York, N. Y. Hartland has not a post office.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 29 for installing mechanical stokers at Hampton Roads, Va., under specification 3124. The cost is estimated at about $21,000.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, has awarded contract for construction of power plant to Gillis & Geoghegan, 537 Broadway, New York, N. Y., at $44,000.

WASHINGTON, D. C.—Appropriations have been granted by Congress for the New England district as follows: For machine shop and foundry at the Boston Navy Yard, $900,000; addition to machine shop, $200,000; addition to foundry, $130,000, and improvements to power plant, $150,000, at the Portsmouth Navy Yard, N. H.; enlargement of the submarine base at New London, Conn., including the construction and equipment of repair shops, $750,000; for enlarging boiler and engine room at the Springfield (Mass.) Arsenal, $225,000.

North Central States

GRAND RAPIDS, MICH.—Material has arrived for the new street-lighting system, which will be installed as soon as possible. The arc lamps now in use will be replaced with nitrogen lamps.

JACKSON, MICH.—The capital stock of the Michigan Light Companw has been increased from $5,925,000 to $6,080,900.

LANSING, MICH.—Plans are being considered by the Olds Motor Works of Lansing for the construction of a new motor plant, to cost about $1,000,000. The work will include the erection of a factory building, 240 ft. by 500 ft. and a concrete loading dock, to cost about $600,000. The equipment will cost about $500,000.

CINCINNATI, OHIO.—The George B. Curd Company, Union Central Building, is contemplating the purchase of a 75-kw., 220-volt direct-current generator, directly connected to engine.

CLEVELAND, OHIO—The Chandler Motor Car Company, it is reported, will erect two temporary buildings, one 44 ft. by 220 ft. and the other 30 ft. by 240 ft., to be used for the manufacture of tractors. The company has a large contract for 10-ton tractors for the government.

COLUMBUS, OHIO—Hoisting equipment will be purchased by the city of Columbus for use in the new municipal coal yard.

DAYTON, OHIO.—The State Public Utilities Commission has authorized the Dayton Power & Light Company to issue $56,000 in capital stock at not less than 85, the proceeds to be used for the installation of a new switchboard at the Fourth Street station.

LORAIN, OHIO—Plans are being considered for improvements to the ornamental lighting system on Broadway and extending it to Eighth Street. It is proposed to transfer the lighting system from the city to the Lorain County Electric Company.

ANDERSON, IND.—Contract has been awarded to Davis & Hunt, Dayton, Ohio, for the construction of an addition to the Remy Electric branch of the United Motors Corporation at Anderson. The proposed building will be 50 ft. by 300 ft., four-stories high.

RICHMOND, IND.—The City Council has appropriated $55,000 for the construction of a dam across the Whitewater River and improvements to the municipal electric light plant.

SOUTH BEND, IND.—Permits have been taken out by the Studebaker Corporation for erection of three buildings, consisting of a steel forge shop, 162 ft. by 306 ft., one-story; concrete machine shop, 200 ft. by 576 ft., and a crane runway. The cost of the work is estimated at about $270,000.

VINCENNES, IND.—The Vincennes Traction Company has abandoned its local power station and is purchasing energy from the Indiana Power & Water Company.

CHICAGO, ILL.—The Baldwin Locomotive Works, it is reported, are contemplating the construction of a new locomotive plant at Chicago, to cost about $5,000,000.

HOOPESTON, ILL.—A substation is being erected at the plant of the Hoopeston Gas & Electric Company. A. W. Mann of Mattoon has charge of construction.

LA HARPE, ILL.—The Western Illinois Utilities Company, recently incorporated, it is understood, will acquire the electric properties at La Harpe and Blandinsville. The company also proposes to erect an electric transmission line to Dallas City (21 miles long) to connect with the transmission system of the Mississippi River Power Company, to secure electricity to operate its system. Branch lines, it is expected, will also be erected to Stronghurst, Terre Haute, Raritan, Sciota and Good Hope.

MARSHFIELD, WIS.—Bonds to the amount of $60,000 have been authorized by the Board of Education for the construction of a vocational training institute and junior high school building.

MILWAUKEE, WIS.—The Downing Box Company, recently incorporated, is planning to erect a factory, 100 ft. by 400 ft., at Third and Indiana Avenues. The plans include a power plant. The company is capitalized at $300,000.

RACINE, WIS.—The Racine Electric Company has increased its capital stock from $25,000 to $100,000. H. Vanbree is president of the company and John W. Ruggabert is secretary and acting manager of the plant.

INDEPENDENCE, IOWA.—The Fayette County Utilities Company of Oelwein has submitted a proposal to the City Council offering to furnish electricity to operate the municipal electric lighting system.

ANDERSON, MO.—Bonds to the amount of $10,000 have been voted for the purpose of establishing a municipal electric light plant and water-works system.

LATHROP, MO.—An election will soon be called to submit the proposal to grant the Light, Heat & Power Company a franchise to construct and operate an electric light and power plant in Lathrop.

PEMBINA, N. D.—The Pembina Light & Power Company is contemplating extending its transmission lines from Bathgate to Hamilton and to St. Thomas and east to Drayton.

GRAND ISLAND, NEB.—At the request of the National Fuel Administration to conserve coal, the City Council and the officers of the Central Power Company are considering merging their electric generating plants during the period of war.

HOMER, NEB.—Bonds to the amount of $7,500 have been voted for the installation of an electric lighting system.

CHANUTE, KAN.—The City Council is considering calling a special election to vote on the proposal to issue $35,000 in bonds for extension to the municipal electric light plant.

Southern States

PARIS ISLAND, S. C.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., to J. Griffith & Sons, 112 West Adams Street, Chicago, Ill., for extension to marine barracks, including electric lighting and steam, water and sewer systems, etc.; construction of sea wall, piers, etc. The cost of the work is estimated at $1,666,000.

SUMTER, S. C.—The question of municipal ownership of the electric lighting plant is under consideration.

ATLANTA, GA.—The Warford Shoals Light & Power Company is contemplating an issue of $50,000 in bonds.

AUGUSTA, GA.—Contract has been awarded by the city of Augusta for the installation of a transformer, to cost $6,575.

JACKSONVILLE, FLA.—The War Department, Washington, D. C., has awarded contract for the construction of buildings, including installation of an electric lighting system, water and gas service, etc., in connection with development of city, near Jacksonville, for shipbuilders to W. P. Richardson of Jacksonville. The proposed project consists of the erection of 165 buildings of cottage and bungalow type, to cost about $750,000.

TULLAHOMA, TENN.—Arrangements are being made by the Public Light & Power Company for the construction of an electric transmission line from Tullahoma to Manchester.

HUTTIG, ARK.—The power plant and a portion of the planing mill of the Union Sawmill Company was recently destroyed by fire, causing a loss of about $40,000.

LITTLE ROCK, ARK.—Contract has been awarded by the War Department, Washington, D. C., to George W. Donaghey of Little Rock for erection of headquarters supply warehouse for aviation field in west Tennessee, Arkansas, Oklahoma and northern Texas. The warehouse building will be 400 ft. by 800 ft., and the barracks will accommodate 500 privates and non-commissioned officers and quarters for officers and officers' clubs. The plans provide for an initial expenditure of $500,000.

LAFAYETTE, LA.—The Benners Salt Company, P. O. Box 836, New Orleans, La., would like to receive prices on crude-oil engines, electrical equipment, mining machinery, crushers, mills, etc., to be installed at its works at Lafayette.

NEW ORLEANS, LA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 12 for boilers and superheaters at the local navy yard under specification 3165, to cost about $25,000.

PLAQUEMINE, LA.—Plans are under consideration by James Black and others to establish a shipbuilding plant, eight ways, including an electric lighting system, sawmill, trolley system, etc.

AUSTIN, TEX.—The City Council is considering the purchase of electrical energy from the Austin Power Company to operate the municipal electric lighting plant. Guy A. Collett is receiver of the power company.

Pacific and Mountain States

SEATTLE, WASH.—Preparations are being made by the Northwest Motor Company of Seattle for the construction of a foundry and machine shop on the Duwamish Waterway. They will be 90 ft. by 250 ft., equipped with iron melting cupola, electric steel furnace and overhead traveling crane. The cost of the initial unit is estimated at $150,000. A. P. Nute is president.

TACOMA, WASH.—Bids will be received by Hamilton F. Gronen, commissioner of light and water, Tacoma, until Aug. 2 for furnishing renewal parts for a 65-cell, 200-amp. storage battery or a complete new battery.

PORTLAND, ORE.—Work has begun on the installation of the steam pipe line leading from the new plant of the Northwestern Electric Company to the heating system in the business section of the city.

PORTLAND, ORE.—Rapid progress is being made on the construction of the new auxiliary power plant of the Northwestern Electric Company. The plant is located on a site adjoining the mill of the Portland Lumber Company in South Portland. Mill refuse from the lumber company's plant will be used for fuel. The generating capacity of the plant will be about 10,000 kw. and will cost about $2,000,000.

FRESNO, CAL.—The California Associated Raisin Company of Fresno is contemplating the construction of a power plant, 85 ft. by 154 ft., at its works at Sun Maid City.

RIVERSIDE, CAL.—Plans are being considered by the Nevada-California Power Company and the Southern Sierras Power Company, a subsidiary, to increase the output of their power plants, known as Nos. 2, 3, 4, 5 and 6, at Birch Creek, Inyo County, to cost approximately $85,000.

MESA, ARIZ.—The Board of Supervisors of Maricopa County has granted the South Side Gas & Electric Company a franchise to erect and operate electric transmission lines on certain roads and highways in Maricopa County.

POPLAR, MONT.—The local power company contemplates the installation of another engine unit at the city pumping station to furnish an all-night electric lighting service for the city.

Canada

VANCOUVER, B. C.—Mundy, Rowland & Company, electrical contractors, Standard Bank Building, Vancouver, have recently been awarded contract by the Lyall Shipbuilding Company for electrical installations on six auxiliary schooners.

NIPIGON, ONT.—Plans are under consideration for a hydroelectric power development on the Nipigon River at Nipigon, about 60 miles from Port Arthur, to supply electricity at Port Arthur and Fort William. The proposed plant will cost about $3,000,000, and develop about 135,000 hp.

OTTAWA, ONT.—Bids will be received by John A. Pearson, architect, and J. O. Marchand, associate, Centre Block, Parliament, Ottawa, until Aug. 2 for coal and ash-handling equipment required in the construction of the central heating plant of the Parliament Buildings.

TORONTO, ONT.—Orders in Council have been passed by the Ontario government authorizing an increase in electrical equipment at Niagara Falls to the extent of $500,000; also authorizing the development of 25,000 hp. to 30,000 hp. at High Falls on the Rideau and on the St. Lawrence between Cornwall and Brockville.

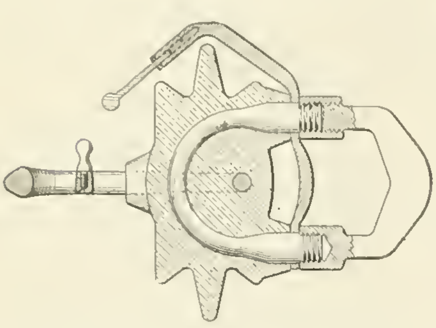
WESTON, ONT.—Bids will be received by the chairman of the Water, Power and Light Commission, Weston, until July 30 for construction of extension to pump and filter house at Weston. James, Loudon & Hertzberg, Ltd., 36 Toronto Street, Toronto, are consulting engineers.

Record of Electrical Patents

Notes on United States Patents

1,270,028. Driving Mechanism; Clark T. Henderson, Milwaukee, Wis. App. filed June 1, 1914. Provides means for effecting the drive of a member at predetermined successive speeds irrespective of variations in the load of such member.

1,270,048. Electric Fuse Plug; Thomas E. Murray, New York, N. Y. App. filed Dec. 29, 1916. A type wherein the contacts are respectively a threaded shell and a plate.



1,270,457—Strain Insulator Provided with Detachable and Adjustable Arcing Means

1,270,062. Terminal Box; Frederick L. Schulz and William Kraft, Toledo, Ohio. App. filed Aug. 21, 1916. A closed box having sheet-metal walls used as loom fasteners.

1,270,080. Telephone Timer and Switch; Albert A. Wells, Detroit, Mich. App. filed May 4, 1917. A timer which limits the use of a telephone by a subscriber.

1,270,100. Method and Apparatus for Determining the Field Strength of Dynamo-Electric Machines; Edwin C. Ballman, St. Louis, Mo. App. filed April 3, 1916. Determines the strength and condition of the permanent magnets of a magneto.

1,270,127. Telephone-Exchange System; Francis W. Dunbar, Chicago, Ill. App filed March 3, 1905. Adapted to systems in which cord circuits are employed for uniting subscribers' lines for conversation.

1,270,128. Telephone System; Francis W. Dunbar, Manchester, Vt. App. filed March 3, 1905. Means for distributing calls from calling subscribers' lines to idle link circuits by means of successively operated automatic devices.

1,270,134. Ship Propulsion; William L. R. Emmet, Schenectady, N. Y. App filed April 5, 1916. Comprises an elastic fluid turbine and an alternating-current generator coupled to said turbine.

1,270,140. Electric Boiler; John N. Fuller, Philadelphia, Pa. App. filed Dec. 1, 1917. A heating coil formed of wire susceptible to an electric current.

1,270,143. Bead Chain; William J. Gagnon, Bridgeport, Conn. App. filed Oct. 18, 1916. Consists of hollow balls and connecting dumbbell links, some of which are insulated.

1,270,198. Electric Water Heater; Leon F Parkhurst, Schenectady, N. Y. App. filed Nov. 23, 1916. An electric heating device comprising a sheathed wire formed with a resistance core inclosed in a metal sheath.

1,270,235. Starter for Electric Motors; George H. Whittingham, Pikesville, Md. App. filed Dec. 10, 1914. An automatic starter for motors, with a plurality of contact fingers.

1,270,268. Light-Distributing Device; David Crownfield, Cambridge, Mass. App. filed Oct. 18, 1917. To enable illumination from an artificial light source to be directed at will upwardly or downwardly.

1,270,272. Fuse; Louis W. Downes and Ralph C. Patton, Providence, R. I. App. filed Oct. 12, 1916. Provided with an air space about its link for the purpose of completely extinguishing the arc.

1,270,277. Two-Wire Automatic and Manual Telephone-Exchange Trunking System; Edward D. Fales, La Grange, Ill. App. filed March 17, 1910. Provision is made for controlling switches over the two sides of the calling line in series.

1,270,303. Handle and Terminal Connection for Electrically Heated Instruments; Frank Kuhn and Jay A. Hand, Detroit, Mich. App. filed Jan. 25, 1917. Obtains a simple construction of terminal which is housed within the handle.

1,270,304. Soldering-Iron Stand; Frank Kuhn and Jay A. Hand, Detroit, Mich. App. filed Feb. 21, 1918. Equipped with a pivotal socket member with which an electric soldering iron may be very quickly engaged or disengaged.

1,270,326. Call Finder for Automatic and Semi-Automatic Telephone Systems; John N. Reynolds, Greenwich, Conn. App. filed Dec. 13, 1916. Finds a calling line not already seized by another line finder and starts a line finder hunting for said calling line.

1,270,335. Fuse Device; Edmund O. Schweitzer and Alfred Herz, Chicago, Ill. App. filed Dec. 17, 1914. Link confined between two blocks under pressure, the channel between blocks having one or more sharp reverse bends formed by what may be termed "baffle plates."

1,270,342. Electric Vibrator; Rude Stockinger, Manitowoc, Wis. App. filed Aug. 7, 1917. To reduce the heating of the magnetic coil to a minimum.

1,270,356. Automatic Circuit Breaker; George B. Wurster, Tuckahoe, N. Y. App. filed Sept. 17, 1917. Single piece of apparatus which will quickly and positively interrupt fire-alarm circuits.

1,270,362. Electric Cable Protecting Apparatus; Sydney N. Baruch, San Francisco, Cal. App. filed Oct. 23, 1916. For protecting against high static charges.

1,270,385. Interrupter Mechanism for Ignition Dynamos; Alfred C. DeLorme, Newark, N. J. App. filed April 20, 1916. To increase the efficiency and lengthen the life of the contacts and their operating parts.

1,270,388. Telephone-Exchange System; Bert G. Dunham, Hawthorne, N. J. App. filed Nov. 20, 1916. Automatic finder switches are apportioned to calling lines by an extended starter wire.

1,270,391. Inclosed Safety Fuse; Alfred L. Eustice, Chicago, Ill. App. filed May 3, 1915. To increase the simplicity of manufacture of renewable cartridge fuses of the so-called ferrule type.

1,270,398. Method and Apparatus for Transmitting and Receiving Sound Waves Through Ground; Reginald A. Fessenden, Brookline, Mass. App. filed Oct. 7, 1915. Determines the location of the place of transmission of waves or impulses.

1,270,420. Electric Vehicle Wheel; John McL. Kingsbury, Great Falls, Mont. App. filed April 12, 1915. A driving wheel bearing its own motor element.

1,270,421. Electric Vehicle Construction; John McL. Kingsbury, Great Falls, Mont. App. filed June 10, 1915. Electrical driving structure in which large gear ratios are eliminated.

1,270,457. Strain Insulator Provided with Detachable and Adjustable Arcing Means; App. filed Nov. 14, 1916. To render them proof against destruction from high frequency and lightning.

1,270,465. Automatic Switching Means; John F. Toomey, New York, N. Y. App. filed Sept. 13, 1916. Relates to battery-charging systems.

1,270,527. Electric Vehicle Wheel; John McL. Kingsbury, Great Falls, ,Mont. App. filed March 8, 1915. Arrangement of the parts for the purposes of compactness, simplicity and accessibility.

1,270,555. Wiring System; Howard R. Sargent, Schenectady, N. Y. App. filed Aug. 24, 1914. To provide for all the practical requirements of a complete system of wiring.

1,270,563. Direction Signal for Motor Vehicles; Wilson D. Stout, Los Angeles, Cal. App. filed May 28, 1917. An attachment to motor vehicles for the purpose of indicating the direction in which the vehicle is to turn.

1,270,636. Electric Light Extension; Ross H. McDaniel, Peru, Ind. App. filed April 14, 1917. An extensible portable lamp adapted for use particularly on automobiles.

1,270,661. Power System; Arthur R. Smith, Schenectady, N. Y. App. filed April 9, 1917. To utilize the non-condensing engine for driving the auxiliaries up to the point at which its exhaust can be efficiently utilized to heat the feed water.

1,270,671. Electric Switch; George B. Thomas, Bridgeport, Conn. App. filed Dec. 6, 1915. Mechanism adapted for use in electric sockets, pendent switches and the like.

1,270,687. Alternating-Current Generator and Group Converter; Georges Belfils, Paris, France. App. filed Sept. 5, 1917. The construction of an alternator exciter machine or a group converter having an induction system common to the two machines.

1,270,723. Telephone System; Frank L. Goheen, Grouse, Idaho. App. filed June 5, 1917. For use in subscriber's stations of a party-line telephone system to prevent eavesdropping.

1,270,786. Apparatus for Electric Welding; Joseph B. Clapper, Lakewood, Ohio, App. filed Oct. 18, 1916. Having regard more particularly to tube-welding machines.

1,270,806. Railway Signaling System; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed June 4, 1915. Special reference to track-circuit railway signaling systems which are operated by alternating currents.

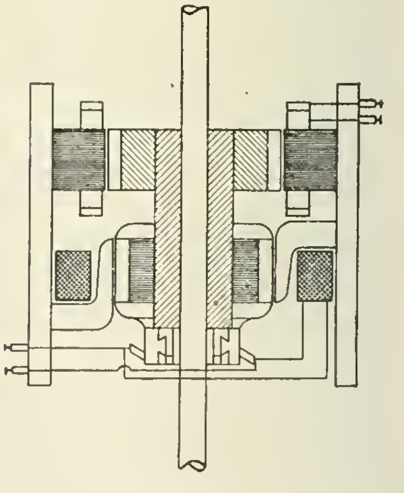
1,270,850. Combination Transformer and Circuit Breaker; William M. McConahey, Pittsburgh, Pa. App. filed Oct. 31, 1913. To provide an improved means for the disposition of electrical apparatus that shall be especially simple and economical of space.

1,270,851. Thermostatically Controlled Circuit; James F. McElroy, Albany, N. Y. App. filed Nov. 3, 1914. Applied to an electric heater circuit.

1,270,856. Support for Electric Lamp Filaments; Roy A. Mailey, East Orange, N. J. App. filed June 27, 1914. Employing two disks of aluminum or other metal and both lying within the reduced extension of the main lamp globe.

1,270,860. Electric Welding Process; Harold A. Newcomb, Wilkinsburg, Pa. App. filed May 11, 1914. The metals to be united are placed in contact with each other, heated by the passage of an electric current and caused to diffuse into each other by the application of pressure.

1,270,861. Combined Telegraph and Telephone Instrument; Herman G. Pape, New York, N. Y. App. filed Feb. 1, 1915. A sound-reproducing instrument or a telephone receiver.



1,270,687 — Alternating-Current Generator and Group Converter

1,270,867. Fuse; Charles S. Price, Rutherford, N. J. App. filed Aug. 3, 1916. A fuse of relatively short length which will not introduce a dangerous fire hazard.

1,270,784. Electrolyte Cells, Such as Lightning Arresters, Condensers, and the Like; Lewis W. Chubb, Edgewood Park, Pa. App. filed Oct. 2, 1914. Refers to certain electrolytes which form high-resistance films upon the surfaces of aluminum, tantalum, platinum and magnesium.

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Lightless Nights and What They Involve

THE midsummer petty savings movement now being under way, we take this opportunity of suggesting some of the things which should be looked out for in carrying out the practical provisions of the situation; and the thing which we particularly want to bring to the public mind is the fact that a great many streets will prove to be insufficiently lighted when the window and display lighting is suppressed. In many instances the municipal authorities have come to lean rather heavily on this private lighting for final results, so that after the auxiliary lighting is dispensed with the street lighting proper in many thoroughfares is rather low compared with what is really necessitated by the traffic. In some cases it will probably be necessary to do more rather than less in the way of street lighting in order to take care of the great and increasing needs. There are very few cities in which the streets are really thoroughly well lighted for the purpose of their use, and cutting down public lighting is quite certain to lead to an increase of accidents, and probably of crime, in such situations. Especially is this true in chief streets where the public lights have remained unchanged for the better during a considerable period of increasing use. As we have many times reiterated, the saving in fuel by the lightless night game is rather ridiculously small; but such as it is we have it, and the only cause for apprehension is lest in the excess of zeal the municipal authorities indulge in cheese-paring economy to the public detriment.

Telegraph and Telephone Control in War

THE government is waging a war in which all our resources and our future are pledged. It deems "necessary for the national security and defense" the "supervision, possession, control and operation" of the telegraph and telephone systems. It is, therefore, assuming complete direction of these great properties and hence undertaking on a large scale what is somewhat in the nature of experiment. We hope that it will receive the same acquiescence and loyal support which are given heartily to other acts having in view the successful prosecution of the war, the centralization of such power in Washington as may be required to bring final victory to our arms.

Whatever ideas may have been held in the past, it is not the past that we are dealing with, but a present which is critical for the civilization of mankind. Those human beings who hold the most delicate and potent of the forces that will decide the issues of the war in the last quarter hour are the federal authorities at Washington, and, irrespective of other considerations, this is the moment to hold up their hands.

It may not be easy for those who have built up the great vital agencies of telephone and telegraph communication to see these properties pass from what they regard as experienced corporate control to a government department. It may be still harder to feel that the new control will be exercised by a Postmaster-General who has sought steadily to substitute government ownership for private ownership of these extensive systems. But the attitude to take is that those points are of no consequence now, that the action of the government is for the duration of the war, and while the exigency lasts it is nothing less than a patriotic duty to maintain the service at the highest possible pitch of efficiency.

Mr. Burleson and those who are associated with him in the control of the telegraph and telephone have a most trying task to perform in caring for the enormous responsibility of the Post Office Department plus the extensive new burdens which are given to them by the Presidential proclamation. The country will look not alone to them, but also to the company officials, to the rank and file, to maintain service of superior character, to prevent disruption or disorganization, physical or personal, from growing at any point.

Fortunately for everybody concerned, the telegraph and telephone companies are most emphatically not in the position of the railroad companies when the carriers were taken over. Telegraph and telephone are pretty well financed up to date. They have not broken down under the strain of unprecedented traffic as did the railroads, and they have generally continued from year to year to make improvements in advance of requirements, instead of falling five or ten years behind as did the railroads. It is, in short, an admittedly efficient machine that the government gets to control, not one broken down and ready for the scrap heap. The telephone system is highly developed from ocean to ocean, from Mexico to Canada. The telegraph situation is a little more complicated by reason of the existence of competing companies. If co-ordination of the facilities of the different companies during the period of the war will help to win the victory in France, the course of the authorities will have ample justification. It is a matter for satisfaction that no charge of profiteering has been laid against the companies. There will be reciprocated satisfaction if the authorities turn back the properties to the owners and creditors at the end of the war, unharmed, bettered if possible, with public benefits from the experiment. May the record of faithful stewardship be marred by no one at any point in the new chapter of telegraph and telephone history!

Sag in Iron Wire Lines

THE bearing of the mechanical properties of iron and steel wire on cheap construction is self-evident. At present costs of poles and labor the natural tendency is toward long-span construction, which means fewer poles and less labor than when following the usual precedents. We have often called attention to the desirability of lengthened spans even in cases where tower construction is not to be considered, and of late years much progress has been made in this direction. The relatively high tensile strength of iron or steel wire, and particularly its high elastic limit, facilitates long-span work and the practical calculation of such spans becomes a matter of considerable importance.

A brief paper by M. D. Leslie tells the story of the solution of the long-span problem for a small plant driven by circumstances to undertake iron-wire transmission lines for light service. In the special instance dealt with, the situation was complicated by a ruling, made after the line was designed and the material obtained, fixing a minimum clearance of 20 ft. (6.1 m.) for transmission lines in rural communities. The upshot of this regulation was that it became desirable to meet it by stringing the iron conductor with about half the sag originally contemplated. The approximate calculation of the line is given in detail by Mr. Leslie. The length of span in this case was 300 ft. (91.4 m.), using No. 6 iron wire.

The practical question which had to be met was the relation of the probable strains encountered to the mechanical characteristics of the wire and the factor of safety under extreme conditions. These conditions are always the critical point in the computation of lines. The early tendency in designing transmission systems was to work along the conventional path marked out by telegraph and telephone practice, using short spacing and factors of safety relatively very large compared with those which are allowed in, for instance, a telegraph line with a score or more of wires all of which can coöperate to break poles or pull off cross-arms. As a rule line designers erred in the direction of excessive precautions, excessive merely because totally unnecessary considering the actual strains to be encountered. To plan a line mechanically so that a pole will stand stiff even if all the wires on one side of it are broken down by a load which could never reasonably be expected means much extra expense. In changing to iron or steel the factors to be considered are the actual load of wind and ice to be expected on the wires and the relation of the very high tensile strength of these wires to their weakest points, determined by flaws or joints.

The experience showed that despite the low theoretical factor of safety the practical one appeared to be sufficient. While an apparent factor of safety as low as that here indicated would not be generally recommended, it probably is in fact a good bit higher than appears on the face of the figures, since the hypothetical sleet and wind factors, although taken below conventional figures, are very likely above anything likely to be encountered in the particular region concerned. Now and then there are districts in which sleet and high winds coincide, but as a rule consultation of the meteorological records show a state of affairs considerably less dangerous than the usual conservative data indicate.

Condensers and Their Design

THE steam turbine brought with it the necessity for better condensing apparatus than had previously been necessary on account of the need for high vacuum to develop the full efficiency of the new engine. With the increasing size of units, too, came the necessity for condensation on a very large scale, which brought with it new requirements in the design of the condensers and their auxiliary apparatus. D. W. R. Morgan's paper on this subject discusses the new problems and the lines of improvement which are being followed out. The general losses which occur in surface condensers and which may produce somewhat serious effects on the economy of the plant are of three kinds—drop in vacuum through the condenser, temperature differences which tend to cool the condensate and hence to lose heat when this is, as usual, employed for the boiler feed, and finally, incomplete removal of the air, which hinders the necessary heat transfers in the condenser. The first source of loss is dependent on the general design, including the size and shape of the shell. The second likewise is a matter of close design with the object of preventing the cooling of the condensate to a point materially below the temperature of the incoming steam.

As in almost every case of engineering, meeting the two sets of conditions here noted is a matter of great skill and finesse, since to a certain extent the easy way out of one difficulty may lead straight into the other and may, too, result in large increase in the cost of the apparatus necessary to obtain given results. Extremely prompt and efficient condensation may imply lessened room for steam flow and consequent drop in vacuum. Large room for steam flow, on the other hand, may introduce too much cooling of the condensate. The third difficulty, incomplete removal of the air, is likely to be due to leaks in the system or insufficient capacity in the air pump, the result being lessening of the heat transfer and a drop in the efficiency of the condenser. Of late the steam ejector type of air pump has come into considerable use and on moderate degrees of vacuum works with great efficiency. At a vacuum as high as 28½ in. (72.4 cm.), however, the hydraulic air pump does better work. Air leakage seems to be more serious in the case of surface condensers than in the jet condensers now largely used. It will thus be seen that the air pressure problem is chiefly a matter of care in keeping the apparatus tight and in thoroughly efficient air pumps.

As the cost of condensing apparatus is no insignificant factor in the cost of plant, the determination of the condenser and its auxiliaries becomes an important feature to the engineer. A balance has to be struck between the gain in fuel by increased vacuum obtained by rather costly apparatus as compared with the increased power and cost necessary to produce it. Mr. Morgan has a word to say, too, regarding the material for tubes. At the present costs of copper and its alloys, there is considerable to be said for steel tubes, particularly in cases where the condensing water does not involve any special risks. The thermal conductivity of the steel is obviously much lower than that of the metal ordinarily used, but cases may arise in which from the dollars and cents standpoint the cheaper metal may prove advantageous. As a final warning Mr. Morgan intimates that as a rule condensers as installed are too small for the maximum work required of them under average conditions, resulting in lowered efficiency at the very times when highest output is necessary.

A Case of Changes In Design

IT IS by no means always that an engineer can comfortably lay out a hydroelectric plant so that everything can proceed in regular order. The hydraulic portion of this proposition frequently leads to unexpected difficulties and forces a shift in design after these have developed. A good example of this contingency is given in our brief article descriptive of a plant on the Klamath River in which construction had to be adapted to things as they were instead of adhering to things as they were expected to be. The plant is of 10,000 kw. rating, transmitting at 60,000 and 34,000 volts, with an equal amount of capacity to be added. The hydraulic situation made desirable the use of a penstock system about 200 feet (60.9 meters) long, reaching from the abutment at one end of the storage dam down to the power house. The original scheme called for a single 17-foot (5.2-meter) penstock, but constructional difficulties as the case developed rendered it desirable to change to two 10-foot (3-meter) penstocks. This brought with it a train of other changes. It was intended to place the hydroelectric unit in the conventional way with the main shaft across the power house. With the adoption of two penstocks a clear waterway had to be made and the generator shaft would of necessity run the other way. By a change in the scroll case of the turbine two inlets were provided and the original runner was installed in the modified scroll case.

As regarded added equipment, it was found that the units could not be symmetrical in utilizing the situation advantageously, so the building was laid out to fit the constructional conditions. Just why anybody should consider symmetry a necessity, or even of any consequence whatever, in a station containing only two large units, it is rather difficult to imagine. A great deal of money has been sacrificed in power-house construction to an obsession of symmetry on the part of the designers. The main thing is to have a power house convenient and the generating units and equipment accessible. Sometimes this implies symmetry and at other times, particularly in the case of plants of somewhat limited capacity and few units, it does not. The distribution is somewhat interesting as being at two voltages, by the use of star and delta connections respectively, while leaving everything ready for passing to the higher voltage at very short notice. It is a rather instructive case of compulsory shift of design from causes arising after the work was initiated.

Overhauling a Hydraulic Plant

SMALL plants, and especially small hydraulic plants using auxiliary steam, provide a good field for the exercise of skill and ingenuity in operation. They do not sound big to those who reckon in thousands of kilowatts, but give extremely useful service to the community, and it is worth noting that a large part of the total available water power depends on its utilization by small plants.

A short report by C. A. Graves in another column gives an account of the improvements made in a little plant at Deposit, N. Y., which is instructive to the operator of like small stations. The plant began in a way which is familiar to collectors of electrical antiquities—three vertical wheels bevel-geared to a horizontal shaft, a jack shaft to which the generators were belted, and two steam engines to take the load when necessary, one of them of the antediluvian slide-valve variety. There was no surplus water capacity, and the average coal consumption for the six years previous was 824 tons. After a fire at the plant which might almost be considered providential in its results, things were put into efficient shape, and the jack shaft, the slide-valve engine, the old generators and the waterwheel harness were thrown into the scrap heap. Hydraulic conditions still remaining unchanged, the original wheel-shaft equipment was retained but belted directly to a 200-kw. generator. The large engine had a 250-kw. generator installed on its extended shaft, and a 50-kw. direct-connected unit was added for light-load periods and for working in parallel with the waterwheel at certain times. To help out the hydraulic plant the tailrace was thoroughly scraped out by a cable-drawn scraper, the waterwheel runners were cleaned and smoothed and new step bearings were put in. The saving in fuel has amounted to over 600 tons per year, which at the present price of coal tells its own story of useful improvement. Such is the brief tale of what has been done in improving one plant of a type of which there are hundreds needing improvement.

The Coming Issues

FEATURES of a new hydroelectric plant serving an interconnected system in the Middle West will be presented shortly, to be followed by a description of the entire system from the interconnection point of view. The second installment of the Bureau of Standards' contribution on iron wire will dwell on the mechanical characteristics of solid and stranded iron wire. Professor Clewell's next article will refer to the selection and installation of motors and control apparatus in the woodworking industry. Other articles will be published regarding outdoor substations and war-time operation of motor-driven pumps.

Sag Calculation for Iron-Wire Lines

Stringing of Iron Wire with Less Sag Is Suggested as a Practicable War-Time Economy Where the Usual Safety Factor Is Not Essential and Weather Conditions Are Not Severe

BY M. D. LESLIE
Chief Engineer Midland Water, Light & Ice Company, Dodge City, Kan.

After designing a transmission line and purchasing the material, the Midland Water, Light & Ice Company was forced to change the design to comply with a new ruling of the Public Utilities Commission fixing minimum clearance for transmission lines in rural communities at 20 ft. (6.1 m.). The company was forced to string the wires with 3.5-ft. (1.07-m.) sag on 375-ft. (114-m.) spans (No. 6 B.B. iron wire), instead of 6.9 ft. (2.1 m.) at 60 deg. Fahr., as originally planned, because additional poles for shorter spans could not be obtained. Experience with this and other lines has led the writer to believe that the usual factors of safety allowed for iron-wire lines for less important service are unnecessarily high where the weather conditions are not severe. The economy effected by less rigid design, moreover, is in keeping with war-time requirements.

It appears that some companies have not taken full advantage of the properties of iron wire when compiling their sag tables. For instance, in some tables hard-drawn copper and iron wire are allowed the same sags for corresponding temperatures and spans. The fact that iron wire has a higher modulus of elasticity and a lower coefficient of expansion than hard-drawn copper makes a considerable difference in the sags allowable with the two different materials. The Midland company has been using a modulus of 24,000,000 and a coefficient of 0.0000064 for iron against a modulus of 16,000,000 and a coefficient of 0.0000096 for hard-drawn copper.

A Useful Formula Applied

After failing to find in any of the existing tables the information necessary for stringing iron wire under local conditions an attempt was made to work out a solution from elementary formulas, but the standard formulas proved inadequate. Eventually a useful formula derived by K. L. Wilkinson was found in the Electrical World of Feb. 6, 1915. It is a cut-and-try method but served the purpose well. For the benefit of persons who may be unfamiliar with this formula calculations for the Bucklin-Dodge City line are reproduced herewith. The length of span is 300 ft. (91.4 m.); the size of wire No. 6 E.B.B. iron, the weight 0.109 lb. (0.049 kg.) per foot, the area 0.032 sq. in. (0.206 sq. cm.), the modulus of elasticity 24,000,000, the coefficient of expansion 0.0000064, and the maximum loading is 0.7 lb. (0.317 kg.) per lineal foot. This load corresponds approximately to ½ in. (1.27 cm.) ice and 4 lb. (1.81 kg.) wind pressure, or 30 miles (48.3 km.) actual velocity, which is considered ample for this territory. The stress allowed was 1310 lb. (594 kg.) or 70 per cent of the ultimate strength of the wire. The N. E. L. A. crossing specifications advise 50 per cent of the ultimate strength, but for reasons which will be explained later 70 per cent to 80 per cent of the strength of the wire is used.

Calculating the sag under loaded condition:

$$D = (W_1 \times L^2)/(8 \times T), \text{ or } D_1 = [0.7 \times (300)^2]/(8 \times 1310) = 6 \text{ ft. } (1.83 \text{ m.})$$

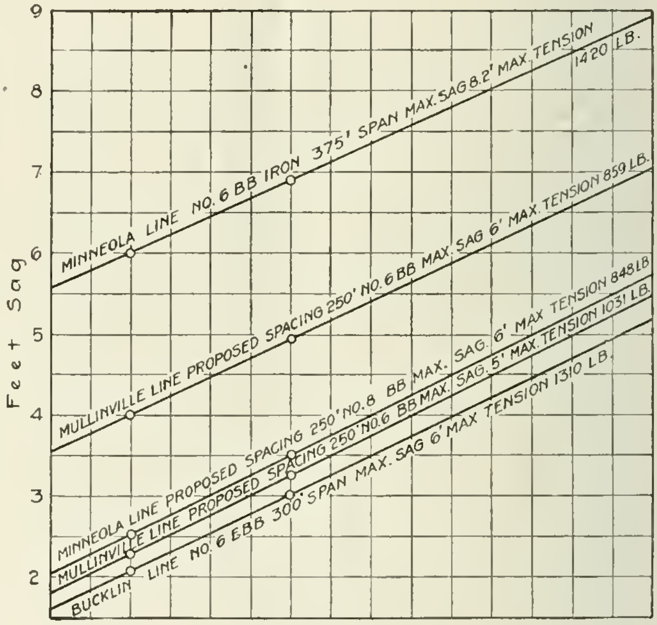
For the length of conductor per foot of span:

$$L_1 = 1 + (8 \times D^2)/(3 \times L^2) = 1 + (8 \times 6^2)/[3 \times (300)^2] = 1.001065.$$

For the unstressed length of conductor per foot of span:

$$L_0 = L_1 - (T_1L_1)/(MA)$$

$$L_0 = 1.001065 - (1310 \times 1.001065)/(24,000,000 \times 0.032) = 0.99936.$$



SAGS USED ON SEVERAL IOWA IRON-WIRE LINES

The formula for determining the sag at zero deg. Fahr. is:

$$D_2^3 + D_2(3 \times L^2)/8 \times (1 - L_0) = 3W_2L^4L_0/64MA, \text{ or}$$

$$D_2^3 + D_2(3 \times 300^2)/8 \times (1 - 0.99936) = (3 \times 0.109 \times 300^4 \times 0.99936)/64 \times 24,000,000 \times 0.032$$

In this formula the length of the wire is the only value which changes in the various calculations so the rest is reduced to definite values and used as such.

Calculating the sag at zero temperature unloaded,

$$D_2^3 + D_2 \times 33,750 \; (1 - L_0) = 53.93L_0$$

$$D_2^3 + D_2 \times 33,750 \; (1 - 0.99936) = 53.93 \times 0.99936$$

$$D_2^3 + D_2 \times 21.6 = 53+$$

For first approximation substitute 2.05 for D_2, giving $(2.05)^3 + 2.05 \times 21.6 = 53$. Therefore the sag at zero deg. Fahr. unloaded is 2.05 ft. (0.625 m.) and the stress in the wire is $L^2W/8D = [(300)^2 \times 0.109]/(8 \times 2.05) = 598$ lb. (271 kg.).

For 60 deg. Fahr.:

$$L_{60} = L_0(1 + 60 \times 0.0000064)$$

$$L_{60} = 0.99936(1 + 60 \times 0.0000064) = 0.99974$$

For the sag:

$$D_2^2 + D_2(33{,}750)\ (1 - 0.99974) = 53.93 \times 0.99974$$

$$D_2^3 + D_2(8.77) = 53+$$

Substituting 3 for D_2,

$$27 + 3 \times 8.77 = 53$$

Hence D_2, the sag at 60 deg. Fahr., is 3 ft. (0.914 m.). The stress is $[(300)^2 \times 0.109]\ (8 \times 3) = 410$ lb. (186 kg.).

In like manner the sag at 120 deg. would be 4.1 ft. (1.25 m.) and the stress 300 lb. (136 kg.). At 30 deg. below zero unloaded the sag would be 1.7 ft. (0.518 m.) and the stress 720 lb. (326 kg.).

According to L. P. Perry's tables (Electrical World, Oct. 13, 1917) the sag at 60 deg. for a 300-ft. (91.4-m.) span should be 10 ft. (3.05 m.), whereas by Wilkinson's formula, with Class B loading and allowing a tension of 50 per cent of the strength of the conductor, the sag at 60 deg. would be 8.3 ft. (2.53 m.). However, the formulas used appear to be suitable for the conditions involved since the lines were mostly on private right-of-way and extended through territory where the usual safety factors are not required and where weather conditions are not severe. Apparently there is no reason why iron wire should not be worked up to 75 per cent of its strength under such conditions.

The accompanying curves give the sag for various span lengths which have been developed for construction or proposed work. It may be noted that the values calculated give straight-line sag curves for the various temperatures.

Observations Made Under Operating Conditions

Referring to the Dodge City-Minneola curve, it may be observed that the sag on these 375-ft. (114-m.) spans calls for 6.9 ft. (2.1 m.) at 60 deg. As already stated a new ruling of the Public Utilities Commission necessitated reducing this sag to 3.5 ft. (1.07 m.). This line had not been subjected to winter conditions up to the time this article was written, but the wind pressure has been very high at times. Some breaks have occurred due to faulty joints or defects in the wire, but they did not occur during storm periods. The Bucklin line has withstood heavy winds, accompanied by severe cold and some sleet, which disabled many of the neighboring telephone lines. Several failures on this line occurred during the first months of operation, due entirely to defective wire.* It is not anticipated that the Minneola line will fail under similar conditions even though the sag is about the same in these 375-ft. (114-m.) spans as for the 300-ft. (91.4-m.) spans on the Bucklin line. It is possible that the first cold weather will reveal a few more weak places, but after these have been remedied it is expected that the line will stand without any further trouble.

As an experiment, one mile (1.6 km.) of No. 6 B.B. iron wire was strung in the fall on poles spaced 412 ft. (125.6 m.) apart and pulled tight, practically without sag. This line withstood a temperature below zero and high winds without failure or apparent damage to the wire. Telegraph companies using No. 6, No. 8 and No. 10 B.B. iron wire on 125-ft. to 150-ft. (38.1-m. to 45.7-m.) spacings (which, according to Mr. Perry's tables, should have, 16 in. (40.5 cm.) sag at 60 deg.) pull all sizes to the same level, which is practically at zero sag. They have been doing this for twenty-five years or more with apparent satisfaction. Transmission companies in the state have also been operating No. 8 and No. 6 iron wire on 300-ft. (91.4-m.) spans with 18-in. sag for two or three years, and they reported no trouble even through the severest weather conditions of last year. Why, then, should 300-ft. (91.4-m.) spans be strung with 10-ft. (3.05-m.) or 8.3-ft. (2.53-m.) sags if 3.5 ft. (1.06-m.) or even 1.5 ft. (0.45 m.) will be sufficient?

While the disregard of established engineering principles is not advocated, it appears that present practice is too conservative. Possibly the trouble lies in the fact that the maximum loading conditions are seldom if ever reached. Never in the history of the weather bureau in this locality has a 60-mile (96-km.) wind been recorded during sleet periods, although this district is included in the section for class B loading. On the contrary, the records show that during sleet periods the temperature is usually above zero with little wind prevailing. Theoretically it was impossible for the test line referred to above to stand under winter conditions, but it did.

Conclusions

The conclusions deduced from these investigations are as follows: The strength of commercial iron wire is equal to or above its estimated strength except for occasional flaws. These flaws are cut out as far as possible during stringing. Those that are missed soon appear after the wire has been in service a short time, and it is preferable to get them out of the line rather than to try to cover them up with a high margin of safety. Wire is strung according to the results given by the foregoing formulas and loading conditions unless it is found that this interferes with prearranged construction plans. In this case a compromise is effected to meet the requirements of the commission rulings and the risk of breakdown is assumed. One reason for doing this is that many breakdowns are not anticipated, and another is that if they do occur it is better to have the interruptions than to pay interest on the largely increased costs necessary to install the wire with heavy sags on poles high enough to meet the required clearances.

During the operation of the Bucklin line, observed over a year, and of the Minneola line, observed over six months, the towns served have never been out of service on account of wire failure. A certain number of interruptions occur owing to broken insulators, faulty joints, transformer and fuse troubles, but the small communities served are not exacting in their requirements of continuous service.

It should be remembered that the lines considered in this article are comparatively long and serve very small communities, so that items such as pole spacing and height make a considerable difference in the feasibility of such extensions. The climate in this territory, moreover, is mild and the conditions of service are not severe. These facts should be thoroughly considered before making use of any of the radical suggestions prompted by the experiences outlined in this article.

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*Since this article was written, however, the Minneola line has withstood heavy wind and sleet without failure.

Motor Drive in Paper and Pulp Mills—II

Need of Suitable Protective Equipment Where Power Demands Are Erratic—Motor Characteristics Required for Specific Operations—Operation of Jordan Engines and of Calenders

BY C. E. CLEWELL
Assistant Professor of Electrical Engineering, University of Pennsylvania

OF THE variety of paper and pulp machines which are well suited to motor drive, there are quite a number which require large motors and whose starting requirements under certain conditions may be very severe. In fact, heavy-duty machines are recommended when specifications are made covering the motors for such mills[1].

With particular reference to the paper and pulp mill industry, Wallace points out that certain structural features should be given special attention in designing motors. For example, form windings are recommended and mechanical attachment of the rotor bars to the short-circuiting end rings of squirrel-cage induction motors must be carefully considered. Another important item is the use of insulation on the motor windings which is capable of withstanding moisture. The importance of this element is clearer after an inspection of some of the processes in pulp mills as illustrated in the preceding instalment, where the wet conditions in certain departments of the mill impose unusual requirement upon the motor structure. A temperature rise of not more than 40 deg. C. is advocated for continuous operation, and the recommendation is made that the motors for this class of service should be capable of operating continuously with an overload of 25 per cent.

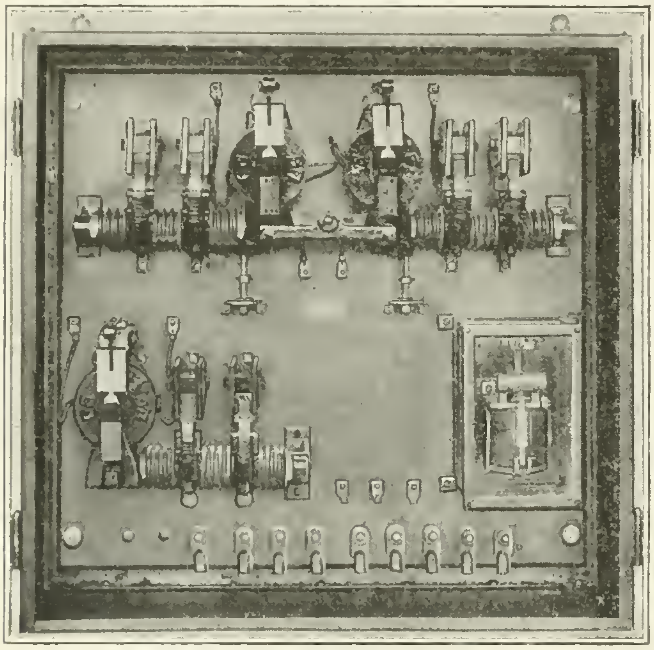

FIG. 1—REVERSING CONTACTOR PANEL USED WITH PAPER AND PULP MILL PLATER

Turning now to the subject of suitable control for paper and pulp mill machinery, it is desirable to consider a few of the characteristics of such machines in their relation to the control problem. The starting characteristics required of the motors employed follow in a general way those which have been discussed in earlier articles relating to other applications, except, perhaps, under the unusual conditions sometimes encountered in the operation of pulp-mill apparatus.

In the operation of those machines where pulp stock is involved, as in beaters, where the stock may settle and harden, a fresh start of the machine may require not only an excessive torque to break up the stock, but considerable care may also be desirable in "coaxing" along the mechanism from the mechanical point of view until it reaches normal operating conditions again. Such circumstances make it desirable to design the resistance grids for slip-ring motors rather liberally to meet the maximum demands likely to be placed on the motor.

With conveyors and log hauls it is not only important to use liberal rotor resistance for the slip-ring induction motors commonly employed, as a safeguard when slow starting is required or when it becomes necessary to break up a jammed condition due to ice formation, but a belt connection is depended upon to slip in case of clogging. Beaters and washers also require liberal resistance design in the starting controller for the slip-ring motors used, belt connection making it possible to place the motor at some distance from the machine, as when in a basement, and adding flexibility to the mechanical system. When a chain belt is used in such cases it should be sufficiently large to offset its tendency to act as a rigid connection between the motor and the driven machine.

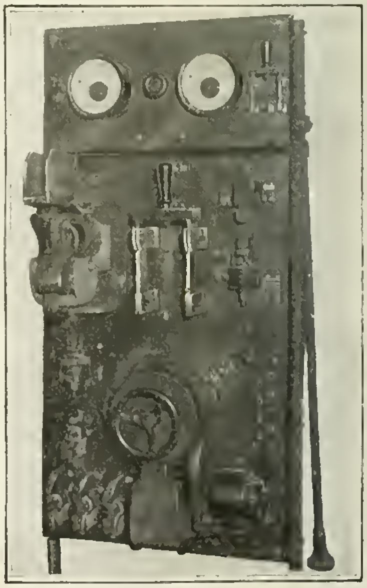

FIG. 2—AUTOMATIC MOTOR-OPERATED CONTROL PANEL

For certain processes, such as the operation of wet machines, where the use of a low speed is essential at times, the slip-ring motor is employed with high auxiliary resistance. In a few cases, typified by super-calenders and rotary cutters, the direct-current adjustable-speed motor is adapted to the conditions of operation. In a general way, therefore, it is apparent that the control problem possesses features which are very closely related to the successful handling of the machines in such mills and that good judgment and proper allowances for abnormal loads are factors which enter into the controller design considerably more perhaps than where the load conditions are subject to a more definite determination. The accompanying illustrations indicate tendencies in the manufacture of such controllers.

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[1] See article by Joseph H. Wallace, "Standard Handbook for Electrical Engineers," fourth edition, p. 1272, to which several references have been made in the preparation of this article. Other sources of information consulted include the paper by W. W. Cronkhite, *General Electric Review*, May, 1917, p. 384, particularly in reference to motor applications for Jordan engines, calenders and platers, and to the paper by W. L. Merrill, *Trans. A. I. E. E.*, Vol. 34, Part I, p. 1340.

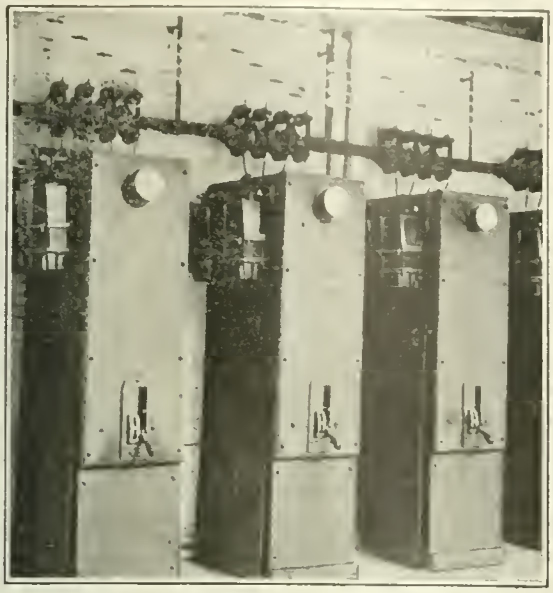

FIG. 3—SOME STARTING PANELS FOR 100-HP. INDUCTION-MOTOR-OPERATED BEATERS

SWITCHING AND PROTECTION

Special care is recommended for the selection of switching apparatus in these motor installations, and protection from overloads is advocated in the form of automatic devices. An indicated by the horsepower requirement in the table printed in Part I of this article, many of the machines must be driven by motors of large size, and hence the use of fuses may involve quite an expense for renewals when the larger sizes are required. A form of protection which has proved successful is that of oil-type switches equipped with low-voltage and overload release.

From the standpoint of mechanical safety, the elements in the transmitting mechanism between the motor and the machine must be sufficiently strong not only for maximum load conditions but also for the sudden jars to the equipment associated with the operation of much paper and pulp mill machinery. With large motors, when operating under unusually heavy load conditions, a three-bearing (rather than two) arrangement is advocated. Mechanical strength in belts and rope drives is essential. The greater rigidity of the mechanical coupling formed by silent-chain drives makes a high safety factor of still greater importance.

ADJUSTABLE-SPEED MOTOR APPLICATIONS

Because of its somewhat limited field in the paper and pulp industry, the adjustable-speed motor does not assume the importance here that it does in machine-shop work. However, several examples of its use will be given to illustrate some of its applications. In one case a 150-hp. five-to-one speed-range adjustable-speed motor is used to drive a line shaft from which a six-cylinder board machine is operated. Some idea of the power requirements of such machinery may be gained by the following data based on published figures for the multi-cylinder board equipment. There are two parts to the power required for this machine, one of which is a constant and the other an adjustable speed drive. Taken together, from about 0.012 hp. to 0.015 hp. is required per inch (width) per foot per minute (speed), the adjustable speed end alone, referred to in these illustrations, taking a little more than half the amounts just given. These figures refer to brake rather than indicated horsepower.

An example of one of the smaller applications of the adjustable-speed motor is its use for the operation of paper-mill winders and coating machines (Fig. 4). When direct-current motors are employed in super-calender operation (Fig. 5C) to obtain the very low speed (about 10 per cent normal) required in the so-called threading operation, stable operation is sought by means of field control, together with a resistance connected as a shunt across the armature terminals. This scheme has been found to be satisfactory, provided that the load is uniform during the operation of threading; but such an ideal condition is not common. Other aspects of the low-speed operation of such machinery are touched upon below in the discussion of super-calender operation.

JORDAN ENGINES

Turning now to several of the specific applications of motors in the paper industry, additional features involved in the use of the motor under extreme operating conditions will be brought out[2]. The first of these relates to the Jordan engine, one case being shown in Fig. 5. The horsepower required to drive such machines ranges from about 50 to 300, the motors in Fig. 5 being 150 hp. each and of the induction type.

The Jordan engine is a type well suited for direct motor drive since the connection between the engine and motor is through a so-called telescope coupling for taking up the motion of the plug of the Jordan. This mo-

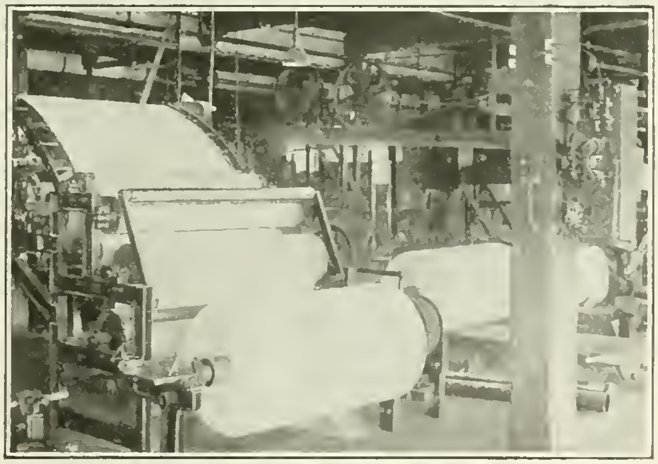

FIG. 4—COATING MACHINE WITH WINDER DRIVEN BY 10-HP AND 5-HP., 1500-R.P.M. DIRECT-CURRENT ADJUSTABLE-SPEED MOTORS RESPECTIVELY

tion may also be provided for by a motion of the motor to and away from the Jordan on a special sliding base as in Fig. 5. In the refining action of the Jordan on paper stock, the pressure of this plug in rotating within the case of the engine has a good deal to do with the results on the product. Hence a graphic wattmeter or even indicating wattmeter readings on the motor may be employed as an indication of the way in which the refining operation is being carried on, this being true because of the dependence of the power required upon the pressure of this plug in its case.

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[2] Motor applications for paper and pulp mill beaters and grinders were described in Part I of this article in a preceding issue.

In starting the Jordan it is not usual to apply the working load until the machine is up to speed; thus only a low-effort starting torque is required to overcome the load, which is made up principally of friction. Consequently the Jordan is a type of machine to which a self-starting synchronous motor may be applied satisfactorily in case its use is warranted from the standpoint of power factor. A reference to Fig. 5 shows that the use of the moving motor scheme of coupling the machine and the motor together calls for a certain amount of play by the motor on its base as the plug moves to and fro. Special telescope couplings, which allow for this motion by the sliding of the two ends of the coupling on each other, allow use of a rigidly fastened motor.

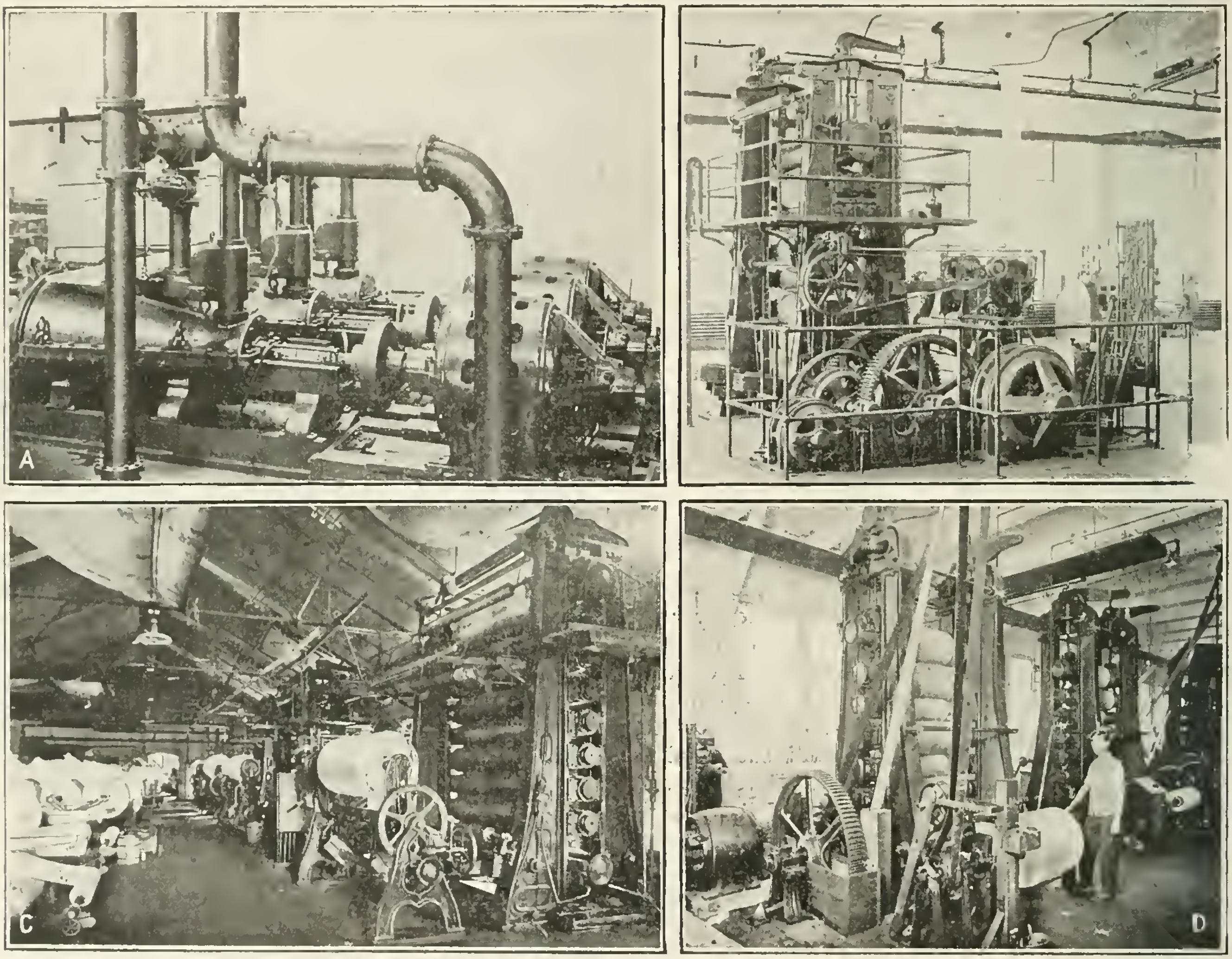


FIG. 5—PAPER-MILL JORDANS, CALENDERS, SUPER-CALENDERS AND FINISHING CALENDERS

A—The three Jordans shown are driven by 150-hp. induction motors. B—A 75-hp. and a 7½-hp. motor operate this 50-in. (1.27-m.) nine-roll calender. C—Four motor-driven super-calenders. D—Individual motor drive applied to finishing calenders.

The power requirements depend on the size of the machine, the nature of the paper pulp which is being handled, and on such factors of operation as the position, pressure and speed of the plug used to refine the pulp. Large differences in the power required to operate a given size of Jordan in two mills may be due to the extra demand placed on the Jordan in one case because of inadequate beater capacity, the Jordan thus being called upon partly to reduce the pulp and partly for refining.

The three views in Figs. 5B, C and D show various applications of the motor to calenders, Fig. 5B referring to a 50-in. (1.3-m.) nine-roll stack paper calender. In this view the two motors are shown, one large for regular operation and one small for threading. The control panel (rear view) is seen to the right. A group of four motor-driven super-calenders is shown in Fig. 5C, and another view of individual motor operation is shown in Fig. 5D, this being a single-motor direct-current equipment in comparison with the two-motor outfit (Fig. 5B).

As previously mentioned, the unusually low speed at which these machines must operate for roughly one-fifth to one-third of the time—that is, on the order of one-tenth the normal speed—imposes peculiar conditions on the motor equipment. This low speed is required as the paper is threaded through the stack of rolls, and this low speed should be fairly stable throughout this part of the operation. From the standpoint of speed, therefore, two widely different values are required, and for each of these practically constant-speed operation is essential. The older practice was to make use of one motor (direct-current in Fig. 5 D) arranged for field control and of a special shunt connection across the armature. A scheme preferable to this method is to use two motors—one small and one large. Often the induction type is selected because so many plants are equipped with alternating current. The smaller unit operates normally at one-tenth of the speed of the large motor and is used for the threading operation. After the paper is threaded through all of the calender rolls, the larger motor is thrown in at the higher speed.

The connection of the larger or smaller motor into the circuit, as just described, may be done by one or more push-button stations. In the modern equipment the control apparatus for two-motor operation includes three push-buttons, one of which starts the larger motor automatically, a second stops the large motor and starts the small motor, and a third brings either to a quick stop. The push-button scheme may be operated in conjunction with a controller, and in starting the motor by the push-button its speed is then governed by the position of the controller. Fig. 5 B shows one of these completely automatic control equipments, the larger of the two motors in this case being accelerated by automatic means instead of by a hand-operated controller.

Speed control and reversal (ten to thirty reversals per minute, depending on the work done) of platers is oftentimes accomplished by remote control too. The controller, which is usually mounted on the plater, actuates contactors on a separate panel.

Construction Problems at Copco Plant

Extensive Changes Made in Design After Work Was Started on This Hydroelectric Installation on the Klamath River, in Oregon, Increased the Natural Difficulties of Work in Narrow Canyon

LIMITATIONS of space and the necessity of providing for extension without interruption called for unusual care in interior arrangement of the Copco plant of the California-Oregon Power Company, which was recently put in service on the Klamath River, Oregon. The difficulties of the work, however, were greatly increased by the fact that radical changes in the original design, made after the work was under way, necessitated rearrangement and even redesign of important features as the work progressed.

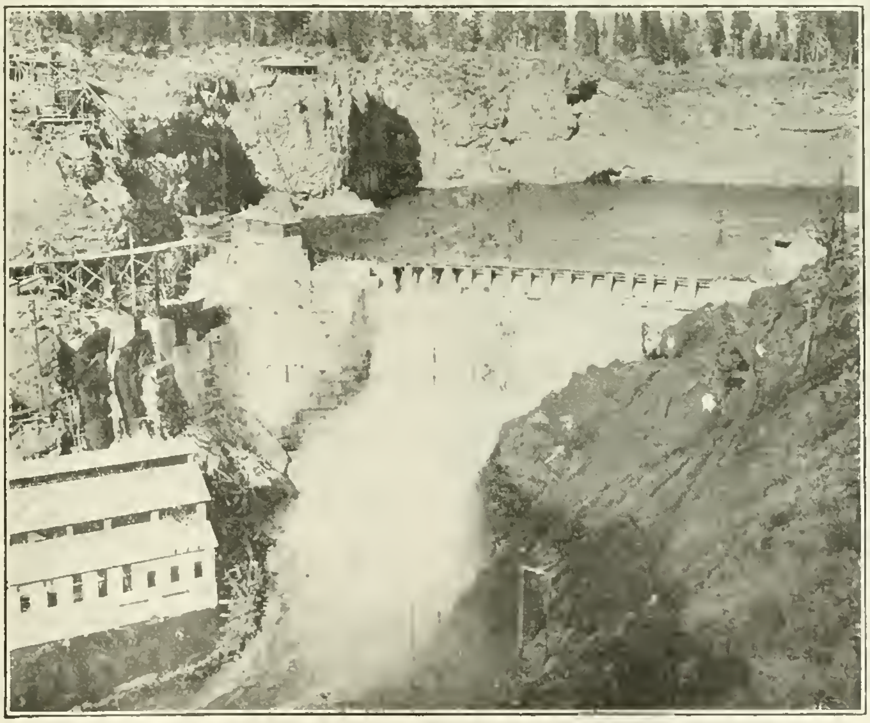


FIG. 1—GENERAL VIEW OF POWER HOUSE AND IMPOUNDED WATER

The power house will be lengthened on the downstream end when the 10,000-kw. unit is added. The gatehouse on the dam is at a height sufficient to allow for raising the dam 16 ft. (4.9 m.).

The plant has an installed capacity of 10,000 kw. and is laid out to provide for the addition of another 10,000-kw. unit without interrupting operation. The capacity of equipment which it was deemed economical to install was based on a normal minimum stream flow of about 1000 sec.-ft. (28.3 sec.-m.) and a reservoir of 1500-acre-feet (185 hectare-m..). This amount of storage is available behind the dam at its present height of 110 ft. (33.5 m.). An additional 16 ft. (4.9 m.) can be added if desired; in fact, the headworks were laid out with that in mind. The dam has a gravity section, is set in the narrowest section of the canyon, and its entire top can be used as a spillway.

The headworks for the plant are located in a massive concrete abutment at one end of the dam. Four remote-control motor-operated gates close openings 4 ft. by 10 ft. (1.2 m. by 3 m.) in size at the throat. The distance of about 200 ft. (61 m.) from the gates to the power house is spanned m.) penstocks by two 10-ft. (30- which enter the power house at roof level on an angle of 35 deg. with the horizontal. The two penstocks were substituted for the original design of a single 17-ft. (5.2-

m.) pipe because of the difficulties of supporting the great weight of the single penstocks at roof level and other attendant problems of arrangement.

The twin-runner waterwheel is rated at 18,600 brake hp. under a 125-ft. (38.1-m.) head at 200 r. p. m. The original plan was to place this turbine and the 10,000-kw., 2300-volt generator to which it is directly connected with the main shaft at right angles to the axis of the building. When a change was made to the twin-penstock line, however, it became necessary to place the unit with the main shaft parallel to the center line of the building in order to obtain the necessary space. When this decision was reached the turbine had already been delivered at the site. It was found possible, however, to redesign the scroll case and provide for two inlets 8 ft. (2.4 m.) in diameter.

The power house was built as close to the dam as was consistent with a reasonable amount of excavation of the canyon wall. On the stream side a bulkhead was necessary to prevent stream currents from interfering with the flow in the tailrace.

After much detailed study it was considered impracticable to lay out a power house in such way that after the future addition the final grouping of units would be symmetrical. Exciter units were placed at the generator end of the main unit, and an additional 15 ft. (4.6 m.) was added to the width of the power-house floor in the main room to provide space for assembly and repair of equipment.

The height of the traveling crane required for handling the machinery was lower than the top of the penstocks where they enter the power house. It was not considered justifiable to give the building the additional height that would permit the crane to travel over the penstocks, so the crane serves only the electric end of the unit. In the duplicate unit the water will probably enter through tunnels so that the traveling crane track can run the entire length of the addition.

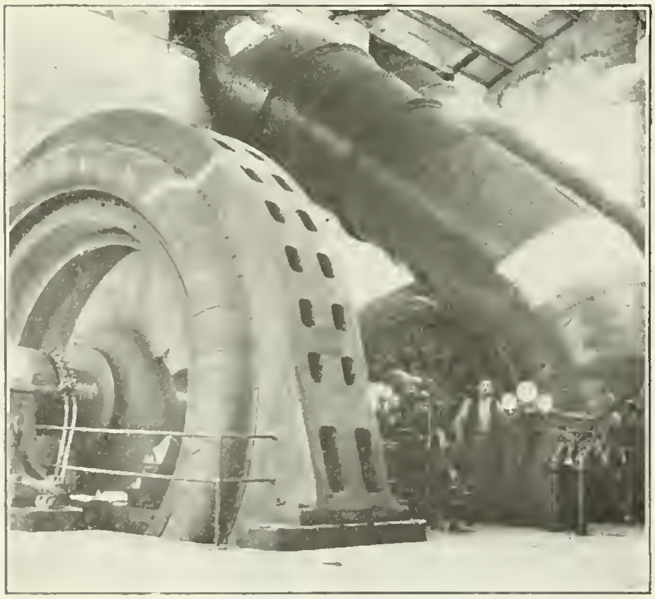


FIG. 2—10,000-KW. UNIT NOW IN SERVICE

The exciter turbines are supplied by an 18-in. (45.6-cm.) pipe tapped into one of the 10-ft. (3-m.) penstocks just outside the power-house wall. This pipe runs vertically down the wall and comes up through the floor to the turbine runner. The exciter supply pipe also furnishes cooling water for transformers and bearings.

In a lean-to, built as an addition on the river side of the power house as originally designed, are the transformers. To avoid the necessity of providing the head room required by high-tension bus clearance, the busbars are carried beneath the lean-to in conduit and the conduit is of sufficient size to provide for additional lines when the duplicate unit is added. Thus the size of the lean-to was kept down to the minimum required by the transformer alone. To compensate for the light shut off by this lean-to structure, every available space was used for windows.

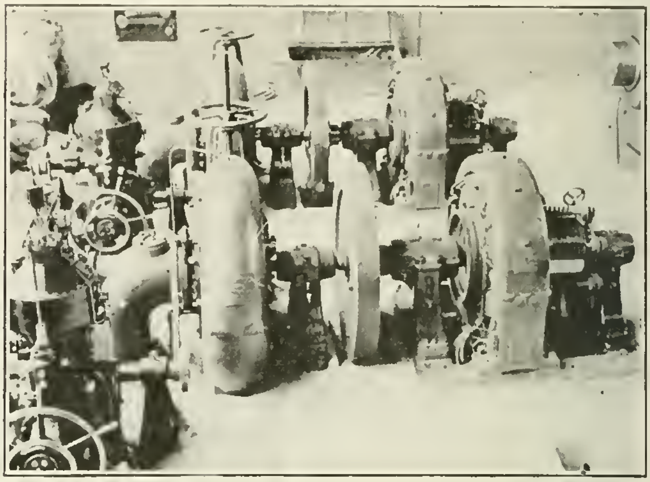


FIG. 3—EXCITER UNITS WITH FLYWHEELS AND GOVERNORS

This plant is located near the geographical center of the company's system, and for the present it is required to supply both the 60,000-volt and the 34,000-volt systems. By star and delta connections 60,000 volts is delivered by one bank of transformers and 34,000 by the other bank. By the use of an oil switch between each transformer bank and the generator the installation was so made that when the duplicate unit is put in the ultimate arrangement for all 60,000-volt delivery can be made by simply changing connections and without disturbing the installed oil switches or transformers. With the contemplated combination of disconnector and oil switches either generator will be able to feed either bank of transformers through a 2300-volt transfer bus. A single high-tension outdoor oil switch has been installed which will be duplicated when the new unit is put in.

Ultimately the high-tension lines will leave the power house on the up-hill side and go over the cliff above. Because of the desirability of having this space free of high-tension lines during later construction operations, however, the leads are temporarily taken directly across the river, where they follow the other bank up stream a few hundred yards and then recross. These two temporary crossings were considered worth while solely to avoid the interference with later construction.

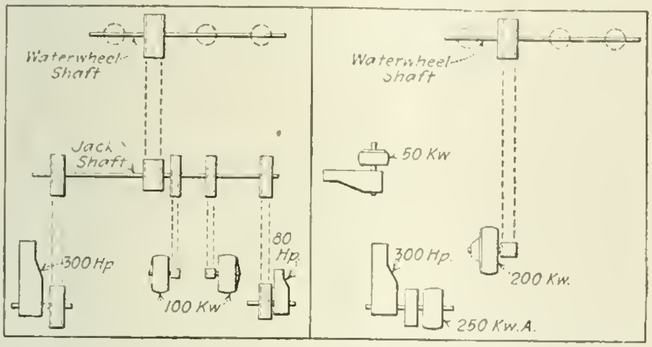
The waterwheels and governors were made by the Allis Chalmers Company and the electrical equipment was supplied by the General Electric Company. The construction was carried out by the California-Oregon Power Company forces, P. O. Crawford being resident superintendent in charge of construction and installation.

UTILIZE DRY SEASON TO OVERHAUL WATERWHEELS

Waterwheel Runners, Bearings and Gates, Alignment of Bevel Gears and Shafts Should Receive Particular Attention

BY C. A. GRAVES

THE summer term, with its usual dry season, should be utilized by the operators of many low-head water-power plants to plan for overhauling their waterwheel equipment, so that it may be made more efficient in the use of the water and thus reduce the amount of coal used for auxiliary power. The principal points to which attention should be given are the waterwheel runners, bearings and gates and the alignment of the bevel gears and horizontal shaft.



FIGS. 1 AND 2—LAYOUT OF EQUIPMENT BEFORE AND AFTER REHABILITATION

The runners, after several years' service, become roughened with rust and blisters, which reduce the efficiency of the turbine by preventing the smooth flow and discharge of the water. Therefore, the runners should be removed from the casing and cleaned. At the same time, the bearings should be inspected and the gates should be adjusted so that they will close uniformly. The continual vibration often noticed in waterwheel harness may be prevented by lining up the shaft and the gears, and this will reduce the loss of power in bearing and gear friction. The tailrace should also be cleaned out, and in many cases it would be of decided advantage to dig it deeper, so that full advantage may come from the maximum net head of the water.

As an example of what can be done in this line, experience at the plant of the Southern New York Power Company, on the Delaware River, at Deposit, N. Y., may be related. Previous to 1914 the power plant consisted of three 42-in. (1.06-m.) vertical waterwheels connected through bevel gears to a horizontal shaft. To this shaft was belted a jack shaft, and to the latter were belted two 100-kw. generators. At one end of the shaft was also belted a 300-hp. four-valve engine, and at the other end an 80-hp. slide-valve engine. The arrangement is shown in Fig. 1. With this plant the average coal consumption for the six years previous was 824 tons per year and there was no surplus water-power capacity.

In 1914, after a fire at the plant, the following changes were made: The jack shaft, the 80-hp. engine and the two generators, as well as the waterwheel harness, were junked, and in their places were installed a 250-kva. generator on the extended engine shaft of the 300-hp. engine, a 50-kw. direct-connected unit, a new harness junked, and in their places were installed a 250-kva. generator, belted to this shaft.

The tailrace was cleaned out by a unique method; that is, a scraper was drawn by a cable back and forth through the race, the cable being passed over a motor-driven drum. The scraper was handled by a man who walked behind it, and some of the time he was up to his waist in water. The waterwheel runners were cleaned and smoothed and new step bearings were installed.

With the new installation the average coal burned for the last three years has been 200 tons yearly, and this with an increased output equivalent to a 30 per cent increase in revenue. The power generated was not recorded prior to 1914, so that no comparison can be made between the power generated and the fuel consumption or the stream flow; but there is now a considerable surplus of water power available. The saving in fuel has been over 600 tons a year, or 75 per cent.

A large part of the saving is due to the improvement in the waterwheel equipment and the elimination of the jack shaft, in that a much larger amount of power was obtained in the dry season. Another saving is due to the method of operating the small steam engine unit in parallel with the waterwheel and making the larger waterwheel unit carry the wattless current while the 50-kw. unit operates at 100 per cent power factor. Still another saving is due to the elimination of the long steam line by keeping the engines close to the boilers. The water in one of the boilers is kept hot at all times so that the steam pressure can be raised to 100 lb. (7 kg. per sq. cm.), if necessary, within thirty minutes. This is accomplished, when there is plenty of water power, by keeping a small fire on the grate during cold weather, and at other times by starting a fire once a week, generally Saturday afternoon, in anticipation of the peak load, and then closing the dampers and keeping the heat in the boilers.

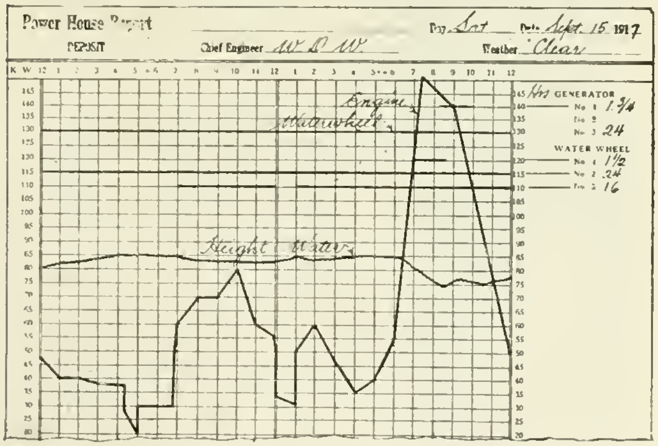


FIG. 3—HOW WATERWHEEL OPERATION AND ENGINE OPERATION WERE CO-ORDINATED

A gage has been installed in the forebay, and periodical readings of the height of the water are taken. The readings are charted hourly in the form of a curve. Full advantage is taken of any increased flow due to showers up the river. The curve also can be used by the operator to determine whether to run the large or the small engine during the peak-load period.

Recent Developments in Condensers

Necessity for Efficient Air Removal in Surface Condensers—Relative Advantages of Steam Air Ejectors and Hydraulic and Reciprocating Air Pumps—Increasing Use of Jet Condensers for Large Units

BY D. W. R. MORGAN

MANUFACTURERS of condensing equipment have put forth strenuous efforts to develop highly efficient air removal apparatus, not because the present type of air pumps have failed, but to obtain the same results with a higher degree of efficiency. They have discovered that within a certain range of vacuum the steam air ejector has a higher efficiency than any of the previous types of air pump. However, if a vacuum of 28.5 in. (82.4 cm.) or higher is desired, the steam consumption of the ejector is greater than that required by a hydraulic air pump, provided that the air pump is driven by a steam turbine of moderate speed, or a motor.

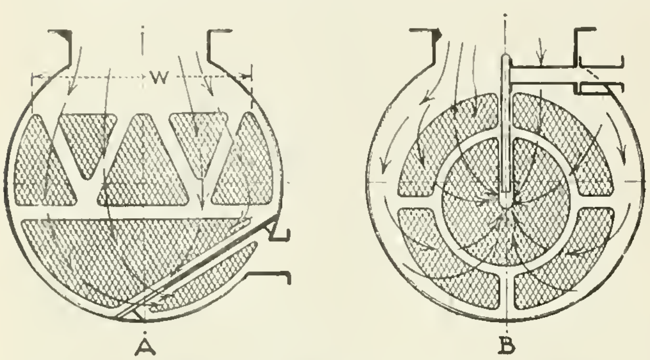


FIG. 1—CONVENTIONAL DESIGN OF SURFACE CONDENSER AND THE RADIAL-FLOW TYPE

Losses in Surface Condensers and How They May Be Prevented

Losses that occur in surface condensers and materially affect the economy of the plant should have serious consideration before the installation is made. They are as follows: (1) Drop in vacuum or difference in pressure between the condensate; (2) difference in temperature of the entering steam and condensate, and (3) incomplete air removal.

The first loss is dependent upon the size of the shell and the shape, provided that the tube spacing is correctly designed—that is, has differential spacing decreasing the space between the tubes from top to bottom of the shell—and assuming that the condenser is of conventional design and not provided with steam lanes down through the nest of tubes to eliminate the drop through the condenser.

The second loss can be reduced to a minimum by careful design. Several large condensers have been built with rain plates inserted to give a substantially dry-tube condenser. However, the resultant loss due to the steam having to travel at right angles causes a loss equal to if not greater than the effect of producing cold condensate. The condensate temperature can be raised by the use of a primary heater in the top pass, but this construction is expensive both as to the cost of condenser and the additional piping required. In the conventional design of condenser of large size the condensate rains down through an appreciable space, and in coming in contact with the cold tubes its temperature is reduced 5 deg. to 10 deg. below that of the incoming steam. Obviously additional heat is required if the condensate is to be used for boiler-feed purposes.

It is extremely important that the tubes be properly spaced. If they are packed together to obtain as much surface as possible in a given size of shell, there is not much room for steam flow. This means that the drop in vacuum will be considerable between the air-pump connection and the steam entrance to the condenser.

Incomplete air removal is caused mainly by air leakage due to the system not being tight and also to the air pump having insufficient capacity. With an inefficient pump air will collect in the lower portion of the condenser, the direct effect being to lower the temperature and to reduce the heat head between the water in the tubes and the steam space. Consequently the heat transfer will be reduced and the condenser will be less efficient.

Either the hydraulic air pump or the steam ejector is capable of reducing the air pressure in the condenser to practically zero, so that the maximum temperature is maintained in the steam space nearest the offtake, meaning that the heat transfer will be increased. The maintenance of high temperatures in the lower part of the condenser also insures the condensate being at the maximum temperature, as it will assume the temperature of the vapor. It must be borne in mind that for every 10 deg. increase in the temperature of the condensate fed to the boilers approximately 1 per cent of fuel is saved.

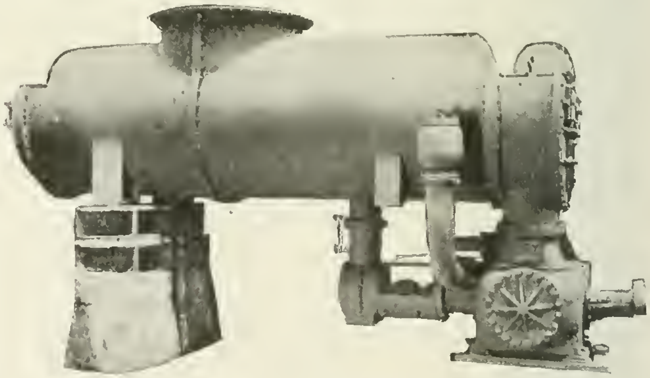


FIG. 2—UNIT-TYPE SURFACE CONDENSER BUILT IN SIZES UP TO 6000 SQ. FT.

With a reciprocating pump the temperature in the steam space in the bottom part of the condenser is about 15 deg. less than in the top part, owing to inefficient air removal. With the hydraulic air pump or steam ejector the temperature in the steam space is nearly the temperature of the steam at the entrance of the condenser, so that the temperature of the condensate is nearly that of the entering steam.

In a jet condenser the only effect of air being present is to add its pressure to that of the vapor, thereby reducing the vacuum by a corresponding amount. That is, if, in a condenser carrying say 28 in. (71.12 cm.) of vacuum, air was allowed to collect in such amounts that its pressure was ½ in. (1.27 cm.), then the vacuum would be reduced to 27.5 in. (69.85 cm.). In a surface condenser, however, the collection of air to the extent of its exerting a pressure of ½ in. (1.27 cm.) would make the vacuum much worse, as the effect would be relatively threefold. It would tend to diminish the vacuum to the same extent as in a jet condenser. The air present would insulate or blanket the tubes so that the heat transfer from the steam space to the water space would be seriously interfered with. The presence of air would also lower the temperature in certain zones of the steam space in the condenser, so that there would be less "heat head" to create a transfer of heat.

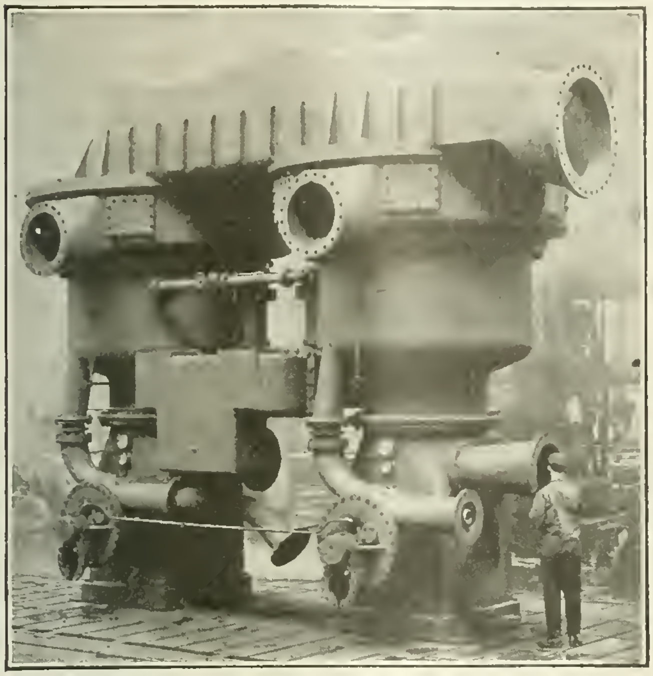


FIG. 3—TWIN-JET CONDENSER CAPABLE OF HANDLING 18,000,000 LB. OF WATER PER HOUR

From the foregoing it will be seen that to get the best results from a surface condenser it is necessary to have air-removal apparatus that can maintain the air pressure in the shell at a negligible value.

CHARACTERISTICS OF AN IDEAL CONDENSER

In theory an ideal condenser should resemble a cone in shape, so that the velocity of the entering steam would be maintained constant to the point of air offtake. Such a condenser would not be practicable to build, however.

In the condenser shown at *B* (Fig. 1) the feature of constant steam velocity is obtained. Steam enters the tube nest substantially around the entire periphery of the shell, and the area of the steam space decreases as condensation takes place. The drop in vacuum from the top of the condenser to the air offtake is negligible, because the path of the steam is so short.

In all cases the condensate temperature is equal to the incoming steam temperature, and test results indicate that it is even 2 deg. to 5 deg. higher. The reason for this is that the area of the steam space at the bottom is slightly contracted, so that there will be an increase in velocity, and obviously an increase in pressure, due to compression. This will cause an increase in temperature, and the raining of the condensate through this steam would mean that the condensate would assume the increased temperature. The air is taken off at the center of the shell, the coldest part of the condenser.

With regard to heat transfer, the statement has been made that certain manufacturers are more conservative than others. This is no doubt due to the type of air-removal apparatus used in conjunction with the condenser. With efficient air-removing apparatus it is possible to establish artifically a greater heat head within the condenser, or, in other words, it is possible with efficient apparatus to use a smaller condenser to do substantially the same work as a larger condenser with inefficient air removal.

The unit-type surface condenser shown in Fig. 2 is designed for power plants of relatively small capacity and is built up to sizes having 6000 sq. ft. (592 sq. m.) of surface. The auxiliary equipment of pumps occupies little additional space as it is set directly under the condenser. The air pump receives its water supply from the main circulating system, regulation by a hand-operated valve giving the proper working suction for the pump. The shell and pumps are supported on beams or concrete, the foot farthest away from the pump being left free to move in the horizontal plane to allow for expansion due to temperature changes.

PROGRESS IN JET CONDENSER DESIGN

In low-level jet condensers the progress made in the last few years has been remarkable. Improvements in design with specific reference to spray nozzles and removal of air have decreased the terminal temperature difference between steam and discharge water from 10 deg. to 5 deg., assuming 28 in. vacuum and 70 deg. water. Formerly it was common practice to eliminate the use of jet condensers if the turbine unit was of appreciable size, say 20,000 kw. and up; but there are good reasons why in particular cases a jet condenser should be used. In the last three years jet condensers have been furnished for use in connection with 15,000-kw. to 45,000-kw. turbines, and they are operating successfully. The largest jet condenser installation to date is that installed in the power plant of the Narragansett Electric Lighting Company, Providence, R. I. It is a twin jet condenser circulating 18,000,000 lb. (8,160,000 kg.) of water per hour and serving a 45,000-kw. cross-compound turbine. It consists of two single-jet condensers interconnected by a steam equalizer at the top with the usual atmospheric relief connection at the end. There is also a connection to equalize the air pressure in the

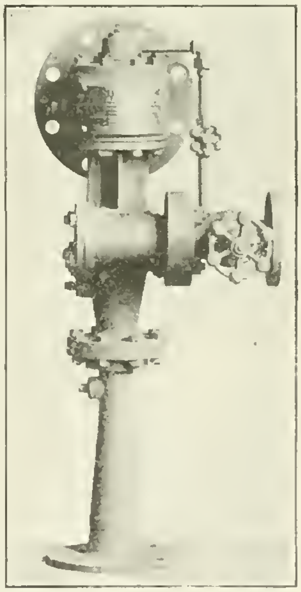


FIG. 4—STEAM-AIR EJECTORS FOR EVACUATING AIR FROM CONDENSERS

condenser and effectively to remove the air in case either pump for any reason should have to be operated at reduced capacity. A water-equalizing connection is also provided to make each removal pump handle its share of water and to maintain the same submergence over each pump.

Owing to the condensers being equalized in every respect, the unit is flexible. If for any reason one pump is out of operation, the condensers can be operated as single units. This arrangement also provides for economical operation, since in winter when cold water is available it is only necessary to operate one side of the condenser. If either of the pumps is in need of repairs, one set of pumps can be removed bodily and a blank flange inserted. One pump will then handle the load.

The field for steam ejectors as air evacuators is growing larger, since they are relatively simple compared with the high-vacuum air pump and require less attention. They have no moving parts, and the steam strainers and nozzles are the only part needing replacement. If a 28-in. vacuum or less is desired, the steam consumption of the ejector is slightly less than that of the hydraulic air pump. However, if 28.5 or 29 in. of vacuum is desired, the capacity of the air ejector must necessarily be greater and the steam consumption is nearly doubled, while the same hydraulic air pump can be used with the same steam consumption as for 28 in. of vacuum. From the standpoint of steam consumption only, the dividing line is 28 in. of vacuum.

Regarding the relative longevity of steel and Muntz metal tubes, the author believes that steel tubes would last as long as bronze tubes if proper precautions were taken to eliminate the action of the water. This is a question for the chemist to solve, however. Tin coating of steel tubes would be more beneficial than similar coating for Muntz metal tubes. The problem is to obtain an even coating, since if spots of the original metal are left open they would be subject to corrosion. From results that have been obtained the life of coated tubes is not appreciably longer than that of uncoated tubes. About 5½ per cent nickel would be required in the steel tubes. Since the time element would be an important factor in heat transfer through steel tubes the cooling water velocities should be relatively low. With a steel tube perfectly clean the heat transfer might be 85 per cent of that obtained with Muntz steel, but in actual operation with the tubes coated the heat transfer would probably drop to a figure ranging from 40 to 60 per cent. If steel tubes are used, it is obvious that it will be necessary to eliminate brass tube plates and circulating pump impellers, using steel or cast iron instead.

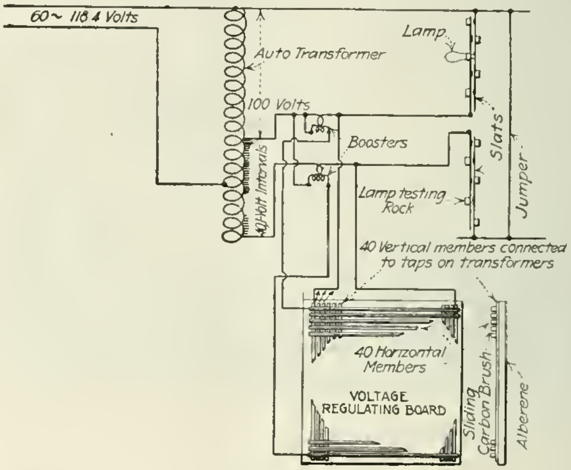
Admiralty metal tubes with zinc plates are better than copper tubes, in the opinion of the author. The proper location for the zinc is on the inner surface of the handhole covers. About 1 sq. ft. (0.092 sq. m.) of zinc plate should be used per 1000 sq. ft. (92 sq. m.) of condensing surface.

Rather than go into the high costs involved in high pressures, efforts should be made first to use to full advantage the vacua that are now available from the modern condenser. Designers need fuller information than they get from the average plant. Average yearly conditions are seldom taken and usually too small a condenser is installed for the maximum work expected. The foregoing discussion formed part of the program at a joint meeting of the Western Society of Engineers and the Chicago Sections of the A. I. E. E. and A. S. M. E.

MEANS OF MAINTAINING ACCURATE TEST VOLTAGE

Arrangement of Auto-Transformer and Booster Transformers to Regulate Lamp Test Voltages at Electrical Testing Laboratories

To obtain accurate voltages for testing the life of incandescent lamps, the Electrical Testing Laboratories, Inc., is using the system indicated in the accompanying diagram. The accurately controlled machine pressure of 118.4 volts is fed into an auto transformer with 40 taps intended to give one-volt steps from 100 volts to 140 volts. These steps are not exactly one volt apart, and it is desirable that the life-test racks should be supplied with voltages of integral values. Moreover, the regulation of the various taps is not the same, some being far more sensitive to changes in load on the transformer than others. Therefore, into each line is introduced a small transformer having its secondary winding in series with the life-test line and the primary winding connected to a switchboard. To the latter are also brought the forty voltages.



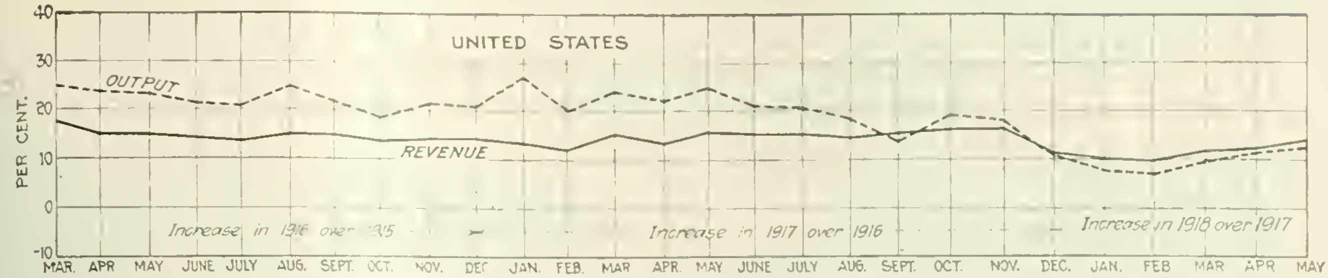
ARRANGEMENT FOR OBTAINING ACCURATE LAMP TEST VOLTAGE

The switchboard has vertical bars carrying the voltages from 0 to 40 and horizontal bars connecting with the boosting transformers. By manipulating carbon brushes on the horizontal members of the board the small transformers may be used for adding to or subtracting from the line voltage by any amount from zero to a maximum of something less than two volts, depending upon the voltage impressed on the primary winding. Inasmuch as there are 40 voltage steps covering a range of less than two volts on the secondary side, the adjustment of the line voltage can be carried out to a very high degree of precision.

By this means the various life-test lines are maintained at all times at the exact values required, irrespective of load. They are checked each day against the fundamental 118.4 volts, using an accurate two-element electrodynamometer as a differential voltmeter.

This information was contributed by Dr. Clayton H. Sharp, technical director of the Electrical Testing Laboratories.

Central Station May Operations



THE MAY GAIN IN BOTH REVENUE AND OUTPUT IS THE LARGEST SINCE NOVEMBER, 1917

MAY returns of the central stations follow the same general course as in the earlier months of the year; that is to say, there is a highly favorable rate of increase as compared with the corresponding month of the previous year. It is on the advancing scale which has brought greater improvement, as compared with 1917, month by month since Jan. 1. The May record indicates for 51 per cent of the industry a gain of 14.2 per cent in industry and of 12.6 per cent in output over May, 1917. On the basis of these figures the ELECTRICAL WORLD estimate for May for the whole industry is: Revenue, $36,320,000; output, 1,991,182,000 kw.-hr.

The May gain in both revenue and output is the largest shown this year and in fact since November. Undoubtedly the totals are affected by daylight saving and by the general movement for economy in fuel and lighting, but this influence is apparently more than offset by the great and continually enlarging demand for power for war industries and by the improvement in rates. Power consumption so largely dominates the business of the central stations that it is significant of the national activities in war that the industry looks upon an increase of 14 per cent over May, 1917, on top of a gain of 25 per cent in May, 1917, over May, 1916.

It is to be noted that the rate of revenue increase continues to be larger than the rate of output increase. This is in marked contrast to the tendency in most of last year, when the rates of increase in revenue during nine months ranged from 3.6 per cent to 12.3 per cent less than the rates of increase shown in kilowatt-hour output. Thus in October, 1917, revenue increased 15.4 per cent and output 19 per cent, while in January, 1917, revenue increased 14.4 per cent and output 26.7 per cent.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Industry Represented	Revenue from the Sale of Energy			Kw.-Hr. Output		
		1917	1916	Per Cent Increase	1917	1916	Per Cent Increase
June	63	$23,279,000	$20,168,000	15.6	1,407,860,000	1,165,629,000	20.8
July	63	22,708,000	19,680,000	15.8	1,397,482,000	1,159,410,000	20.5
Aug.	63	22,718,000	19,972,000	13.8	1,451,928,000	1,223,373,000	18.7
Sept.	63	23,861,000	20,896,000	14.3	1,376,370,000	1,219,117,000	13.0
Oct	62	25,748,000	22,334,000	15.4	1,522,149,000	1,279,140,000	19.0
Nov.	62	26,665,000	23,183,000	17.0	1,485,370,000	1,292,113,000	15.1
Dec.	58	28,144,000	25,026,000	12.4	1,517,001,000	1,362,299,000	11.3
		1918	1917		1918	1917	
Jan.	62	27,035,000	24,977,000	8.2	1,508,353,000	1,422,121,000	6.1
Feb.	60	24,690,000	22,307,000	10.6	1,254,217,000	1,168,288,000	7.4
Mar.	60	25,396,000	22,702,000	12.3	1,418,222,000	1,294,561,000	9.5
Apr.	60	25,864,000	22,966,000	12.6	1,450,221,000	1,297,843,000	11.7
May	51	18,523,000	16,213,000	14.2	1,015,503,000	901,873,000	12.6

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States			Percentage of Industry Represented	Pacific and Mountain States		
			1917	1916	Per Cent Increase		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase
REVENUE	June	64	$2,641,000	$2,290,000	15.4	65	$9,281,000	$8,017,000	15.7	53	$6,718,000	$5,563,000	20.9	86	$4,480,000	$4,174,000	7.4
	July	64	2,634,000	2,205,000	19.4	65	8,919,000	7,687,000	16.1	53	6,690,000	5,643,000	18.6	86	4,482,000	4,110,000	9.2
	August	64	2,352,000	2,025,000	16.2	65	9,021,000	7,881,000	14.5	53	6,910,000	5,718,000	20.9	87	4,819,000	4,270,000	21.9
	Sept.	64	2,811,000	2,362,000	19.0	64	9,139,000	7,963,000	14.7	53	7,232,000	6,177,000	17.1	87	4,636,000	4,355,000	6.4
	Oct.	64	3,057,000	2,530,000	20.7	66	10,683,000	9,173,000	16.5	52	7,422,000	6,304,000	17.8	85	4,586,000	4,327,000	6.1
	Nov.	64	3,391,000	2,834,000	19.7	65	10,159,000	8,873,000	14.5	52	8,454,000	7,063,000	19.7	84	4,661,000	4,410,000	5.9
	Dec.	64	3,483,000	2,999,000	16.1	58	10,834,000	9,949,000	8.8	48	8,935,000	7,464,000	19.7	82	4,892,000	4,614,000	0.6
			1918	1917			1918	1917			1918	1917			1918	1917	
	Jan.	63	3,393,000	2,990,000	13.8	64	9,677,000	9,517,000	1.6	53	8,862,000	7,639,000	16.8	86	5,113,000	4,831,000	5.8
	Feb.	62	2,995,000	2,272,000	8.0	57	9,473,000	8,658,000	8.6	53	7,779,000	6,746,000	15.3	84	4,443,000	4,131,000	9.5
	March	62	2,985,000	2,724,000	9.2	59	9,904,000	8,922,000	11.0	53	7,947,000	6,735,000	18.0	84	4,560,000	4,321,000	5.5
	April	62	2,990,000	2,578,000	12.1	59	10,054,000	8,946,000	12.4	53	8,431,000	7,103,000	18.7	84	4,489,000	4,339,000	3.5
	May	61	2,777,000	2,499,000	11.1	57	8,439,000	7,389,000	14.2	36	4,518,000	3,829,000	18.0	72	2,789,000	2,496,000	11.7
			1917	1916			1917	1916			1917	1916			1917	1916	
KW.-HR. OUTPUT	June	64	106,817,000	87,345,000	22.4	65	496,784,000	392,905,000	26.5	53	393,770,000	318,316,000	23.6	86	399,622,000	358,727,000	11.2
	July	64	109,399,000	83,451,000	31.4	65	494,965,000	396,538,000	24.8	53	379,087,000	311,931,000	21.5	86	412,635,000	366,237,000	12.7
	August	64	105,848,000	85,113,000	24.5	65	514,254,000	420,806,000	22.3	53	415,966,000	333,549,000	24.7	87	413,462,000	381,353,000	8.3
	Sept.	64	114,339,000	92,319,000	24.0	64	482,112,000	405,070,000	19.0	53	399,480,000	345,953,000	15.5	87	379,221,000	374,685,000	1.4
	Oct.	64	121,666,000	94,853,000	28.5	66	589,242,000	472,619,000	24.5	52	417,018,000	351,713,000	17.0	85	394,223,000	359,955,000	9.6
	Nov.	64	130,311,000	108,561,000	20.0	65	532,301,000	445,537,000	19.6	52	443,374,000	384,480,000	15.2	84	379,384,000	357,535,000	6.1
	Dec.	64	135,703,000	111,342,000	21.8	58	548,316,000	486,368,000	12.7	48	437,264,000	367,534,000	12.8	82	395,518,000	377,058,000	4.8
			1918	1917			1918	1917			1918	1917			1918	1917	
	Jan.	63	125,212,000	111,339,000	12.4	64	477,200,000	466,158,000	2.3	53	486,291,000	453,009,000	7.3	86	419,651,000	391,624,000	7.3
	Feb.	62	110,454,000	102,562,000	7.7	57	438,721,000	403,122,000	8.3	53	358,276,000	342,257,000	4.5	84	346,766,000	320,025,000	8.4
	March	62	121,518,000	111,576,000	8.9	59	501,320,000	452,250,000	10.8	53	398,166,000	356,860,000	11.5	84	397,218,000	373,875,000	6.2
	April	62	117,416,000	101,888,000	15.2	59	497,460,000	431,786,000	15.2	53	437,054,000	392,304,000	11.4	84	399,126,000	372,465,000	7.1
	May	61	119,929,000	103,456,000	15.9	57	453,467,000	401,819,000	12.8	36	210,860,000	194,171,000	8.6	72	231,247,000	202,427,000	14.2

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

SPEEDING DELIVERIES AND MINIMIZING OVERHEAD COST

Companies Report Idle Stock to Clearing House, Which Then Issues List of Stock for Immediate Delivery

Realizing that it is difficult if not impossible to get new equipment under present conditions and desiring to keep down the investment in idle stock, some companies with electric service plants in various parts of the country have established clearing houses for idle stock regardless of whether it is new or used. Each plant is required to report its idle stock on hand periodically, this information being published in booklet form by the holding company and distributed among its plants. When any plant is in need of equipment included in this list it can communicate with the plant having the apparatus or material or with the holding company. Thus equipment can be obtained in a very short time compared with most manufacturers' deliveries nowadays. Furthermore, very much less reserve stock has to be carried.

SELECTION OF FUSES FOR MOTOR-DRIVEN MACHINES

Fuses Rated to Withstand Starting Current of Squirrel-Cage Motors Sometimes Fail to Operate on Overloads and Do Not Protect Machine

Although fuses are quite commonly employed in motor-circuits their use is liable to be attended with uncertain results when starting and operating induction motors, the starting current of which may greatly exceed the full-load current, unless they are properly applied. The accompanying table brings out a few of the difficulties which may be experienced in the attempt to select a fuse with a rating adapted both to starting conditions and to ordinary running conditions.

From this table it is apparent that in many cases of starting induction motors a fuse selected to protect from overload is very likely to blow at starting and a fuse capable of carrying the starting current will not protect for ordinary conditions of operation. Hence in those cases where the motor is started and operated through the same fuses it is necessary to take into account the starting current, the time interval over which the high starting current flows and the time lag of the fuse itself. Such tests show that these factors vary over quite wide limits for different fuse types and to some extent for the same fuse at different periods.

STARTING CURRENT OF THREE-PHASE, 60-CYCLE SQUIRREL-CAGE INDUCTION MOTORS

	—Starting with Light Load—		Starting with Full Load	
Manufacturer's Indication	Per Cent of Full-Load Current	Time Involved	Per Cent. of Full-Load Current	Time Involved, Sec.
1	600	Instantaneous	600	5
2	500 to 600	Instantaneous	500 to 600	5 to 8
3	600	Instantaneous	600	6
4	450 to 500	Instantaneous	450 to 500	4 to 5
5	600	One-half second	600	30
6	500 to 600	Instantaneous	500 to 600	5
7	600	Instantaneous	600	6
8	500	Instantaneous	500 to 600	6 to 8

AUTOMATIC CIRCUIT BREAKERS SAVE LABOR IN COAL MINES

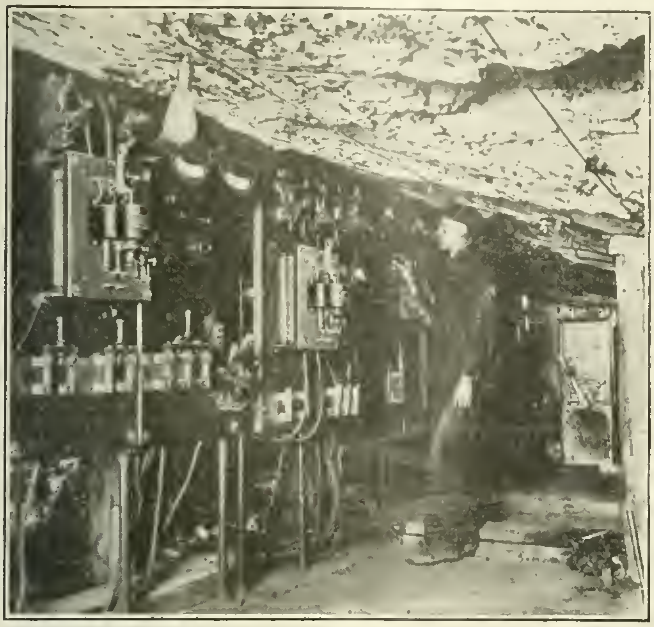
Installation Both Above Ground and Underground Is Being Practiced to Keep Coal Production at Maximum Figure

Coal mines in the Central West which use electric power for operating coal-cutting machines and haulage systems are finding economical applications for circuit breakers of the automatic reclosing type. At ordinary mines, with a power house or substation above ground feeding 250-volt direct current to different places underground, a single large breaker is usually installed at the station and a breaker for each branch circuit is installed at the undergound boards.

To illustrate the operation of such a system it may be assumed that a 1200-amp. automatic reclosing circuit breaker is installed in the substation and two 600-amp. and one 400-amp. reclosing circuit breakers below ground. Each of the latter is connected with a branch circuit running far out into the workings. If a short circuit or heavy overload should occur on one of the 600-amp. lines on account of a "cave-in" tearing down a trolley wire or from some similar cause, then the 600-amp. breaker would open the circuit and keep it open until the trouble was cleared, when it would automatically reclose. This would not interrupt the men working in parts of the mine served by the other circuits. If the case is not serious, the miners could clear the ground, after making sure that the breaker would stay open, by grounding the circuit with a chain or crowbar placed between the trolley and the rail. After the chain or crowbar was removed the breaker would close of its own accord. If the breaker were of the manually operated type, work would have to be held up while some one traversed the entire distance from the end of the workings to the switchboard to close the switch.

A low-resistance shunt path around the reclosing coil of the automatic reclosing breaker to ground prevents it from alternately opening and closing at high speed under short-circuit conditions. It will remain either open or closed as conditions on the circuits justify. The practice of installing an automatic breaker at the substation is usually followed because the attendant is not always right at hand and this unit is required to protect the station apparatus. The rating of this breaker is usually less than the sums of the ratings of those on branch circuits on account of diversity factor.

In some mines the installation of this apparatus is effecting substantial savings in money and in labor. One mine which formerly paid a man $5 a day to sit at its switchboard under ground and see that a 1200-amp. breaker stayed closed has now replaced this arrangement with an automatic breaker at a total cost of $600. Thus in less than 120 days the mine had its money back, and during that time and ever since it had the productive labor of another miner. The usual installations are smaller than the one mentioned, requiring breakers of 100 amp. to 400 amp. in rating which can be installed for $135 to $150.


SWITCHBOARD INSTALLATION DOWN IN MINE, EQUIPPED WITH RECLOSING CIRCUIT BREAKERS

CONVENIENT MARKER FOR SERIES LAMP SOCKETS

Its Use Has Been Found Necessary by One Company Where Lamps Are Operated on Low-Voltage Circuits

BY R. A. PAINE, JR.
Edison Electric Illuminating Company of Brooklyn

When it is necessary to supply lighting on a bridge or on a side street with heavy trees, or where a small number of lamps are needed on underground service and there is an existing series lighting circuit in the vicinity, the most economical method of supplying service is generally by the use of a one-to-one current transformer the primary of which is connected to the existing high-voltage series circuit and the secondary to the circuit to supply the new lamps. Since the secondary voltage of these current transformers is low, it is necessary to use a disk between the clips of the series sockets of the lamp containers supplied from the transformers that will puncture at a lower voltage than the standard disk used with the series sockets on the high-voltage circuits.

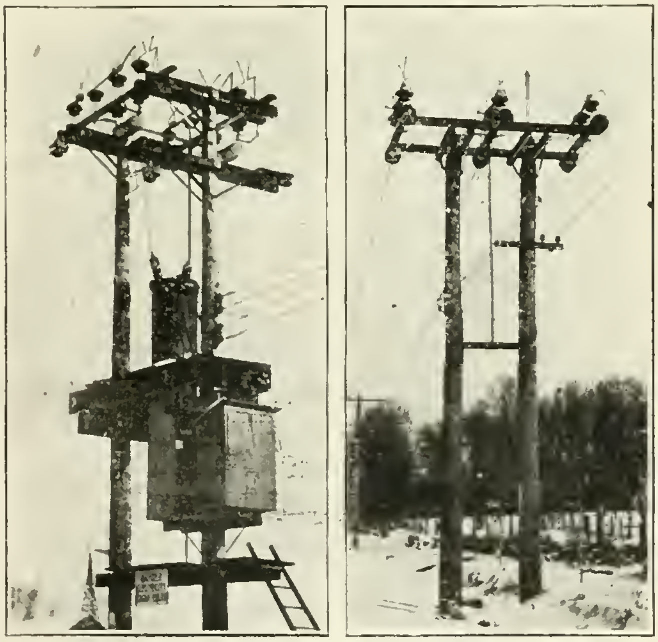
This arrangement makes necessary the use of two types of disk, and it has been found advisable to mark the series sockets on the low-voltage series circuit in some manner that will indicate that a low-voltage disk is to be used with them. A large public service corporation has found that a convenient way to mark these sockets is to use a piece of varnished cambric cut in the shape of a semicircle of $\frac{7}{8}$-in. (2.2-cm.) radius in which a slit is cut to allow the marker to be slipped over one of the clips of the socket to a point where it rests on the rubber washer just above the porcelain of the socket.

STURDY SUBSTATION FOR SERVING SMALL TOWNS

Switching Apparatus Mounted on Double-Pole Construction and Substation Equipment Arranged with Double Platform

In order to serve small towns from substations with a minimum first cost and at the same time be assured that the apparatus is accessible for repairing, the Northern Iowa Gas & Electric Company has constructed the sections shown in the illustrations. The substation (Fig. 1) consists of a 20-kva. Moloney transformer and Delta-Star switching equipment mounted on a two-pole, two-story platform structure. The transformer is mounted on the upper platform, and the low-tension switching equipment is mounted slightly above the lower platform so that it may be reached easily. The box in the foreground contains the main switch, the fuse for 220-110 volt three-wire distribution system, a watt-hour meter and a time switch for the street-lighting circuit. A telephone station with protective apparatus is contained in the box directly under the transformer.

The switching station (Fig. 2) consists of a three-pole-type DM 33,000-volt Delta-Star disconnecting switch mounted on a wooden frame composed of the double cross-arms on each pole and longer arms running across their ends.


FIGS. 1 AND 2—SIMPLE SUBSTATION AND SWITCHING STATION FOR SERVING SMALL TOWN

As may be seen from the pictures, the poles are set with the gains parallel to the lines. The dead-end insulators at which the conductors terminate are also attached to this frame.

ECONOMICAL PRACTICES WITH JEWELS FOR METERS

Minneapolis Company Uses Diamond Jewels but Changes to Sapphire When Meters Are Taken Out of Service

Realizing that diamond meter jewels must be kept in service to justify their high first cost, the Minneapolis General Electric Company places these jewels in each instrument when the installation test is made but replaces them with sapphire when the service is disconnected. Thus money invested in expensive jewels is not allowed to become idle when meters are placed in stock. The diamond jewels are considered more economical where they can be kept in service because they will withstand 40,000,000 revolutions without showing appreciable wear, whereas sapphire will withstand only 700,000 revolutions before wearing out.

The extent to which the jewels are lubricated has also been found to affect their wearing qualities and the friction considerably. According to a test with jewels operating under three conditions—flooded with oil, with only a trace of oil, and dry—the jewel flooded with oil gives the best results and the dry jewel gives the worst.

AVOIDING DISTURBANCES CAUSED BY SPOT WELDERS

Topeka Company Urges Customers to Use Direct-Current Motor-Generator in Order to Keep Fluctuations Off Lighting Circuit

When the Perfection Metal Products Company, Topeka, Kan., applied for electric service for its spot welders the central-station company's single-phase primary line was inadequate to take care of the intermittent load caused by this service. In order to effect conservation on copper and keep the undesirable load off the alternating-current lighting circuit, the central-station company asked its prospective customer to purchase a 95-hp., 600-volt direct-current motor which was connected to a heavy 600-volt direct-current lead. The motor was direct-connected to a 75-kw. welding generator with automatic regulation, which in turn is connected to the two spot welders. This arrangement has given the customer entirely satisfactory service.

RAISING STEEL POLES BETWEEN EXISTING LINES

Wooden Box Built Around Pole Top Used as a Protection to Prevent Grounding of Leads During Construction

One of the difficulties encountered in raising steel poles between existing lines is that the steel pole frequently comes in contact with one of the conductors and not only impairs service but is likely to injure one or more of the erecting crew. To obviate this difficulty, the Fort Smith (Ark.) Light & Traction Company built wooden boxes around the tops of steel poles which it was erecting to take the place of woolen poles which supported light and power distribution lines and trolley span wires on the main streets of the city.

The boxes were made by using 1-in. by 8-in. by 12-ft. (2.5-cm. by 20.3-cm. by 3.6-m.) soft pine boards as sides and 1-in. by 4-in. by 12-in. (2.5-cm. by 10.1-cm. by 30-cm.) pine boards for ends of the box. These were nailed together so that the pole taper held them from sliding down. After erection and adjusting clearances the boards were removed.

SIMPLE TESTING MEANS FOR SHORT CIRCUIT ON MAIN

Fuse Inserted in Transformer Secondary and Momentary Connections Made with Split-Type Current Transformer at Different Points Along Main

BY LEON C. WHITE
Superintendent of Operation Twin State Gas & Electric Company, Brattleboro, Vt.

Where a large number of services are taken off from one transformer it is sometimes a long job to locate a "short" which has developed in the entrance pipe or underground service. The following method may be used to locate the service which is causing the trouble:

Open the secondary at the transformer and place a split-type current transformer connected to its ammeter on the secondary main leading away from the main transformer. Close the secondary through a piece of fuse wire small enough to prevent primary fuses from blowing and note if the ammeter indicates any current. If so, follow along the main at intervals and make tests until no indication is shown upon closing the secondary. The services just passed can then be tested. The one which causes an ammeter depletion will be found to be the one which is in trouble.

In closing the secondary it will only be necessary to touch the ends quickly as this will be sufficient to "kick" the ammeter and save the fuse. If the transformer is located in the middle of the secondary main, a test on each side of transformer will determine which way trouble lies.

CEMENT COATING SAID NOT TO HARM INSULATORS

Trouble on Transmission Line Operating at 33,000 Volts Near Cement Mill Fails to Develop, Says Central West Company

When a 33,000-volt, three-phase transmission line was built about three years ago to serve a cement mill in the Central West little thought was given to the fact that the fine cement dust flying through the air would soon coat the insulator on the side nearest the mill. When the engineers of the central-station company supplying the energy noticed this coating becoming more and more dense, some apprehension prevailed as to what the possible effect would be on the insulating characteristics of the insulators. Up to the present time, however, no trouble has developed, and none is expected since the insulators are now coated to a considerable thickness with a dull gray coat of cement on one side. The engineer of this power company is of the opinion that, under similar circumstances, guarding against the deposit of cement on 33,000-volt insulators is not necessary. This may not be so where conducting particles are deposited with the cement or where the insulators are subjected to salt air or acid vapors.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

TOPEKA CENTRAL STATION CO-OPERATES WITH BANK

Time Payment Sales on House Wiring and on Appliances Are Still Handled on a Large Scale by Turning Over Collections to a Bank

In the last three and one-half years the Topeka (Kan.) Edison Company has done $110,000 worth of wiring and appliance business, practically all of which was on the time-payment basis. This includes the wiring of 2500 homes. After $90,000 worth of this business had been done, the company carrying all finances itself, a plan of co-operation with the Morris Plan Bank was arranged. Between Sept. 15, 1917, and April 17, 1918, the company turned over $23.222 worth of business to the bank, of which amount a bank had already collected $19,676. The company's proposition to the bank was that it would stand back of the paper and would pay the bank 4 per cent. As most of the paper runs only six months, this makes the earnings of the bank about 8 per cent on an annual basis.

A regular form of contract is used which was selected because it can be recorded, in order to give the company legal recourse in case subsequent payments are not made by the purchaser. On the reverse side of this agreement is found the following: "For a valuable consideration, receipt of which is hereby acknowledged, we hereby sell and assign the installment contract specified on the reverse side to the Topeka Morris Plan Company, Topeka, Kan. The Topeka Edison Company hereby agrees to pay the Topeka Morris Plan Company any amount that may remain unpaid on this contract." This is merely an assignment of the contract to the Morris Plan Bank, together with an agreement to make good any unpaid balances.

ADVICE ON HOW TO USE THE NEW-BUSINESS DEPARTMENT

Collection of Data on Essential Character of Company's Power Customers Is Job at Which Salesmen Are Effective

What to do with the remaining members of the central-station sales department is a problem confronting some managers. With virtually no energy to sell, the routine sales work in a number of companies is at low ebb. Nevertheless, it does not appear desirable to part with the older trained men of the sales department, because the time will surely come when their expert knowledge will be needed. Meanwhile they must find something profitable to do. Transference to another department is favored by some executives as a means of broadening the salesmen's point of view. Especially good results have been secured in some cases by placing former commercial managers in charge of credits, collections and billing. In still other places the men have been assigned to special work.

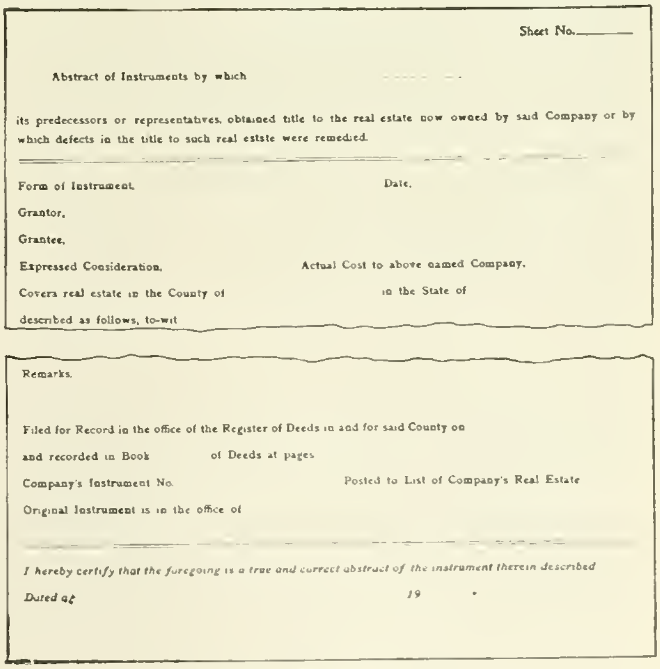
One special job which an Indiana manager has assigned to his commercial department is that of collecting data on the operations of power users. These data consist of records of energy used, amount and character of product turned out by customers, and calculations to show how much of the energy used is being devoted to the manufacture of essential products.

The object of getting this data is twofold. First, it gives the manager facts and figures on which to base his "case" when priority on coal or material is sought. Second, it will afford an excellent guide for the manager if in the coming winter it is found necessary temporarily to curtail service because of coal shortage or other emergencies.

THE OPERATIONS OF LAND AND TAX DEPARTMENT

Statement of Purpose for Which This Unusual Bureau Was Formed and Something About Its Methods of Saving Money

The Northern States Power Company, with headquarters at Minneapolis, Minn., has a "land and tax department" with subsidiary branches in eight cities, its duties being to purchase land for transmission lines, water-power developments steam-station and substation sites, and to study tax questions with an idea of keeping


Sheet No.______

Abstract of Instruments by which

its predecessors or representatives, obtained title to the real estate now owned by said Company or by which defects in the title to such real estate were remedied.

Form of Instrument, Date,

Grantor,

Grantee,

Expressed Consideration, Actual Cost to above named Company,

Covers real estate in the County of in the State of

described as follows, to-wit

Remarks,

Filed for Record in the office of the Register of Deeds in and for said County on

and recorded in Book of Deeds at pages

Company's Instrument No. Posted to List of Company's Real Estate

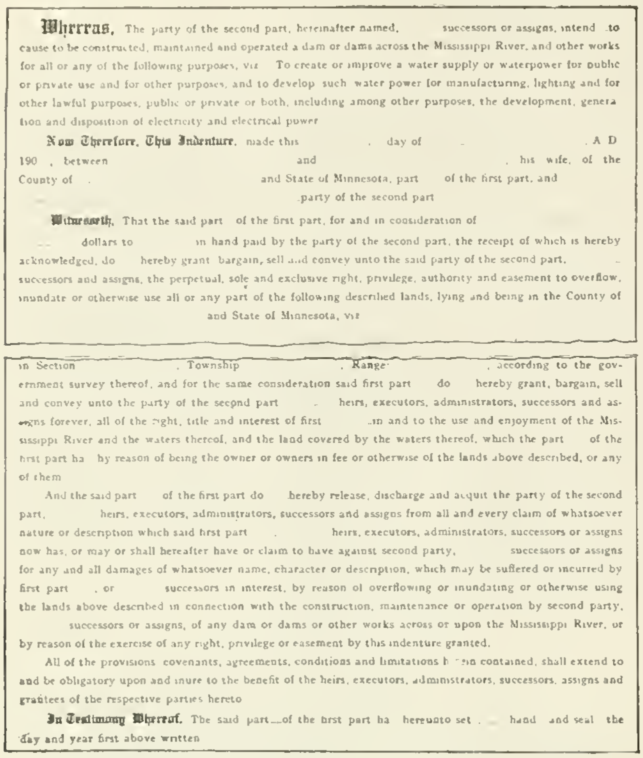
Original Instrument is in the office of

I hereby certify that the foregoing is a true and correct abstract of the instrument therein described

Dated at 19 .

FIG. 1—DUPLICATE DEED FORM USED FOR CONTINUAL REFERENCE

the taxes paid by the company as nearly as possible within an amount equal to that asked of other taxpayers. Since it was formed in 1906 this department has purchased 40,000 acres of land for water-power development alone. The taxes on real estate and personal property over which it has jurisdiction range from $240,000 to $300,000 per year. The department has saved this company considerable money and has well justified its establishment.



Whereas, The party of the second part, hereinafter named, successors or assigns, intend to cause to be constructed, maintained and operated a dam or dams across the Mississippi River, and other works for all or any of the following purposes, viz To create or improve a water supply or waterpower for public or private use and for other purposes, and to develop such water power for manufacturing, lighting and for other lawful purposes, public or private or both, including among other purposes, the development, generation and disposition of electricity and electrical power

Now Therefore, This Indenture, made this , day of , A D 190 , between and , his wife, of the County of and State of Minnesota, part of the first part, and party of the second part

Witnesseth, That the said part of the first part, for and in consideration of dollars to in hand paid by the party of the second part, the receipt of which is hereby acknowledged, do hereby grant bargain, sell and convey unto the said party of the second part, successors and assigns, the perpetual, sole and exclusive right, privilege, authority and easement to overflow, inundate or otherwise use all or any part of the following described lands, lying and being in the County of and State of Minnesota, viz

in Section , Township , Range , according to the government survey thereof, and for the same consideration said first part do hereby grant, bargain, sell and convey unto the party of the second part heirs, executors, administrators, successors and assigns forever, all of the right, title and interest of first in and to the use and enjoyment of the Mississippi River and the waters thereof, and the land covered by the waters thereof, which the part of the first part ha by reason of being the owner or owners in fee or otherwise of the lands above described, or any of them

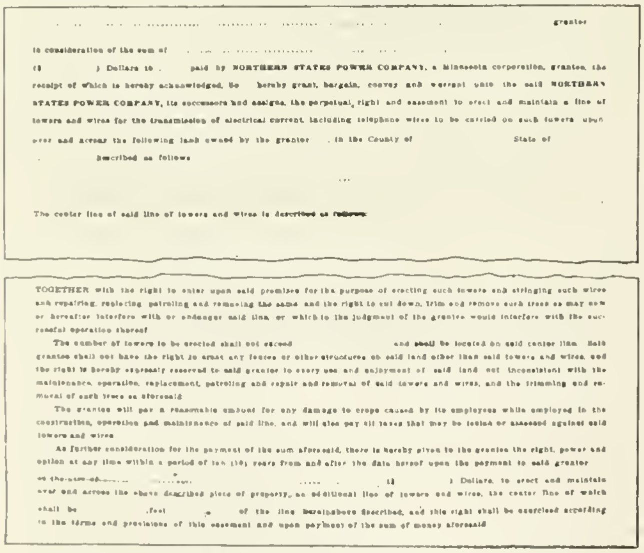
And the said part of the first part do hereby release, discharge and acquit the party of the second part, heirs, executors, administrators, successors and assigns from all and every claim of whatsoever nature or description which said first part heirs, executors, administrators, successors or assigns now has, or may or shall hereafter have or claim to have against second party, successors or assigns for any and all damages of whatsoever name, character or description, which may be suffered or incurred by first part , or successors in interest, by reason of overflowing or inundating or otherwise using the lands above described in connection with the construction, maintenance or operation by second party, successors or assigns, of any dam or dams or other works across or upon the Mississippi River, or by reason of the exercise of any right, privilege or easement by this indenture granted.

All of the provisions covenants, agreements, conditions and limitations herein contained, shall extend to and be obligatory upon and inure to the benefit of the heirs, executors, administrators, successors, assigns and grantees of the respective parties hereto

In Testimony Whereof, The said part of the first part ha hereunto set hand and seal the day and year first above written

FIG. 2—FLOWAGE DEED USED WHERE OUTRIGHT PURCHASE IS NOT DESIRED BY LAND OWNER

Some of the forms that have been developed for use by this department may be found of interest to other companies. One of these is a deed form. It was not thought advisable to have the original deed moved around from place to place and used as a source of constant information. The original deed is therefore filed with the company's legal department in Chicago, while this loose-leaf form, made out to give the same information that should be secured from the original deed, is preserved in the land and tax department for continual reference.



grantor

in consideration of the sum of

($) Dollars to paid by NORTHERN STATES POWER COMPANY, a Minnesota corporation, grantee, the receipt of which is hereby acknowledged, do hereby grant, bargain, convey and warrant unto the said NORTHERN STATES POWER COMPANY, its successors and assigns, the perpetual right and easement to erect and maintain a line of towers and wires for the transmission of electrical current, including telephone wires to be carried on such towers upon over and across the following land owned by the grantor , in the County of State of described as follows

The center line of said line of towers and wires is described as follows:

TOGETHER with the right to enter upon said premises for the purpose of erecting such towers and stringing such wires and repairing, replacing, patroling and removing the same and the right to cut down, trim and remove such trees as may now or hereafter interfere with or endanger said line, or which in the judgment of the grantee would interfere with the successful operation thereof

The number of towers to be erected shall not exceed and shall be located on said center line. Said grantee shall not have the right to erect any fences or other structures on said land other than said towers and wires, and the right is hereby expressly reserved to said grantor to every use and enjoyment of said land not inconsistent with the maintenance, operation, replacement, patroling and repair and removal of said towers and wires, and the trimming and removal of such trees as aforesaid

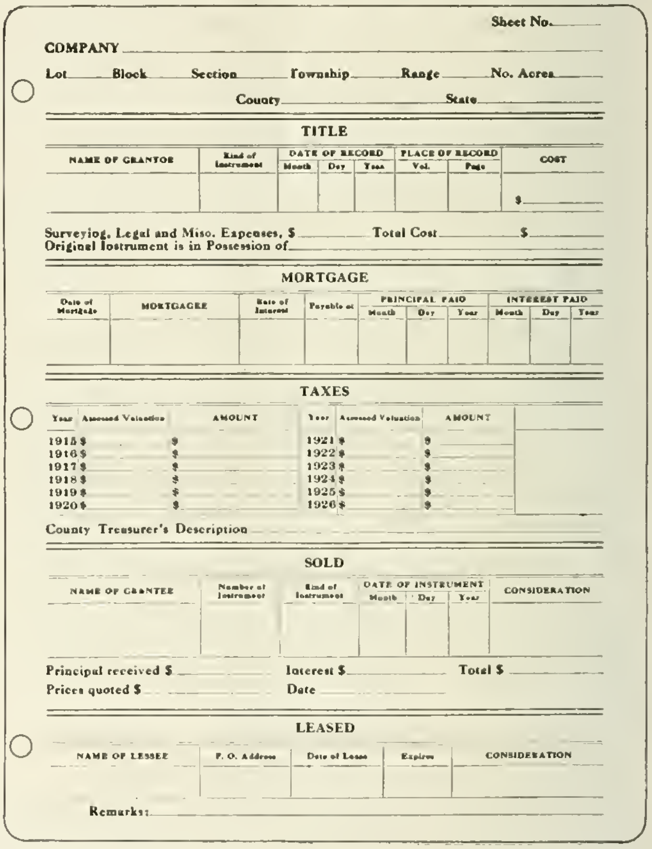
The grantee will pay a reasonable amount for any damage to crops caused by its employees while employed in the construction, operation and maintenance of said line, and will also pay all taxes that may be levied or assessed against said towers and wires

As further consideration for the payment of the sum aforesaid, there is hereby given to the grantee the right, power and option at any time within a period of ten (10) years from and after the date hereof upon the payment to said grantor of the sum of ($) Dollars, to erect and maintain over and across the above described piece of property, an additional line of towers and wires, the center line of which shall be feet of the line hereinabove described, and this right shall be exercised according to the terms and provisions of this easement and upon payment of the sum of money aforesaid

FIG. 3—TRANSMISSION-LINE PERPETUAL EASEMENT

Another interesting form which the department has worked out is the flowage deed. A need for this document was felt largely because it is advantageous to be able to go to a land owner with more than one definite proposition. The plan under which this form was used was to go to the land owner with the proposition to buy the land outright or to buy the right to overflow the land at any time. This flowage deed gives the latter right. It has proved very useful in simplifying and expediting negotiations with owners of property that the company desires to acquire.

The perpetual easement which is shown in Fig. 3 has been worked up to cover all points that the land owner has been found prone to ask questions about when a transmission-line right of way is sought. It covers such questions as tree trimming, patrolling the line, damages to crops, and taxes.



Sheet No. ______

COMPANY ______

Lot ______ Block ______ Section ______ Township ______ Range ______ No. Acres ______

County ______ State ______

TITLE

NAME OF GRANTOR	Kind of Instrument	DATE OF RECORD			PLACE OF RECORD		COST
		Month	Day	Year	Vol.	Page	
							$

Surveying, Legal and Misc. Expenses, $ ______ Total Cost ______ $ ______

Original Instrument is in Possession of ______

MORTGAGE

Date of Mortgage	MORTGAGEE	Rate of Interest	Payable at	PRINCIPAL PAID			INTEREST PAID		
				Month	Day	Year	Month	Day	Year

TAXES

Year	Assessed Valuation	AMOUNT	Year	Assessed Valuation	AMOUNT
1915	$	$	1921	$	$
1916	$	$	1922	$	$
1917	$	$	1923	$	$
1918	$	$	1924	$	$
1919	$	$	1925	$	$
1920	$	$	1926	$	$

County Treasurer's Description ______

SOLD

NAME OF GRANTEE	Number of Instrument	Kind of Instrument	DATE OF INSTRUMENT			CONSIDERATION
			Month	Day	Year	

Principal received $ ______ Interest $ ______ Total $ ______

Prices quoted $ ______ Date ______

LEASED

NAME OF LESSEE	P. O. Address	Date of Lease	Expires	CONSIDERATION

Remarks: ______

FIG. 4—OFFICE RECORD ON HISTORY OF PROPERTY

A fourth form which the department has found of considerable value is an office record for data on each piece of property owned by the company. A separate sheet is used for each individual site. Each page contains data on location, price, title, mortgages, taxes and sales relating to that individual piece of property. The sheet is indeed a complete history of the piece of property, a feature of which is the record of the taxes. If the amount of taxes goes up out of proportion, it can be immediately discovered from this sheet, and steps can be at once taken to remedy the trouble if this is possible.

NEW SEASONAL RATE OF MAINE CENTRAL STATION

Summer Energy Billed at 15 Cents per Kilowatt-Hour with Opportunity for Year-Around Customers to Save Amount in Winter at 5-Cent Rate

An interesting seasonal rate has recently been placed in effect on the beach resort territory served by the York County Power Company of Biddeford, Me. The rate is designed to yield an increased revenue during the summer months, when the peak load in this territory occurs, and at the same time enables the off-season user and the year-around resident to obtain energy at a reasonable charge. The rate does not apply to the urban centers at Biddeford and Saco, or to the areas immediately adjacent, but affects users of energy in Scarboro, Old Orchard, Kennebunk, Kennebunkport, North Kennebunkport, Wells, York and that part of Biddeford and Saco east of lines running north and southwest from the Pool Road substation, for all lighting purposes, domestic heating apparatus and appliances, and motors of 1 hp. or less used in connection with a lighting installation.

Energy used in June, July, August and September is billed at the rate of 15 cents per kilowatt-hour for the first 200 kw.-hr. used per month, a rate of 10 cents per kilowatt-hour applying to all energy in excess of 200 kw.-hr. For energy used in other months than the above, the rate is 10 cents per kilowatt-hour, with the following exceptions: A customer may use in one or more of the months of November, December, January and February at 5 cents per kilowatt-hour an aggregate amount of energy up to but not in excess of the aggregate amount used by him at 15 cents per kilowatt-hour in any or all of the months of June, July, August and September.

This schedule was prepared in response to a recent decision of the Maine Public Utilities Commission reducing the seasonal rate from 20 to 15 cents during the four summer months. The rate of 10 cents is enjoyed by year-around customers only, and these receive credit at the rate of 5 cents per kilowatt-hour for all energy which they use during the summer months, as indicated. This arrangement places the higher rate on the peak-period service, which involves a greatly increased overhead charge to the company, and it applies the reduction to the year-around customers at a time when the load on the summer district, so to speak, is at its minimum. The rate carries a minimum charge of $12 per year. For any period less than one year the minimum charge is fixed at $2 for each of the four summer months plus $1 for each of the remaining months of the year. In no case, however, is the total minimum charge for a period less than one year allowed to exceed $12.

The foregoing rates are net, and under them the company installs one or more initial meters at its option, all other meters being installed at the request of the customer at a rental charge of 50 cents per month per meter. To avoid the necessity of reading meters on the first day of any month, so that the billing rate will apply to the previous month, the company specifies that a meter reading shall be considered as rated in the month in which the majority of days have elapsed at the date of the reading; for example, a reading July 10 would be billed at the June rate; a reading on Oct. 17 would be billed at the October rate, etc.

The new rates enable large users like summer hotels to obtain a substantial reduction upon using relatively large amounts of energy even in the peak-load period; while users at other times, whether permanent or temporary residents, get the benefit of lower rates. This is advantageous in the case of caretakers of large estates using energy outside the summer season and to other occupants of the separated territory.

VALUE OF CO-OPERATION TO NEW-BUSINESS DEPARTMENT

Employees Should Realize the Importance of Understanding How Utility Company Conducts Its Affairs So as to Help Make Public Good Will

There is no doubt that utility employees, in their contact with the public, can, by understanding better what the company stands for and how it conducts its business, help the company in many ways. One of these is in the matter of getting new business. The points in this connection which follow were brought out at a recent meeting of the Lincoln (Neb.) Gas & Electric Company by James Greenstone of the new-business department, in a paper entitled "Co-operation—Wherein It Will Assist in Increased Business":

> Every business that amounts to anything has a very carefully thought-out and perfected organization. In fact, a modern business organization is usually a very intricate thing, not conceived at once in its entirety, but invented and developed a part at a time. No student of business can afford to pass up the study of organization, for a good organization is essential to success. Even if a person is to be but a spoke in a wheel, he should observe how it goes around and why.
>
> Regardless of the trouble this company has had in the past, its popularity with the public in general is very encouraging and the business houses hold us in high regard. We are doing a good business, taking everything into consideration. But the point I wish to emphasize is that both our popularity and our volume of business must be increased, and the percentage of increase must be of good proportion for our future welfare.
>
> The subject of co-operation, you will agree, is a big one. One could offer any number of suggestions as to how the various departments could assist the new-business department in securing additional business, but they would be of no consequence unless you could first be made to understand that it is essential for you to feel that you are an equal factor in a combined force seeking to attain a combined result.
>
> You should know that we can supply for any purpose an appliance for either gas or electricity that can be made use of by any one, and that the appliance obtained through us will be of the best and at a more reasonable price than can be found elsewhere, because we are a part of one of the largest concerns of this nature in the country and are the largest buyers of this line of goods in this city.
>
> You should know that we do not recommend an appliance from the standpoint of its ability to consume an unreasonable amount of our products, but that our recommendations are based on the ability of that appliance to give satisfaction, in order that the purchaser shall keep it in constant use and thereby add to output. In this lies the real profit for the company.
>
> You should know that we maintain service departments for the benefit of our consumers so they may derive the maximum of satisfaction in the use of our products or the appliance they may purchase from us. And, knowing these things, you should not be backward in telling others about them.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Lamps and Lighting

Lighting Effect of New Interstate Bridge.—A description of the bridge across the Columbia River at Vancouver, Wash., giving details of the lighting system installed with illustrations—*Journal of Electricity, Power and Gas*, July 1, 1918.

Fundamentals of Illumination Design, Part III.—WARD HARRISON.—This part of the series includes a general discussion of the principles underlying the use of reflectors and inclosing glassware for illumination purposes and also gives typical applications of various well-known units. Four principal characteristics of glassware are considered, namely, absorption, reflection, refraction and diffusion. By the proper understanding of the application of these characteristics the light from almost any source may be controlled as desired. For reflecting purposes both polished metal and mirrored glass are available. Polished silver has very high efficiency, but it may be difficult to keep it clean, and although mirrored glass reflectors may be less efficient than polished metal reflectors, they are more permanent. By properly shaping the reflector light may be directed as desired. The use of parabolic reflectors for automobile headlights is a good example. With rough matte-surface reflectors (such as blotting paper) the shape is immaterial, since the illumination appears to be of the same intensity viewed from any direction. Care should be exercised, however, in use of deep bowls of this type, since a great deal of light may be lost by absorption when the rays are reflected back and forth within the bowl. The author points out the use of prismatic glassware for directing the light and states that the efficiency of this type of reflector is high on account of the low absorption. For the transmission of light from sources of high intrinsic brilliancy he suggests the use of clear glass which has been "flashed" to form an opalescent coating, on account the high efficiency of this inclosing globe.—*General Electric Review*, July, 1918.

Report on Automobile Headlamps.—The report of the 1916-17 committee on automobile headlamps covers the general requirement of vision, including road illumination, intensity distribution, direction and glare. It also includes the general topics "Optical Principles of Headlighting," "Practical Headlighting" and "Safety Limitations."—*Transactions I. E. S.*, July 20, 1918.

Generation, Transmission and Distribution

The Major Power Possibilities in California.—F. H. FOWLER.—In discussing the general power situation in the West the author points out that the sources of power, light and heat for California, Oregon, Washington, Nevada and Arizona for 1917 were: Coal and coke, 16 per cent.; fuel oil and natural gas, 64.5 per cent; hydroelectric power, 19.5 per cent. For California alone 84,000,000 bbl. of oil were used, of which 34,000,000 bbl. were for the railways, showing the possibilities of oil economy by electrification of the railways. Curves are presented showing the increasing use of electrical energy in California, from which it is estimated that the peak load in 1921 will be 700,000 kw. To meet this rapidly increasing demand there are three principal developments which offer the greatest possibilities. These are the Pit River project, from which a continuous minimum output of 130,000 kw. may be anticipated; the Feather River project, from which a minimum of 145,000 kw. is expected, and the Big Creek development, where 100,000 minimum kw. may be obtained. With these developments immediately in view the author feels that the California companies need not hesitate to start active campaigns for new business.—*Journal of Electricity, Power and Gas*, July 1, 1918.

Constructive Water-Power Policy.—JOHN A. BRITTON.—War conditions have greatly developed the industries of the Far West, but too much oil is now used for the generation of electricity. This energy should be derived from the water-power sites so abundant in that vicinity. The writer states that present laws are unfair, as capital is not attracted under existing conditions. He does not think that the attitude of the government in exercising absolute control over water powers is justified where the government owns but little land adjacent to the stream supplying energy. As an example, in connection with the Lake Spalding development, the goverment owns thirty-eight acres compared to 12,000 acres privately owned along the stream under development. Bills now before Congress provide for a freer use of power sites under national control. A strong plea is entered for the encouragement of those who would develop the water power of the West now going to waste.—*Journal Electricity, Power and Gas*, July 1, 1918.

Large Oil-Break Switches.—Design data are given for certain large oil-break switches to be used for heavy service as manufactured by the British Thomson-Houston Company of Rugby, England. There are two long breaks in each phase. The minimum break is 16 in. (40.6 cm.), giving 32 in. (81.3 cm.) per phase, or a total break of 64 in. (1.63 m.) on a single-phase circuit. Each break occurs in a separate oil vessel of seamless drawn steel tested to a very high pressure. The contacts open and close at a speed of about 5 ft. (1.5 m.) per second, and the circuit is not ruptured until the moving parts have been accelerated to that speed. Each oil vessel contains baffle plates which smother the arc and reduce the tendency of the oil to leave the vessel. This arrangement imposes upon the arc a pressure much in excess of that due to the head of oil and cools down the oil gases, thus minimizing the risk of explosion above the oil switches. The switches are made in two forms, one with 8-in. (20.3-cm.) and the other with 10-in. (25.4-cm.) diameter of oil vessels. The capacity of the former is intended for a range from 2000 amp. at 15,000 volts to 100 amp. at 70,000 volts, and the latter from 4000 amp. at 15,000 volts to 300 amp. at 70,000 volts. A third form with 12-in. (30.5-cm.) oil vessels and still larger capacities is in process of design.—*London Times Engineering Supplement*, June, 1918.

Norwegian Water Power.—One of the largest water-power developments of Europe is that proposed for the Norwegian government known as the Laagen development, where 320,000 hp. will be installed. The energy is to be derived from lakes about 1260 ft. (384 m.) above sea level, taking the water from a drainage area of about 770 sq. km. According to the plans, there are to be two power houses, known as the upper station at Rodburg, where there will be twelve units of 21,500 hp. each, and the lower power station at Vrenne. The available head varies between 342 m. and 324 m.—*London Times Engineering Supplement*, June, 1918.

Traction

High-Speed Circuit Breaker.—A large circuit breaker to prevent flash-overs on 3000-volt direct-current generators has been installed for use by the Chicago, Milwaukee & St. Paul Railway. It is a single-pole magnetic blow-out type rated at 3600 volts, 3000 amp. direct current. The breaker and mechanism form a self-contained unit mounted on a structural-iron framework with cast-iron base. The operating mechanism is sc arranged that the breaker can be closed either by hand or by a motor controlled from the switchboard. The main contacts are of the laminated brush type, the brushes forming the stationary contact. The movable contact is a solid copper forging made as light as possible in order to reduce to a minimum the mass to be moved in operation. The blow-out and trip coils are connected in series so that the blow-out coils are excited at all times, as the usual arrangement of such blow-out coils was not found to give sufficient speed of blow-out. The main and secondary contacts are operated by a nest of compression springs which exert a force of 8000 lb. (3629 kg.) when the breaker is adjusted for operation. The tripping is accomplished through a train of latches and levers actuated by a solenoid, the magnet frame and core of which are specially laminated to obtain a quick magnetic response to the short-circuit current. Calibration, in order to take care of the varying number of units in several stations, is obtained by means of an adjustable tension spring directly opposing the pull of the solenoid. The rate of separation between the main and secondary contacts is approximately 8000 ft. (2438 m.) per second, and they are released in a time as short as 0.003 second or less from the beginning of a short circuit. This compares with about 0.10 second to 0.15 second, the speed of ordinary switchboard-type breakers.—*Electric Railway Journal*, July 27, 1918.

Installations, Systems and Appliances

Magneto Ignition for Farm Tractors.—J. G. ZIMMERMAN.—The author points out that poor judgment is used in the location of magnetos on tractors, stating that the magneto should be placed where it is out of danger of injury but still in an accessible position. On account of faulty selection of the wiring, energy is often lost between the magneto and spark plug, which may serously weaken the start. The essentials of a good spark are, according to the author, first a good kick voltage high enough to break down the spark gap and then a rapid follow-up current of fixed value which will be right on the heels of the break-down across the gap. The author discusses the type of starting devices which should be used on slow-speed traction engines employing low-grade fuel, pointing out that the old make-and-break spark may be advantageous for this use. The problem of producing a satisfactory spark during the cranking operation is also discussed. The article is illustrated by many oscillographic tests.—*Journal Society of Automotive Engineers*, June, 1918.

How to Save Fuel Oil.—ROBERT SIBLEY and C. H. DELANY.—A pamphlet has been prepared by J. M. Wadsworth, United States Bureau of Mines, for the Fuel Administration, on details of the economical use of oil fuel. The various suggestions in the pamphlet are amplified and explained by Messrs. Sibley and Delany to make these points of most practical value to operators.—*Journal Electricity, Power and Gas*, July 1, 1918.

A Steel Works Electrification.—The plant of the Frodingham Iron & Steel Works, Scunthorpe, Lincolnshire, has been electrified for the purpose of increasing the output. Of special interest is the replacement of a large engine by a 750-hp. direct-current motor with heavy flywheel to take momentary overloads. This motor can be almost instantly disconnected from the rolling mill which it drives for the sudden stopping of the roll. The motor and flywheel were put in place of the engine on the same foundation with only eleven days' interruption to the service. The electrical equipment was furnished by the General Electric Company, Ltd. of Witten.—London *Electrical Review*, June 28, 1918.

Electrophysics and Magnetism

Thermal Insulation.—R. B. FEHR.—More attention should be given to the matter of surface resistances, which, in the cases of glass or other poor insulators, constitute practically the total resistance, says the author. The velocity of the air on the warm side of the wall probably exerts as much influence on the total surface resistance as the velocity of the air on the cool side. The total surface transmission (both sides) for cork board, glass and building paper, in the usual ranges of temperature for conditions involving slight air movements, is not far from 25 to 30 B.t.u. per twenty-four hours per square foot per degree Fahrenheit. In the case of poor insulators it rises to about 50, for a moderate velocity on the warm side and a higher velocity (1000 ft. per minute) on the cool side. For "dead-air" spaces ½ in. (1.27 cm.) wide formed by ordinary building paper, and for the usual temperature differences, the transmission varies inversely as the number of exposed surfaces, the value for one layer (or two surfaces) being practically 25 (twenty-four-hour basis). Properly arranged, inexpensive air spaces can be made as effective as the same thickness of the best insulating materials on the market.—*Pennsylvania State College Bulletin*, Feb. 15, 1918.

Effect of Hydrogen on the Electrical Resistivity of Carbon.—T. PECZALSKI.—The effect of hydrogen on the electrical resistivity of carbon has been studied at different temperatures and pressures and it has been found that: (1) Hydrogen apparently produces no effect on the resistivity at ordinary temperatures for pressures up to 33 atmospheres; (2) the resistance of carbon increases considerably when the filament is heated to a high temperature (1590 deg. K. brightness temperature) in hydrogen; (3) the resistance at room temperatures following such a heating in hydrogen shows a similar and more marked increase; (4) subsequent heating of the filament in vacuum to the same temperature produces the opposite effects; (5) the effect is greater for the higher pressures than for the lower pressures, and (6) these changes are suggestive of an exponential law and are about equal in magnitude in cases where the filaments are not injured appreciably by the processes involved.—*Nela Research Laboratory Bulletin*, November, 1917.

Electrochemistry and Batteries

Electrolytic Deposition of Alloys, VIII, Iron and Iron-Nickel at Ordinary Temperature and High Hydrogen Pressure.—R. KREMAN and H. BREGMESSER.—The equilibrium potential of hydrogen with respect to pure water being — 0.41 volt, and that of iron in normal solution of FeSO — 0.46 volt, the electrolyte becomes depleted of H-ions in the immediate neighborhood of the cathode, and hydrogen and hydroxyl are deposited with the iron. To prevent this the electrolysis should be conducted in hot concentrated solutions, preferably of iron chloride, which is more soluble than the sulphate. For working at low current densities the electrolyte may be acidified, but the current yield is lowered in such case. A distinction has to be made between the gas pressure of the hydrogen in the electrolyte and the hydrogen dissolved in the iron. To keep the latter percentage low, the gas pressure of the hydrogen should be high (not low). The presence of hydrogen is generally supposed to render the iron hard and brittle, especially on the side in contact with the cathode, but the authors suggest that the brittleness depends upon a certain structural rearrangement which can be avoided by keeping the bath hot (75 deg. C.) and neutral. The magnetic properties of the iron are hardly affected by the conditions of the electrolysis. Deposited under hydrogen pressure from normal $FeSO_4$, the iron at once shows the equilibrium potential, which it only reaches after a considerable time under other conditions. Attempts to improve iron-nickel alloys by working under high hydrogen pressures failed. Mixed ferrous and nickelous sulphates yield alloys poorer in nickel than the bath, and the alloys are brittle; the two metals do not appear to alloy when electrolytically deposited together.—*Science Abstracts, Section A*, May 31, 1918 (abstracted from *Monat. d. Chemie*, December, 1917).

Current Rushes.—Some observations of heavy transient currents have been made by Prof. E. W. Marchant in the distribution systems of the Liverpool Corporation with an oscillograph. When a transformer was switched into an alternating-current supply system dangerous currents did not occur at 100 cycles or 50 cycles, but very large currents were observed with 25-cycle transformers. These currents depend not only upon the point of the voltage wave at which the circuit is closed but also upon the magnetism remaining in the iron. In tests made with a bank of three 100-kw. step-down transformers switched into the mains the maximum value of the current rush was over ninety times the steady magnetizing current. Tests made with a 300-hp. induction motor generator coupled to a 220-kw. continuous-current generator showed an extreme current rush of ten times the full-load current when the induction motor was switched in. The pressure curve remained quite steady during these tests, thus accounting for the large value of the currents. Oscillographic records of other transitory phenomena showed more or less striking results.—*London Times Engineering Supplement*, June 1918.

Miscellaneous

Blind People in the Electrical Industries.—Sir Arthur Pearson, in the interest of blind soldiers in Great Britain, has suggested that the work of winding armature coils can be done by the blind. He has succeeded in interesting others in the enterprise, so that experiments are now being conducted at the Birmingham Royal Institution for the Blind to test the blind in coil winding.—London *Engineering*, July 21, 1918.

German Substitutes for Copper.—F. NIETHAMMER.—Owing to the war, connections to busbars on switchboards and for the various pieces of apparatus have had to be made of substitutes for copper, mainly Al, Zn, Fe, and an alloy called "electron," which has a density of 1.8 and is mainly composed of Mg. The author considers the general principles on which the sizes of these conductors should be determined.—*Science Abstracts, Section B*, May 31, 1918 (abstracted from *Electrot. u. Maschinenbau*, Jan. 27, 1918).

Necessity for Inspection and Testing of Refractory Brick.—C. E. NESBITT and M. L. BELL.—Many instances can be cited where bricks of poor quality have been accepted without knowledge of their inferiority, resulting in the premature failure of the furnace or other structure. Much of this loss could have been avoided if the bricks had been tested before being put into service. A great deal can be accomplished by careful visual inspection, by means of which all bricks irregular in shape or size, fire-cracked, improperly molded or of poor general appearance would be eliminated. If proper care is taken in the brick plant, this rejection need not be a very large percentage of the output.—Extracted from paper presented before the American Society for Testing Materials, June 25-28, 1918.

Frequencies.—B. G. LAMME.—The author refers to factors that have influenced the selection of certain frequencies at different times and says that it is surprising that a wider range has not been considered. Occasion has arisen times without number where an obvious solution of a given problem would lie in modification of the frequency to allow the use of apparatus and equipment already designed, but the engineers of manufacturing organizations have steadily held out against such policy, regardless of the apparent need of the moment. The swing of the pendulum from 60 cycles and back has covered a period of many years and therefore cannot be considered as a fad of the moment, but is the result of well-defined tendencies, supported by experience.—*Electric Journal*, June, 1918.

Readers' Views and Comments

THE DEVELOPMENT OF THE ELECTRICAL SEARCHLAMP

Inferences Regarding German and American Patents in Recent Article Disputed

To the Editor of Electrical World:

Sir: I wish to enter a protest against the inaccurate article appearing in the issue of the Electrical World of June 22, 1918, entitled "Development of Electrical Searchlamps," by Louis J. Auerbacher. The author appears to have gone out of his way to bring into prominence the Imperial German Patent Office, the imperial German patents, Gebr. Siemens & Company of Charlottenburg, Heinrich Beck of Meiningen and several other Germans. The excellent work of Mrs. Hertha Ayrton of London, of the great French physicist, A. Blondel—the pioneer and recognized authority on flaming arcs—and of a host of our own American inventors is passed without mention. The fact seems to have escaped the author that the flaming arc commonly known as the inclosed arc received its first great impetus in America.

United States Antedates Germany

As an example of the claims made in the article it may be pointed out that Mr. Auerbacher cites the German patent 210,251 to show a development in providing a metal coating on an electrode, whereas this had been done in the United States as early as 1893—or fifteen years before the German patent cited appeared. (See United States patent to Siebold of New York, No. 498,141, May 23, 1893.) Furthermore, the inclosure and protection of a carbon by tubes appeared before any of the German patents cited in the article appeared. (See United States patent to André Blondel of France, No. 764,105, July 5, 1904.)

The German patents cited by the author have in most cases equivalents in United States patents, but only in the case of Beck does he cite a United States patent, and in this instance also he takes occasion to cite the German patents. For instance, the United States equivalent of the German patent No. 203,549 is U. S. patent to Viertel, No. 969,814, Sept. 13, 1910, and United States equivalent of the German patent No. 210,251 is U. S. patent to Kalkner, No. 916,877, of March 30, 1909. Other instances could doubtless be found.

The only searchlight patent mentioned issued to an American—or, for that matter, any one outside of Germany—is the patent of Elmer A. Sperry, which is not only branded by the author as disclosing nothing new but is also given an incorrect number. The correct number of the patent is 1,227,210. Where the author got the number 221,917 from I am at a loss to understand. This patent is not the only proof of Mr. Sperry's work in connection with high-intensity lights (see British patents Nos. 12,999 and 102,971, which Mr. Auerbacher evidently overlooked). The United States patents corresponding to these British patents are not yet published. British patent No. 12,999 discloses the Sperry system of air cooling, whereby the employment of alcohol is rendered unnecessary. This system has entirely superseded the alcohol system in this country. The second British patent contains an interesting scientific discussion of the high-intensity arc.

There is one point in which the author is correct, however, and that is the alcohol "breath" in which Beck undertakes to burn his arc. This is characteristically German and comprises the German contribution to this art, in the writer's opinion. The author, however, does not seem to be aware that the Sperry system with its great simplicity has rendered the association of all such wholly extraneous substances as alcohol and the like with an arc entirely unnecessary and obselete. The article in question seems to be a sort of last gasp to rehabilitate this totally discredited practice of using the alcohol flame. The author distinctly states that its use is for the prevention of oxidation and consumption of carbon. He does not seem to be aware that by official tests on the part of some twelve officers of our army it was demonstrated that a given length of carbon of the identical dimensions would burn longer in the Sperry lamp and give more light than it would in the Beck lamp. These tests were extremely exhaustive and conclusive, and one of the results was the decision to abandon the more complex lamp and system in favor of the simpler one.

In addition, the author, in describing Sperry's American searchlight lamp, makes a gross misstatement. He states—in the second column on page 1321—that in the Beck lamp the consumption of the positive electrode is only 200 mm. to 240 mm. per *hour*, and that in the Sperry lamp it is 13½ in., or 343 mm., per *minute*. Whether such a gross misstatement of facts is intentional or not I do not know, but the facts, as stated above, are that the consumption in the Sperry lamp, instead of being sixty times greater, is in reality less than in the Beck lamp.

German Lamp Practically Obsolete

The article gives the impression to the reader that the Beck lamp is superior to all other types of lamps used in this country or elsewhere. It seems only fair to correct this impression, since at the present time the Beck system of operating searchlights is practically obsolete, having been completely superseded both by the Sperry system as disclosed in the Sperry patent and by other systems. The Beck system of operation was rendered obsolete for the following reason, among others, that it could not be utilized for anti-aircraft work—a field which has been recently opened and which at present constitutes one of its greatest applications.

In addition to the fact that the searchlight beam is invaluable for apprehension of aircraft at night and as an aid to anti-aircraft guns, it has been discovered that if an aeroplane can once be brought within the intense beam of a searchlight the pilot and all observers in the aeroplane are rendered perfectly helpless by the dazzling effect of the glare, and it has also been determined that there is no difficulty whatever in keeping the aeroplane in the beam after it has once been spotted, no matter what maneuvers or sudden moves are resorted to by the pilot to escape the beam. The Beck system, in exhaustive government tests, was found to be too complicated for operation under service conditions, as stated.

American Lamp a Great Advance

The Sperry system with the air-cooled electrode holders and the elimination of alcohol or other cooled gas around the arc proved to be a great advance step in the field of high-intensity searchlights. That such advance has been made is recognized by the government both by the grant of letters patent to Sperry and by wide adoption of his light.

Regarding further the priority of development claimed for German investigators, it may be pointed out that it was old to rotate and feed the positive electrode in a searchlight as far back as 1893, as shown in patent No. 493,359, issued to R. M. Hunter of Philadelphia, March 14, 1893. It was also old to burn an arc in a flame or inert gas, as shown in the United States patents to N. S. Keith of New York (No. 246,517, Aug. 30, 1881) and to L. Colburn of New Haven (No. 316,340, April 21, 1885). The idea of operating electrodes with high-current density was known in the United States as early as 1882. (See U. S. patent No. 255,466 to Charles W. Siemens of England, March 28, 1882. In this patent the negative electrode was heated to such a temperature that it was necessary to cool it by water jacketing.)

The development of the modern searchlight was based essentially upon the flaming-arc carbon, which, as we heretofore stated, was developed largely in the United States, and which fact is totally ignored by the article. (See United States patent No. 527,826 to Acheson, Oct. 23, 1894, and others.) We, of course, do not deny that a great deal of credit is due the German engineering firms for certain developments, but an attempt to prove that the modern high-intensity light is the result of development of thin electrodes for the old-style pure carbon lights is absurd.

Herbert H. Thompson,
Secretary Sperry Gyroscope Company.
Brooklyn, N. Y.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

BOSTON EDISON COMPANY SELLS $3,000,000 NOTE ISSUE

Proceeds of Four-Year 7 per Cent Securities Will Provide for Increased Generating and Distribution Facilities

The Edison Electric Illuminating Company of Boston has sold $3,000,000 of four-year 7 per cent notes, dated Aug. 1, to Lee, Higginson & Company, Old Colony Trust Company, F. S. Moseley & Company, Kidder, Peabody & Company and Parkinson & Barr. The notes were sold to the public on a 7.10 per cent basis. Proceeds of the issue will provide for increased generating and distribution facilities to accommodate the large growth in business, due partly to greater war requirements.

INDIANAPOLIS COMPANIES DEMUR AT CITY PAYMENTS

Pending Outcome of Surcharge Controversy, Merchants' Company Refuses to Turn Over Percentage on Gross Receipts

The Merchants' Heat & Light Company of Indianapolis, which has the city contract for lighting the streets of that city, has notified the Indianapolis officials that it will not pay at this time 5 per cent of the gross receipts received from the city under the lighting contract to the city as part of the regular franchise tax of the company. The amount involved is between $8,000 and $9,000.

The city of Indianapolis, through its Board of Public Works, is refusing to approve claims filed by the heating and lighting companies for war surcharges allowed by the Public Service Commission. The city in this case takes the position that it is not bound by the order of the commission. Both the Merchants' company and the Indianapolis Light & Heat Company are refusing to pay the regular franchise tax to the city because they have surrendered their franchises to the Public Service Commission under the Indiana utility law and are operating under indeterminate permits. The amount involved is approximately $75,000 a year.

According to the Merchants' Heat & Light Company, that company is not refusing to pay the 5 per cent franchise tax under the street-lighting contract, but is holding payment in abeyance until it can be determined what action the city finally will take in regard to the surcharge payments.

The company says the city now owes it approximately $30,000 in surcharge payments. Both electric companies now have petitions before the Public Service Commission asking for a renewal of the authority to collect surcharges on all bills because of war-time increases in the cost of materials, labor and fuel.

PERSONNEL OF UNDERWRITERS' ELECTRICAL COMMITTEE

Dana Pierce Appointed to Succeed Chairman Cabot, Who Resigned, and New Members Have Been Added to the Committee

Dana Pierce of New York has been appointed chairman of the electrical committee of the National Fire Protection Association, succeeding F. E. Cabot of Boston, who recently resigned.

The history of this important and well-known committee, which has charge of the National Electrical Code, extends over twenty-two years, during all of which period Mr. Cabot has been its chairman. His services to the electrical industries in this work have been recognized as of great value, and his resignation, due to the pressure of other duties, will be regretted by his wide circle of friends in the electrical field.

The new chairman, Mr. Pierce, is a vice-president of the Underwriters' Laboratories, Inc., and is well known as the electrical engineer of that institution. He has been a member of the electrical committee for the last ten years.

The following new members of the committee have also been recently appointed: Dr. Morton G. Lloyd of the Bureau of Standards, Washington (replacing W. J. Canada); K. W. Adkins of the Missouri Inspection Bureau, Kansas City, Mo.; F. F. Burroughs of the Mutual Fire Prevention Bureau, Oxford, Mich.; C. B. Landon, Factory Insurance Association, Hartford, Conn.; A. N. Miner, Jr., Underwriters' Bureau of New England, Boston, and H. R. Sargent, Schenectady, N. Y., representing the Associated Manufacturers of Electrical Supplies.

Electric Sign Spurs War Stamp Salesmen

Stretching across one of the corners from which five important Indianapolis streets radiate is an electric sign which tells what progress captains of war-savings sales teams are making. The captains' names are given on placards above the sign, and in front of each placard is a lamp.

COMMITTEE ON POWER UNIFICATION IN ILLINOIS

Body Reporting to Fuel Administration on the Coal Saving Is Headed by L. E. Meyers of Chicago

The Illinois Fuel Administration has appointed a committee on power unification and utilization. The committee is made up as follows: L. E. Meyers, chairman, president of the L. E. Meyers Company, Monadnock Block, Chicago, representing the public utilities; Wallace G. Clark of the Sanitary District, representing state municipalities; Clarence G. Mark, secretary, representing Chicago manufacturers; Fred J. Postel, supervising engineer, Department of Public Works and Buildings, representing the state government, and Charles H. Ewing, of Decatur, representing manufacturers in the southern district of the state.

Data regarding conditions in industries in Cook County will be gathered by Harold Almert and facts from other parts of the state by Joseph Harrington. Both of these gentlemen, who are chairmen of engineering boards, are established consulting engineers of Chicago. It is stated that the elimination of superfluous plants will be brought about by negotiations, where this is possible, and by withholding coal where the concerns are stubborn.

USE OF EFFICIENT STATIONS TO CONSERVE COAL SUPPLY

President Harriman of the New England Power Company Says that 40,000 Kw. Additional Capacity Is Needed for Next Winter

President Henry I. Harriman of the New England Power Company recently discussed the power outlook before the Massachusetts Gas and Electric Light Commission and emphasized the importance of coal conservation through the maximum use of the most efficient stations. Mr. Harriman said that at present the company has practically no secondary power, substantially all the contracts now in force being on the primary basis.

In 1916 the company produced 236,000,000 kw.-hr. from water and 9,000,000 kw.-hr. from steam; in 1917 the hydroelectric output was 245,000,000 kw.-hr. and the steam output 54,000,000 kw.-hr., due to the growth of the load. It is estimated that 116,000,000 kw.-hr. will be delivered by the steam plants connected to the system this year and that the hydoelectric output will be about the same as last year. Since last winter the company has been supplied in part by the 45,000-kw. turbine of the Narragansett Electric Lighting Company in Providence, R. I.

At present it is extremely difficult to provide additional power, even on old contracts. A demand for 10,000 kw. a few days ago from a central station in Massachusetts could not be met at this time, but the possibilities of such a supply are being studied with care.

Under good conditions, Mr. Harriman stated, a large modern turbine plant will operate at 2 lb. of coal or a little less per kilowatt-hour, and in the case of the Providence company 1.85 lb. has been attained at times. The fuel consumption per unit of output depends on the load factor and many other conditions. Very few manufacturing plants can do better than 3 lb. Occasionally a very large industrial plant will improve on this figure, but the average 1000-kw. plant is very fortunate if it gets energy at 3 lb. In these days it is almost a crime to burn 3.5 lb. to 4 lb. when 2 lb. would do the work.

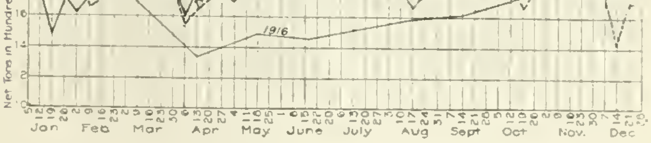
On the New England company's system the outputs and the peak loads follow each other very closely. There is a winter peak, but it is relatively small compared to that of an electric light company. This year the company plans to use the water in its Somerset reservoir, on the upper Deerfield River, practically on peak load business alone, barring accidents. The flow of this stream cannot be allowed to fall below a minimum of 200 sec.-ft. In the past, before the load was so large, that water could be used to keep the flow up to 300 or 400 sec.-ft. This year the water must be saved for November, December and January, when it can be let down at the rate of 600 or 800 sec.-ft. in order to run the plant during the peak hours of these months at maximum capacity.

A mere statement of hydroelectric development does not show what a plant will turn out. At the company's Vernon plant on the Connecticut River, by drawing 2 ft. the station can be run at practically full capacity (20,000 kw.) for two or three hours, so that even in low-water times this plant can be run at 500 kw. during the day and at 20,000 kw. for two hours in order to handle the peak. Last winter the system peak load reached 72,000 kw., and in June it was running about 65,000 kw. Last year the New England company purchased about 35,000,000 kw.-hr. from the Turners Falls Power & Electric Company, but this year the latter has sold so much of its capacity that the New England company may not be able to get over 12,000,000 kw.-hr. from this source and will therefore be obliged to increase the steam output as the water resources are diminished.

An additional capacity of at least 40,000 kw. is needed for next winter's load. Some relief may be gained by rearranging the hours of operation of the factories in New England to avoid overlapping lighting and power peaks. If the daylight saving plan is carried throughout the year, it will mean the saving of hundreds of thousands, perhaps millions, of horse-power of capacity in the country.

Bituminous Output Is Now Better

According to the Geological Survey, the bituminous output in the week ended July 13 was 13,243,000 net tons, an increase over the five-day week of July 6 of 2,987,000 net tons, or 29 per cent, and over the corresponding week of last year of 1,479,000 net tons, or 12.5 per cent. The weekly output of 13,243,000 net tons is approximately 1,031,000 net tons, or 8 per cent, above the average weekly requirements of 12,211,500 tons estimated by the United States Fuel Administration. However, the average weekly production for the coal year to date is estimated at 11,568,000 net tons, or 5.3 per cent behind the weekly requirements.



ELECTROCHEMICAL SOCIETY ACTION ON ALIEN MEMBERS

Resolutions Passed by Directors Provide that Members Shall State Whether They Support Our Aims and Ideals

Directors of the American Electrochemical Society have passed the following resolutions:

> Whereas a communication has been submitted to the board of directors bearing the signature of sixteen members in accordance with paragraph 5, Article III of the constitution, requesting "that all members of the society who are subjects of Germany or Austria be dismissed, on the ground that they are opposed to the United States of America in its war for the preservation of civilization, and are consequently enemies of the majority of the members of our society," therefore be it
>
> Resolved, That it is the sense of this board that all members of the society who are enemy aliens and who are in sympathy with the enemies of the United States of America in the present war should be dismissed from membership on the grounds above set forth, and
>
> Resolved, That the secretary be instructed to send a copy of this resolution to all such members requesting that they either appear in person at the meeting of the board of directors to be held at the Niagara Club, Niagara Falls, N. Y., Saturday, Aug. 24, 1918, at 11 a.m., or file answer by letter, stating whether or not they support the aims and ideals of the United States of America in the present conflict.

Members have therefore been asked to state by notice to the secretary, Joseph W. Richards, their nationality and citizenship.

GOVERNMENT ATTITUDE ON THE COMMERCIAL MEN

Questions Affecting Services of Salesmen of Central-Station Companies Are for the Local Draft Boards to Settle

Managers of commercial departments of central-station companies who are anxious to do their full duty and more in aiding the government to win the war, and at the same time do their full duty to the public in the distribution of labor-saving devices of an electrical character, as well as their full duty to their companies in conserving the supply of employees, such as salesmen, should take up with local draft boards each and every question of a saleman's services, under the recent ruling of "work or fight," issued by the Provost Marshal General.

This information, furnished by the Washington correspondent of the ELECTRICAL WORLD, was obtained at the office of the Provost Marshal General. A request for an interpretation of the "work or fight" order as it applies to the commercial departments of central-station companies was met at the General's office in Washington with the statement that ordinarily the employees of such commercial departments would come under the classification of sales clerks in commercial establishments, but that there are so many salesmen of electrical devices who are highly skilled in electrical work of other character that the best way of settling the question of whether such salesmen are occupied in essential work is to consult local draft boards.

It was pointed out by the correspondent of the ELECTRICAL WORLD that the managers of the commercial departments throughout the country in ninety-nine cases out of a hundred are willing to go beyond the strict requirements in giving up men whenever necessary, and at the office of the Provost Marshal General it was said that this was realized. It is also realized that many companies have in their employ men selling vacuum cleaners, washing machines, heating devices, percolators, flatirons, etc., which are labor-saving devices, and that these men in many cases have skilled knowledge of electrical matters which might make them valuable and essential to their employers in fields other than salesmanship or in addition to salesmanship. For this reason, it is stated in Washington, local draft boards will be required to take up each and every case along this line on its merits.

CALIFORNIA REGULATIONS CURTAILING ELECTRICITY

Order of the California Power Administrator Resulting from Reductions in the Supply by Drought Affects Many Industries

The order of the California Power Administrator, H. G. Butler, regulating the use of electricity in northern and central California because of the depletion of the supply by drought, was mentioned in last week's issue of the ELECTRICAL WORLD. The order affecting signs reads:

> 1. Effective during August and September, 1918, except Saturdays, Sundays and legal holidays, no electrical energy shall be used: (a) For advertisements, notices, announcements or signs designating the location of an office or place of business or the nature of any business; (b) for external illumination for ornamentation of any building; (c) for lights in the interior of stores, offices or other places of business when such stores are not open for business; d) for excessive street lighting intended for display or advertising purposes.
>
> 2. This order shall not be construed to prohibit the furnishing of electricity for such lights as may be required by law or public safety.

The brewery order forbids power companies to take on new brewery business until further notice and required that the brewery load carried should be reduced 50 per cent on Aug. 1.

Cement manufacturers and large irrigation companies have agreed with the Power Administrator to shift their heavy usage of electric energy from day to night. Gold dredging companies have accepted a regulation by which their electric consumption is cut considerably.

The orders were decided upon after a conference of several hours between Power Administrator Butler and representatives of all the electric companies in northern and central California. The district includes the tier of counties above Merced County. These companies were in hearty accord with Mr. Butler and stated an intention to send to each consumer and to have published in all newspapers in their territory the following card, headed "Conserve Electricity":

> Patriotism demands that you save electricity for war industries.
>
> Northern and central California have a serious power shortage because of lack of rain during the past winter and the increased use of electricity by war industries.
>
> These war industries must have power.
>
> There is not enough power for everybody at the present rate of consumption. It is up to you to save. Turn off your lights whenever possible and use lower power lamps.
>
> This is one other thing you can do in the great struggle.

The Power Administrator has written to the mayors and officials of cities and counties stating the absolute need of conserving electricity and asking that every endeavor be made to reduce the use of energy for public or private purposes.

The Power Administrator has stated that the shortage of electricity over normal, caused by the lowering of water in the rivers and streams of northern and central California from which electric power is taken and also by the unprecedented demand for electricity by war industries, has made it essential to decrease the consumption of electrical energy in northern and central California by 20 per cent. He figures that the saving made by these orders and requests will partly meet the shortage and that future orders will be made to bring the district through the crisis.

SEATTLE SEEKS FUNDS TO DEVELOP THE SKAGIT RIVER

More Hydroelectric Energy Needed to Care for Industries and Stabilize Power Production in Puget Sound District

The municipal authorities of the city of Seattle have filed a statement with the Capital Issues Committee at Washington in behalf of an application by the city of Seattle for the approval of $5,500,000 for light and power bonds with which to erect a hydroelectric development on the Skagit River. The Mayor of the city, the chairman of the finance committee, its corporation counsel and R. H. Thomson, former city engineer, were in Washington this week to press the case before the Capital Issues Committee.

The statement filed traces the growth of the municipal electric light system of the city of Seattle, which comprises a hydroelectric development on Cedar River and a steam plant in the city of Seattle, from its inception. It is now proposed to erect a 35,000-kw. hydroelectric plant on the Skagit River. If it were not for the war, work on this plant would be under way.

Desiring to coöperate with the federal government in carrying on the war, the city of Seattle, however, applied to the Capital Issues Committee of the War Finance Corporation last April for its approval of a bond issue to carry out the development. The matter was referred to a sub-committee at San Francisco, where an issue was raised as to the necessity for more power at this time. The city representatives of Seattle point out that the municipal light and power plant has at all times been run and is now being run for the benefit of the public and that the city officials had also determined that an actual necessity existed for more power. However, in order to verify the correctness of the conclusion, a careful investigation was made by the city through its engineer, A. H. Dimmock; its superintendent of lighting, J. D. Ross, and R. H. Thomson, who for nineteen years prior to 1912 was the city engineer. In addition, M. M. O'Shaughnessy, city engineer of the city of San Francisco, was employed to make a personal investigation and report on the urgency for further development of electric power.

The unanimous opinion of the engineers is that it is necessary at this time for the city to undertake the development of a large amount of additional hydroelectric power. The four engineers found the following to be the situation as regards the supply and the demand for electrical energy at Seattle:

Maximum theoretical energy which can be produced most favorable conditions by hydroelectric plants:

Puget Sound Traction, Light & Power Company.	Hp
White River	61,330
Snoqualmie	26,330
Electron	18,660
Cedar Falls, city of Seattle	13,860
Total hydroelectric	120,180
Less 20 per cent loss between waterwheel and customer	24,036
Usable hydroelectric energy	96,144

Maximum theoretical energy which can be produced from steam:

Puget Sound Traction, Light & Power Company:	Hp.	Hp.
At Georgetown Station—		
One generator	10,666	
One generator	4,000	
At Post Station—		
One generator	4,267	
Seattle city plant, total of	26,660	
Total steam	45,593	
Less 10 per cent loss from plant to consumer	4,559	
Total usable from steam		40,934
Total hydroelectric energy, as above		96,144
Total usable energy		137,078

In reference to the foregoing statement of supply there must be considered the Tacoma municipal plant. This plant can produce at times of high water 26,667 hp., and during the high water of 1917, when one of the generators at the White River plant, mentioned above, was out of order, this plant furnished considerable relief. All excess electricity above the Tacoma demands, however, has been sold to and is now being used by the American Nitrogen Products Company. Therefore this plant cannot be considered as a source of supply.

The maximum usable power of 137,078 hp., as detailed above, in the Seattle district can be generated only when all steam and hydroelectric machinery is in perfect condition and water is abundant. The run-off of the various streams is extremely variable. Cedar River varies in run-off from 32 cu.ft. to 900 cu.ft. per second. One second-foot at the Cedar Falls plant will produce 37 hp. The stream, therefore, at extreme low water, without storage, would only produce 1184 hp., instead of the maximum of 14,000 hp.

Puyallup River, supplying the Electron plant, varies in flow from 120 cu.ft. to 1620 cu.ft. per second. One second-foot there will produce 62 hp. Thus at low water the Electron output is reduced from 18,660 hp. to 7500 hp. The committee points out that during the winter months, owing to the fact that the Electron plant derives its energy from water furnished from the run-off of the Mowitz Glacier on Mount Rainier through a wooden flume more than 10 miles in length, in which the water sometimes freezes solid, it is not uncommon for this plant to be out of commission for lack of water for a considerable period of time, and it cannot be depended upon at any time to furnish more than 18,660 hp.

The Snoqualmie River, supplying the Snoqualmie plant, varies in flow from 321 cu.ft. to nearly 12,500 cu.ft. per second. One second-foot will produce 19 hp. at this plant, and the output of this plant from lack of water actually drops from 26,330 hp. to 6100 hp.

The flow of the White River, supplying the White River plant, varies from 420 cu.ft. to 3700 cu.ft. per second. One cubic foot per second there produces

40 hp. The output may thus vary from the maximum of installation, 61,330 hp., to 16,800 hp.

The Nisqually River, which supplies the Tacoma plant, varies in flow from 220 cu.ft. to 4800 cu.ft. per second. One second-foot there will produce 33⅓ hp., so that plant may fall from its rated capacity of 26,667 hp. to 7333 hp.

These facts put in tabular form show the variation of supply from hydroelectric plants to be as follows:

	Possible Maximum, Hp.	Possible Minimum, Hp
Cedar River	14,000	1,184
Electron	18,660	7,500
Snoqualmie	26,330	8,100
White River	61,330	16,800
Tacoma	26,667	7,333
Total	146,987	36,917

The Cedar River plant has storage in Cedar Lake which will run the plant at full capacity for about twenty-three days.

The Electron plant has no storage other than in the forebay; this would operate the plant for one hour only.

Snoqualmie has storage to run the full plant for but four and one-quarter hours.

The White River plant has storage to operate the plant for sixteen days at full load.

Nisqually has storage for two hours only.

It is not expected that all these plants will or may become disabled or reduced to a minimum at the same time, although that happened in 1915 and will probably occur again this year owing to lack of snow in the mountains. The facts, the committee contends, show that the possibility of furnishing even a fairly uniform supply of electric energy to the Seattle district is next to nothing under existing conditions, and that a failure to hasten every effort to increase and stabilize the power production of the district would be criminal neglect.

This condition is emphasized by the demand for energy as of Dec. 30, 1917; but on July 1, 1918, it had changed greatly, as illustrated by the following figures submitted by the committee.

MAXIMUM DEMAND FOR POWER

The maximum demand during 1917 was approximately as follows:

	Hp.	Hp.
From Puget Sound Traction, Light & Power Co.	103,333	
From city plant	24,260	
Total maximum demand during 1917		127,593
Thus leaving a theoretical surplus of		9,485
Up to July 1, 1918, additional demands have been made upon the municipal plant and contracts signed for		17,143
Notification has been given the management of the city plant that various plants will require an additional supply of		44,191
Making a total of		61,334
To furnish this amount of energy to customers will require the installation of additional machinery to produce		67,467
The demand which may have been, or which hereafter may be, made on private companies in addition to the demand as of Dec. 30, 1917, we do not know, but it must be very considerable. Disregarding that entirely, and remembering that as of Dec. 30, 1917, there was a theoretical surplus of but 9485 hp. in excess of the maximum demand, the increase, as indicated by the contracts made by the city, shows a shortage as of July 1, 1918, of 17,143 hp. less 9485 hp., or of		7,658
And considering the notification made, a probable shortage as of Dec. 30, 1918, of 67,467 hp less 9485 hp., or		57,982

and this absolutely regardless of additional demands on private plants.

The development of an additional hydroelectric plant at this time, the committee says, is not the hastily conceived plan or freakish idea of any one, but is the logical and normal growth of a necessary municipal utility. Economy in the use of light and power has been urged, and the city has darkened many of its street lights in an effort to conserve fuel and the energy developed therewith.

Although within the State of Washington there is 9,920,000 potential water horsepower, of which only 3.3 per cent has been developed, practically two-thirds of the power being generated by the city is generated through the use of fuel oil. At the present time about 700 barrels of oil per day are being used by the city for this purpose, at a daily cost of $1,190. As winter approaches this will increase to 1000 barrels a day, causing a daily expenditure of $1,700, or an average yearly expenditure for oil of more than $500,000.

It is pointed out that the city could burn other fuel—coal by means of stokers or in powdered form, or mill refuse. Coal in Seattle averages about 10,000 B.t.u per pound, so that even if burned at the same efficiency as oil, it would require as the equivalent of 1000 barrels over 300 tons of coal daily. Stokers would require special coals, and the capacity of the boilers would probably be limited. Powdered-coal equipment would cost, with railway and land for storage, about $350,000. The time required to get this equipment, and to obtain the necessary lands by condemnation, would be nearly as long as it would take to build a 35,000-kw. hydro plant on Skagit River. As to the men used, counting miners, railway men, coal handlers and firemen, there would be about the same number of men employed on a coal-burning steam plant as in the building of a hydroelectric plant.

Summarizing, the committee urges that it is imperative that the city proceed at this time with the development of additional hydroelectric power, for the following reasons:

1. There is at this time no surplus of power (regardless of how generated) in the city of Seattle or deliverable thereat.

2. Assuming for the purpose of argument that a surplus of power exists at this time, there are two answers: (a) that it is generated by the use of fuel, while water power goes to waste, and by operating at all times steam auxiliary plants that were only intended as standby or emergency plants, leaving no reserve in case of accidents or disasters such as have heretofore actually occurred; (b) any apparent surplus will be wholly inadequate to care for the peak load of the coming winter, and no provision is being made for the peak load of a year from the approaching winter.

3. The actual condition of the city's existing hydroelectric plant, relying as it does upon the old wooden dam and penstocks and the wooden building, will stamp any course as criminal neglect which does not without delay make immediate provision for its relief at the earliest possible date. Obviously, a relief plant must be started or no relief can be had.

4. The city obtains its entire water supply for all purposes from Cedar Lake. The daily supply is 62,000,000 gal. Should the old wooden power dam go out, Cedar Lake would be lowered 14 ft., the result being that the city water supply would be entirely dependent upon the low water flow of the river, which at times has been about 32,000,000 gal. (approximately one-half of the present water supply).

PRIORITY REGULATIONS OF WAR INDUSTRIES BOARD

Circular No. 4 Issued to Simplify Administration of Priorities for Both Government and Manufacturer and to Expedite War Work

The priorities division of the War Industries Board has issued Circular No. 4 embodying a revision of its rules and regulations governing priority in production. The circular, which is signed by Edwin B. Parker as priorities commissioner, Bernard M. Baruch as chairman of the War Industries Board, Secretary of War Baker, Secretary of the Navy Daniels and Edward N. Hurley, chairman of the United States Shipping Board and president of the Emergency Fleet Corporation, will be mailed at once to all who have made application at any time for priority certificates and to all against whom certificates have been issued. They are asked by the priorities committee not to request copies unless they fail to receive them after a reasonable time has elapsed. Then copies may be procured on application to Maurice Hirsch, secretary of the priorities committee, Washington, D. C.

The new circular continues in effect Class AA, which comprises only emergency war work; Class A, which comprises other war work, and Class B, which comprises orders and work which, while not primarily designed for the prosecution of the war, yet are of public interest and essential to the national welfare or otherwise of exceptional importance. In order to secure rating within these three classes, application must still be made to the priorities committee on forms furnished on request, save in cases where provision is made for automatic classifications and the conditions for procuring automatic classifications have been strictly complied with.

The circular embodies, however, two fundamental changes:

First—The addition of Class D (corresponding to what was formerly Class C) and the creation of Class C as a class entitled to precedence.

Second—The establishment of automatic ratings.

Class C, as described in the new circular, comprises all orders and work not covered by priority certificates or automatic ratings but which are to be utilized in furtherance of one or more of the purposes embraced within what is designated as the "General Classification of Purposes Demanding Preference Treatment."

No Class C certificates are issued, but the orders designated within Class C are automatically so classified, provided that the person intending to use the materials, equipment or supplies files with and as a part of the order a prescribed affidavit in writing.

On direct government orders, the new circular provides that orders placed after June 30, 1918, by a duly authorized officer of the War Department, the Navy Department or the United States Shipping Board Emergency Fleet Corporation which fall within Class A shall, upon the placing of the order, automatically be classified as Class A-5, provided that the order carries an indorsement personally signed by the officer placing the order, as follows:

"Unless re-rated by express order in writing by the priorities committee of the War Industries Board, this order is by authority of said priorities committee rated as Class A-5, and its execution shall take precedence over all your orders and work of a lower classification to the extent necessary to insure delivery according to the date specified herein, as prescribed by Circular No. 4, issued by the priorities division of the War Industries Board, of date July 1, 1918, and all amendments thereto."

Automatic classifications are likewise allowed on orders for materials, equipment or supplies for the following specific uses:

(a) For the manufacture of turbines (all classes), A-4.

(b) For the repair or construction of steam railroad locomotives for use on the railroads under the jurisdiction of the United States Railroad Administration, A-4.

(c) For the production of electrodes, A-5.

(d) For the manufacture of rope wire and of wire rope, A-5.

(e) For the building of ships or other water craft for and under direct contracts with the United States Shipping Board Emergency Fleet Corporation, A-5.

(f) For the building of all cargo water craft (but not pleasure craft) save such as are under construction by or for the United States Shipping Board Emergency Fleet Corporation, A-6.

(g) For the manufacture of machine tools for working both metal and wood; of machinists' tools, of small tools, of hand tools, and of mining tools, machinery and equipment, A-6.

(h) For the manufacture of steam-railroad materials, equipment and supplies (other than locomotives) for use on the railroads under the jurisdiction of the United States Railroad Administration, B-1.

(i) For the manufacture of locomotive cranes and traveling cranes, B-1.

(j) For the manufacture of electrical equipment other than turbines (but not electrical supplies as distinguished from equipment), B-2.

(k) For the manufacture of farm implements, B-2.

(l) For the manufacture of textile machinery, B-2.

(m) For the manufacture of tools, implements, machinery and equipment required for the production, harvesting, distribution, milling, canning and refining of foods and feeds, B-2.

(n) For the manufacture of binder twine and rope, B-2.

(o) For the manufacture of oil-well supplies or equipment —by which is meant supplies for the production of petroleum and natural gas—but not including pipe lines, storage tanks of 1000 barrels capacity or over, tank cars or refineries, B-2.

However, before an order takes the automatic classification, it must be accompanied by a prescribed affidavit. Where the automatic rating will not secure reasonably satisfactory delivery, application for a higher classification should be made, such application disclosing facts evidencing that the public interest requires an earlier delivery of the order than can be secured under the existing automatic rating.

The circular calls attention to the method of securing a place on the preference list compiled by the priorities board, of which the priorities commissioner is chairman and H. G. Phillips is secretary. Applications must be made on a separate and distinct form of application, which may be secured from Mr. Phillips on request. The circular points out that the priorities committee does not issue priority on fuels, food or feeds, or transportation. The preference list compiled by the priorities board is used as a guide by the United States Fuel Administrator and the United States Railroad Administration in the distribution of fuel to industries and plants.

The new circular calls attention again to the test in requesting priority:

"The paramount purpose of priorities is the selective mobilization of the products of the soil, the mines and the factories for direct and indirect war needs in such a way as will most effectually contribute toward winning the war. In requesting priority the petitioner should join with the committee in applying the test: To what extent, if at all, will the granting of this application contribute, directly or indirectly, toward winning the war; and if at all, how urgent is the need?"

APPROVES RATE INCREASE FOR PACIFIC ELECTRIC COMPANY

California Railroad Commission Enumerates Factors Contributing to the Necessity for Higher Electric Rates at This Time

The California Railroad Commission has authorized an increase of electric rates to the Pacific Gas & Electric Company, the Great Western Power Company and the City Electric Company. The order is of a temporary character and is intended to provide the companies with sufficient revenue to safeguard their service to the public and to protect their financial status during the war emergency. At a later date the commission will continue hearings and at that time will make a final decision establishing permanent electric rates for these companies. The order is intended to provide the company with sufficient additional revenue to reimburse it for extraordinary increases in operating expenses, as a result of emergency conditions.

Among the factors contributing to the necessity for increased electric rates at this time are the following:

1. Higher prices of materials and higher wages paid to employees to meet the increased cost of living and to equalize wages paid in competitive industries.
2. Period of water shortage, resulting in substantial reduction in the amount of hydroelectric power available, and the consequent necessity for a greatly increased production of electricity in steam-power plants using fuel oil.
3. Increases in the price of fuel oil, which has more than doubled in the last two years. This in itself would increase the cost of electric power during a normal year, but during a year of reduced hydroelectric supply further adds to operating costs on account of the greater consumption of oil.
4. A curtailment in the use of electricity for lighting purposes and a resulting reduction of revenue on account of the daylight-saving act.
5. The necessity for the maintenance of the financial status of public utilities during the war period in order that they may obtain funds necessary to continue expansion of facilities.

Before raising the rates to consumers the commission by a sweeping order has removed all discriminations in rates paid by consumers which have existed on account of competition in the large cities and on account of old contract rates. This will place all consumers who have heretofore enjoyed special rates on a par with other consumers, and in the future all consumers will pay schedule rates and in addition the surcharges fixed in the order

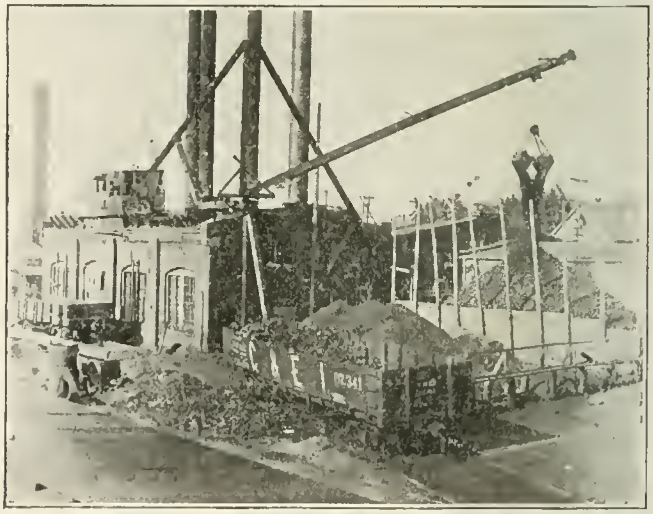
The Pacific Gas & Electric Company is authorized to add a surcharge of 1 cent a kilowatt-hour on all energy used for lighting purposes, and a surcharge of 0.2 cent a kilowatt-hour on all energy sold for power purposes. The bills for state department, county and municipal lighting and power, including street-lighting rates, will be raised 10 per cent. Energy sold to electric railways and to other electric companies at wholesale is raised 0.1 cent a kilowatt-hour. These increases, together with the additional revenue provided by placing special consumers on regular schedules will provide the Pacific Gas & Electric Company with over $2,000,000 more revenue than was obtained from existing rates. So great have been the increases in operating expenses, however, that in spite of these increases and the increases in gas rates granted by the commission last month, the net income of the company will be $500,000 less than was earned during 1916 before the increased operating expenses occurred.

Very large power consumers that have special contracts which are outside of the scope of regular rate schedules have had their rates increased only by the 0.2 cent power surcharge. The contracts will remain as rates for these classes of service until the final adjustment of rates is made in the future.

The Great Western Power Company and the City Electric Company have been likewise ordered to remove all discriminations between consumers and to place all consumers on filed rate schedules except those special contracts to which no rate schedule applies. The lighting rates of these companies have been increased 1 cent a kilowatt-hour, and the power rates have been increased 0.2 cent a kilowatt-hour. No rate increases were allowed the Great Western Company or the City Electric Company for power sold for municipal street lighting, for electric railways served and to other public utilities for power at wholesale.

Urging Coal Storage in Indiana

An unusual but practical coal-handling outfit is a stiff-leg derrick mounted on top of power house. This illustration is sent, with a booklet on "Storage of Indiana Coal for Steam Purposes," by the Federal Fuel Administration for Indiana to all Indiana utilities. In an accompanying letter Evans Woollen, Indiana Fuel Administrator, says: "Should a shortage of coal exist next winter, as now seems probable, the state administration will not indiscriminately help you to procure coal because you are a public utility but will carefully scrutinize applications for assistance. This administration will require you to show that you took all reasonable precautions to avoid a shortage."



Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 239 of this number

Dixie Club.—This association, composed of Southern jobbers, met at Atlantic Beach, Fla., on July 22 and 23.

Association of Electrical Dealers and Contractors.—The national association has decided upon Milwaukee as the convention city of 1919.

Engineers' Club of Philadelphia.—As begun on July 16, a regular feature of the club will be a "Tuesday address luncheon." Well-known speakers will address the club on up-to-the-minute subjects. H. A. Stockly is secretary.

Jovian Electric League.—The annual convention of the Jovian Order will assemble at Dallas, Tex., some time in October. Jupiter Strickland has announced the committees to have charge of the Dallas meeting, and a complete program will be forthcoming in about a month.

Southwestern Electrical and Gas Association.—In place of the regular annual conventions this association has decided to hold quarterly meetings to be rotated between Houston, San Antonio and Dallas. This plan will permit the discussion of problems developing from rapidly changing war conditions more nearly as they arise. The first of these quarterly meetings was held at Dallas, July 19, with general program as follows: The sections (light and power, street and interurban railway, and gas) met in the morning separately, each under its chairman, to discuss matters of particular interest to the members. All sections assembled for a get-together luncheon at noon. In the afternoon a general session was addressed by the president of the association on matters concerning practically all utilities in the state. The general secretary's report was also read. All of the meetings are executive. The secretary of the association is H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

Association of Iron and Steel Electrical Engineers.—As announced before, the twelfth annual convention of the association has been scheduled for Sept. 9-14, to be held at the Southern Hotel, Baltimore, Md. The tentative program of papers to be presented is as follows: "Methods of Education for Electrical Employees of Iron and Steel Mills," prepared by the educational committee; "Remote-Controlled Substations," by W. T. Snyder; "Automatic Engine Stops," by Walter Greenwood; "Standardization of the Rating of Large Steel-Mill Motors," by K. A. Pauly; "Practical Method of Selecting Carbon Brushes," by Alfred Mullhaupt, Jr.; "Bridge Motors for Cranes," by R. H. McLain; "Condensers and Condensing Engineering Practice," by D. D. Pendleton; "Roller Bearings for Cranes," by P. B. Liebermann; "Installation and Operation of Auxiliary Drives," by J. D. Wright; "High-Tension Installation Under Severe Conditions," by James Farrington; "Electrically Driven Mills, Showing Tonnages, Costs, etc.," by J. T. Sturtevant, and "Sixty Cycles Versus Twenty-five Cycles for Steel Mills," by J. E. Fries.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Expert Opinion.—In an action under the "death act" for death by electric shock, the testimony of defendant's former lineman, in answer to the question whether in his opinion it would be possible for the primary wire to jump over on certain bare places, that it would be possible under certain conditions, was admissible; for usually a subject cannot be developed by one question and answer, the Supreme Court of Michigan held in Brabon versus Gladwin Light & Power Company (167 N. W. 1024).

Right of Insurance Company to Collect Insurance for Employer Under Compensation Act.—Neither section 6, part 2, of the workmen's compensation act, providing that the insurance associations may recover indemnity from other persons who would have been liable to the insured employee, nor any other part of the act, in express terms or by implication, confers authority upon the insurer to reimburse himself for compensation paid to an injured employee as against a third person through whose negligence the injury occurred, or to be subrogated to the rights of the beneficiary as against such third person, the Court of Civil Appeals of Texas held (203 S. W. 1115) in Southern Surety Company versus Houston Lighting & Power Company.

Filing of Power Location.—A power company that files its map of water-power location first has the prior right to such location, a paper being deemed to be filed within the meaning of the law when it is delivered for that purpose to the proper officer and received by him, and it is not necessary that it shall be indorsed as having been so filed, the "file" mark being evidence but not essential, according to the Supreme Court of North Carolina in Carolina-Tennessee Power Company versus Hiawassee River Power Company (96 S. E. 99). A statute granting a charter to an electric power company cannot be attacked in a suit for an injunction against the purchase of land by another power company on the ground that the thirty days' notice required by law for the passage of private laws has not been given. The legislature may grant a power of eminent domain to one public service corporation, such as an electric power company, without granting the power to other public service corporations of the same class.

Assumption of Risk.—Notice of railroad company to employees to avoid high-voltage wires and stating that they assumed the risk thereof, though signed and read by an employee, did not change the rules of law governing assumption of risk, since it was not a contract, and, even if so, it had no force because signed after the original employment and in any event contrary to public policy in so far as it relieved the company from liability for its own negligence, the New York Supreme Court held (170 N. Y. S. 697). Risk of negligence of fellow employee in turning on current in high-voltage wire without warning, producing an unsafe place to work, may be assumed under the federal employers' liability act, unless the place was rendered unsafe by consequence of the negligence of the employer.

Condemnation of Water Power.—On certiorari by the owners of water rights to review a judgment of condemnation in favor of a power company, the function of the Supreme Court is limited to a finding of the reasonable practicability, necessity and public use of the projected scheme, the Supreme Court of Washington held (173 P. 192). The law requires, in order to condemn property, that the enterprise be for a public use, that the public interests require its prosecution, and that the land or property is required and necessary for the enterprise. In a power company's action to condemn water rights, the court's findings that a city granted the company a franchise in order that its inhabitants might be provided with electrical power for various uses, etc., that the city and its inhabitants depended on the power company to supply power and water, that the company's present plant was insufficient to meet the demands of a growing population, and that the company was proceeding to condemn in aid of its franchise, was sufficient to satisfy Rem. Code 1915, 925, requiring that the enterprise be public, be required in the public interest, and that the land or property sought to be condemned is necessary, the court not being obliged to find in bare words that the contemplated use is a public use, but merely to find facts from which the legal conclusion can be drawn. The mere fact that an electrical company was a riparian owner on a stream gave it no right to divert the waters, and, in the absence of a showing of intention so to do, of present acquisition of a right to divert the water, and of a way to divert and carry it, the electrical company was not entitled to compensation for deprivation of such use of the water when a power company condemned rights in the stream.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Deposit for Municipal Plant Meters.—An ordinance was passed recently by the commissioners of Owensboro, Ky., requiring a deposit of $2 with the municipal lighting plant before meters will be installed for patrons who do not own the property in which they live.

Rate Increase in Texas.—The Brush Electric Company, Galveston, Tex., is the latest Cities Service Company subsidiary granted an increase in rates. This rate increase became effective on July 1 and, it is estimated, will add about $45,000 annually to the net earnings under present conditions.

Demand for Power in Seattle.—Recently the Seattle municipal plant has rejected applications from large industries for approximately 5400 kw., according to a statement made by Superintendent of Lighting J. D. Ross. "This means that the 12,000 kw. of the new unit of the Lake Union plant is already exhausted," said Ross. "In the last six months we have signed contracts with local industries to furnish 14,784 kw. connected load, or 11,116 kw. maximum load."

Conservation in Refrigerators.—On account of the shortage in the supply of sheet steel and in order to meet increased needs of the government for certain other materials, the war service committee of the refrigerator manufacturers of the United States has been in conference with representatives of the War Industries Board to work out a program of conservation and substitution of materials. The committee report of a plan to eliminate various sizes and styles of refrigerators for the purpose of saving not only materials but labor and capital as well will be submitted soon to the conservation division of the War Industries Board.

Patent Office Needs Examiners.—There is a need for technically trained persons for the examining corps of the Patent Office. Men or women are desired who have a scientific education, particularly in higher mathematics, chemistry, physics and French or German and who are not subject to the draft for military service. Engineering or teaching experience in addition to the above is valued. The entrance salary is $1,500. Examinations for the position of assistant examiner are held frequently by the Civil Service Commission at many points in the United States. One is announced for Aug. 21 and 22, 1918. Details of the examination, places of holding the same, etc., may be had upon application to the Civil Service Commission, Washington, or to the Patent Office.

War Training for Mechanics.—The War Department committee on education and special training reports that success seems sure to attend a plan just put into effect to train mechanics in 150 institutions, such as trade schools, technical high schools, colleges, etc., with which is fitted in a course of instruction on the war aims of the United States and those of other countries, including the Teutonic empires, so that the men being trained may not only be able to fight behind the lines with their hands in matters of mechanics but be able to fight with their brains as well, by being able to know what they are fighting for. In the work of "training mechanics and developing their morale," of which C. R. Dooley is in charge as educational director of special training, the plan being worked out is to give enlisted men an eight weeks' course in mechanical training.

Loan to New Orleans Railway & Light Company.—The United States War Finance Corporation has agreed to lend the New Orleans Railway & Light Company $1,000,000 to reimburse the company for necessary expenditures, according to a letter of D. D. Curran, president of the company, addressed to holders of the two-year gold debentures which matured June 1 last. The Finance Corporation has stipulated that before the money shall be available the $4,000,000 outstanding debentures must be deposited under the company extension agreement and the success of the extension must be assured. Under the company's plan for the extension of these debentures, which was submitted to noteholders the middle of June, they were urged to deposit their holdings and receive in exchange a new one-year 7 per cent note, due June 1, 1919, callable at 100 and interest on thirty days' notice. According to Mr. Curran, more than 50 per cent of the debentures have been deposited.

Heavy Increases in War Taxes Proposed.—Heavy increases in war taxes with an excess profits tax as high as 80 per cent are proposed by a special committee on financing the war of the Chamber of Commerce of the United States in a report just sent out to the chamber's membership for a referendum vote. Repeating earlier declarations against special profits arising out of the war, emphasizing anew the necessity of economy and elimination of waste and extravagance, and quoting the committee's statement of last year regarding the advantages of heavy taxation in war time, the report presents eleven specific recommendations. The special committee is composed of John V. Farwell, chairman, Chicago; Edward A. Filene, Boston; P. W. Goebel, Kansas City, Kan.; John H. Gray, Minneapolis; Edmund D. Hulbert, Chicago; Stoddard Jess, Los Angeles; Hugh McK. Landon, Indianapolis; J. Lawrence Laughlin, Chicago; Robert F. Maddox, Atlanta; J. K. Orr, Atlanta; John T. Scott, Houston; Oliver M. W. Sprague, Cambridge, Mass., and Jesse I. Straus, New York.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Discontinuing Unprofitable Heating Service.—The Illinois Public Service Commission holds, in a decision affecting the Alton Gas & Electric Company, that where a steam-heating utility had been operating its plant at a loss, though rates were reasonable compared with the value of the service, and the company could not continue operation without rehabilitating its plant at a considerable expense and continue rendering service with a reconstructed plant at a reasonable rate and secure a fair return on its investment, the company should be authorized to discontinue rendering heating service.

Emergency Action.—Commissioner Hubbell of the New York Public Service Commission, First District, in an opinion affecting the Queens Borough Gas & Electric Company, says in part: "The commission is of the present opinion that a conclusion as to the merits of the present requests for temporary emergency relief can be reached without subjecting the company, the city or the commission to a 'present-cost' appraisal. . . . Generally, however, where (1) no change in relations between classes of consumers or localities is concerned; (2) the increase is asked for to cover only a temporary and emergency period, approximating the duration of the war or less, and (3) the increase is asked for to cover only the elimination of a current deficit in operating expenses, or, at most, the continued earning of some part of the fair and reasonable return ordinarily earned by the particular company in normal times, it is not believed that the commission need enter upon a regular rate proceeding with a reappraisal of the corporate property. Except where substantial reason appears for belief that a public utility company is currently earning more than a reasonable return upon its investment outlay, the commission is of the opinion that it may as well refrain from conducting rate cases in the usual formal fashion during the war and may devote itself to ascertainment of the relief necessary to be granted for the war period to prevent the breaking down of public utility service and lasting detriment to public utility property. Except where substantial reason for a contrary course appears, the commission is of the opinion that it need not, in awarding emergency relief for the limited period, inquire fully into the normal valuation of the corporate property or try to ascertain whether the existing rates have ordinarily yielded more or less than a reasonable return upon that value."

Men of the Industry

Changes in Personnel and Position—Biographical Notes

R. E. Bowen has been appointed engineer of the power station of the Little Rock (Ark.) Railway & Electric Company to succeed A. W. Russell.

C. J. Schultz has been promoted to be superintendent of the Bernardsville territory of the New Jersey Power & Light Company, succeeding John MacLean, resigned.

E. F. Neal, for many years chief electrical inspector for the city of Seattle, has resigned to take the position of assistant manager of the Standard Electric Company, Seattle.

John M. Drabelle, who has been electrical engineer for the Iowa Railway & Light Company of Cedar Rapids, has been appointed, effective Aug. 1, mechanical and electrical engineer of the company's entire system.

F. W. Laas, chief engineer of the Iowa Railway & Light Company, the Iowa Electric Company and the Iowa Falls Electric Company of Cedar Rapids, Iowa, has resigned his position to become superintendent of power for the Western Light & Power Company at Boulder, Col.

H. L. Nichols, manager of the Minnesota Gas & Electric Company, Albert Lea, Minn., and the River Falls Power Company, Hastings, Minn., has been selected as captain of the Red Cross canteen service for the Albert Lea canteen station of the Northern Division. Mr. Nichols was also county chairman for Freeborn County of the Red Cross second war fund campaign.

William C. Lounsbury has recently been appointed general manager of the Superior (Wis.) Water, Light & Power Company. He has been general superintendent for a number of years. He is a member of a number of technical societies and is at present vice-president of the Wisconsin Electrical Association. Mr. Lounsbury was born thirty-eight years ago in Brooklyn, N. Y., and is a graduate of the Massachusetts Institute of Technology. His promotion is the result of twelve years' work in the Superior company.

C. D. Flanigen, the new president of the Southeastern Section of the National Electric Light Association, is president and general manager of the Athens (Ga.) Railway & Electric Company. He was born in Philadelphia and was graduated from the Polytechnic College of the State of Pennsylvania with the degree of B.M.E. It was some years later that he entered the utility field. In 1883 he became manager of the Athens Gas Company, continuing in that capacity until 1890, when he became engineer for a development company and business manager of the Athens *Daily Banner* until 1894. Since that time he has advanced from superintendent to his present position with the Athens Railway & Electric Company. Mr. Flanigen has, in addition, taken a wide interest in local affairs, being vice-president of the Commercial Bank of Athens and having been for two terms, 1915 and 1916, president of the Chamber of Commerce.

Robert A. Bachman, for many years connected with Thomas A. Edison as vice-president and general manager of the Edison Storage Battery Company, has resigned in order to devote more time to his personal affairs.

George A. Hoadley, president-elect of the Illuminating Engineering Society, was born Dec. 2, 1848, at Sheffield, Mass. He was graduated from Union College, Schenectady, in 1874, with degrees from both the scientific and civil engineering courses. Until 1888 he was principal of the high schools in Argyle, N. Y., Fort Edward, N. Y., Florence, Mass., and Northampton, Mass., when he became head of the department of physics in Swarthmore College. From 1894 to 1914 he was vice-president of Swarthmore College, then retiring from active college work. Mr. Hoadley is the author of textbooks on physics, the latest having been published in 1913 under the title "Essentials of Physics." He is a charter member and fellow of the American Physical Society, a fellow of the American Association for the Advancement of Science, associate member of the American Institute of Electrical Engineers, having been chairman of the Philadelphia Section for one year, and in addition is a member of the board of managers of the Franklin Institute. He was chairman of the Philadelphia Section of the Illuminating Engineering Society in 1913 and represented that section in the council of the society as vice-president for the following two years. At the present time Mr. Hoadley is serving the Franklin Institute as acting secretary, on account of the absence of the secretary, Major R. B. Owens, in active military service overseas.

G. A. HOADLEY

W. H. Harland has been appointed senior electrical engineer of the eastern district, Bureau of Valuation of the Interstate Commerce Commission, to succeed Milan V. Ayres, resigned to accept an appointment as major in the National Army. Mr. Harland will be in immediate charge of the electrical, signal, and telephone and telegraph branches.

Milan V. Ayres has resigned as senior electrical engineer for the eastern district, Bureau of Valuation of the Interstate Commerce Commission, to accept an appointment as major in the National Army. Mr. Ayres was born in Kansas in 1875 and at the age of twenty-three was graduated from the electrical department of the Massachusetts Institute of Technology. He first entered the employ of the General Electric Company at Schenectady in the testing department. In 1903 he became electrical and mechanical engineer for the Boston & Worcester Street Railway, South Framingham, Mass., continuing in that position until July, 1911, when he became assistant to the general manager of the Rockland Light & Power Company, Nyack, N. Y. In November of the same year he resigned to become chief engineer of the Mobile (Ala.) Light & Railroad Company. The following year he went with Ford, Bacon & Davis, consulting engineers, New York City, where he stayed until he became connected with the Interstate Commerce Commission in the spring of 1914.

Obituary

G. A. Goodnow, vice-president of the Chicago, Milwaukee & St. Paul Railway Company, died July 27 after a brief illness at Seattle, Wash. He was a prominent figure in the electrification program of that road.

Lieut. Warren Harries, youngest son of General George H. Harries, president of the Louisville Gas & Electric Company and vice-president of H. M. Byllesby & Company, according to a Paris dispatch, was killed in an automobile accident on July 25 in a provincial French city, where he was on duty. General Harries at the present time is serving in France in the American army.

Charles Allis, aged sixty-five, died in Milwaukee, Wis., July 22 of pneumonia following an operation. Mr. Allis was the first president of the reorganized Allis-Chalmers Company and at the time of his death was president of the Chicago Belting Company, trustee and member of the executive committee of the Northwestern Mutual Life Insurance Company and a director of the First National Bank and First Trust Company of Milwaukee. He was the second son of the late Edward P. Allis, founder of the E. P. Allis Company. Of late he had given most of his time to the Milwaukee County Council of Defense. He is survived by his widow.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

NEW SYSTEM ADOPTED FOR GOVERNMENT BUYING

Provides for Review of All Contracts by Control Boards, Centralizing of Purchases and Standardizing of Contracts

In connection with the method of purchasing supplies by the government the War Department authorizes the following statement:

With the coöperation of the Department of Justice, the War Department has nearly completed a system of control designed to protect the government in the procurement of all war materials. This system, in part, was put in operation under the direction of the General Staff about six weeks ago.

The new system provides for a review of every contract by boards of control, the centralizing of purchases, the standardization of contract clauses, a daily fiscal survey and provisions for public information on War Department needs.

About May 1, 1918, under instructions of the Secretary of War, a new division of the General Staff began to supervise the policy and practice of War Department purchases. The new division has arranged to centralize the purchase of commodities falling within the same classification in the hands of one bureau, so that now, for instance, one bureau instead of five, as heretofore, purchases all leather goods for the whole army and for hardware and all the usual trade classification of materials. There have been set up in each bureau boards of awards which are the ultimate authority on awards of all important contracts.

More than six weeks ago a committee composed of officers and civilians whose duty has been to prepare the tens of thousands of contracts of the War Department began an intensive study of every contract clause and policy in every agency of the War Department in an endeavor to prescribe in the light of more than a year's experience with war conditions the form of contract clauses that would best safeguard the interests of the government, with a view to prescribing for instant use well-considered and practice-proved forms for every conceivable circumstance of purchase. This committee is about ready to make its report.

On June 1 the General Staff ordered that, except in cases of immediate necessity, no contracts should be made with sales agents and that all War Department procurements should be negotiated either with the manufacturer or with recognized jobbers carrying the stocks on hand from which they proposed to supply the army.

LABOR DECISION MUST BE PUT IN EFFECT TO GET REHEARING

War Labor Policies Board Conferring with Unionized Labor and with Industry Regarding the Standardization of Wages

The National War Labor Board authorizes the following:

"The National War Labor Board has refused an appeal from a group of employing companies in Waynesboro, Pa., for a review of the board's recent decision in the controversy between the employers and workers in eight metal manufacturing plants in that city. The employers were told to put the decision into effect and that until they did so the board would not hear them.

"The decision of the board granted a general increase in wages to all of the workers, 3000 in number, and ordered that a system of collective bargaining be established and that an administrator be sent to see that the award was enforced. This representative of the board, Stiles P. Jones, has reported that the men are prepared to coöperate with him in every way. The employers, however, complained against the award on the ground that it was unworkable, opposing in particular that clause in which 40 cents was fixed as the minimum hourly wage to be paid to any employee in any classification, including the common laborer. They refused to meet with representatives of the men to develop a plan for giving effect to the award. Mr. Jones reported also that the situation has led to a feeling of unrest among the men that threatens to culminate in a repetition of the strike which brought the case first to the attention of the board.

"Upon hearing the report, Loyal A. Osborn, vice-president of the Westinghouse Electric & Manufacturing Company, made the following motion, which was unanimously adopted:

"'I move that it is the sense of the board that, inasmuch as the manufacturers in Waynesboro agreed to abide by the decision of the board, and the decision having been made, we expect the decision to be put into effect. We are not willing to give any further hearings in the matter pending the putting into operation of the decision.'"

A later announcement from the board on wages states:

"For several days the War Labor Policies Board has been conferring with representatives of union labor and with representatives of industrial management concerning the national standardization of wages. In seeking standardization the precedents of unionized industry are being followed."

REPLACING CARBON AND "GEM" WITH TUNGSTEN LAMPS

Gradual Progress Toward Change, Which Is a Fuel-Saving Measure, Is Essential if Serious Lamp Shortage Is to Be Avoided

Before the war Germany made annually about 100,000,000 lamps. Of these she exported 60,000,000. In addition to this she exported 60,000,000 bulbs. When the war started the demand for these 60,000,000 lamps and 60,000,000 additional bulbs came upon the lamp manufacturers of the United States. It soon developed that the manufacture of bulbs was the crux of the entire situation. Steps were therefore taken to increase the production of glass bulbs to a point where production would equal demand. Up to this point no attention was given to guiding the lamp production along lines of fuel conservation. Demand was the determining factor.

Now, however, as the necessity for conserving coal has become more acute, it has been suggested that substitution of tungsten lamps for carbon and "gem" lamps can be undertaken as a fuel-saving measure. Data on the subject worked out by lamp manufacturers indicate that 17 per cent of all fuel burned to produce incandescent lighting is consumed in operating carbon and "gem" lamps. Obviously to secure the same amount of light by the use of tungsten lamps instead of these carbon and "gem" lamps would require the burning of considerable less coal. Thus the question arises whether it is or is not possible to replace all carbon and "gem" lamps with tungsten-filament lamps

Considering only the utilization of the lamps, it will be apparent that the change could be made, with few exceptions. There are a few classes of very rough service in which tungsten lamps do not give long enough life. The manufacturer's problem, however, is a different matter. It is estimated that it would require the entire output of all American lamp factories for two years to replace all of the carbon and "gem" lamps now operating. If, therefore, the Fuel Administration or other governmental authority were to require the sudden replacement of all carbon and "gem" lamps, the first thing to happen would be an incandescent lamp shortage.

It is entirely within reason, however, to go about replacement of the less efficient lamps gradually. The manufacturers claim that during the coming season it would be possible to replace with tungsten lamps all carbon and "gem" lamps which burn out. Again, it appears that the manufacture of glass bulbs is the limiting factor. It would be possible to replace the burned out carbon and "gem" lamps with tungsten lamps only because bulbs which were originally intended to become carbon and "gem" lamps could be filled with tungsten filaments. It is stated authoritatively, however, that the only way to make better progress than this is for the government to return to the glass factories some of the skilled workers who have been called to active military service.

It is thought to be unlikely, in face of these facts, that the government will take action requiring wholesale replacement of inefficient lamps. It is expected, however, that some plan of gradual replacement will be worked out.

METAL MARKET SITUATION

Price of Copper Again Under Discussion—Conferences with Government Board Next Week

As Aug. 7 is close at hand, a further increase in the price of copper is being generally discussed. On that date the smaller producers of the metal, whose costs are higher than the average, may ask the War Industries Board to place the figure as high as 30 cents a pound, though 27.50 cents may be settled upon instead of 26 cents, the present price. A great many consumers, particularly in the electrical field, believed 23 cents, the former price, was quite high enough and were opposed to a change. Reports are that buyers are placing orders at the current rate deliverable prior to Aug. 15, when whatever price is decided upon will go into effect.

Selling agents, as heretofore, are supplying only a small part of the metal requested, as the government requirements have taken practically the entire amount available. It is significant that there are no large quantities of copper to be had for delivery before Aug. 15. There is a strong feeling that should the War Industries Board again change the fixed price manufacturers of brass and other products made of copper will make a request that the new quotation be established for as long a period as possible

In a year tin has advanced over 100 per cent. The supply is not ample. Lead rules strong, influenced by the scarcity of offerings. In the other metals inquiry is very quiet and price changes of no moment.

NEW YORK METAL MARKET PRICES

	July 22	July 29
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26 00	Govt price 26.00
Electrolytic	Govt. price 26 00	Govt. price 26.00
Casting	Govt. price 26.00	Govt. price 26.00
Wire base	29 75	29 25
Lead, trust price	8 05	8 05
Antimony	13 12½ to 13 37½	13.00 to 13.25
Nickel, ingot	40 00	40 00
Sheet zinc, f.o.b. smelter	Govt price 15.00	Govt. price 15 00
Spelter, spot	8 65 to 8 75	8 35 to 8 50
Tin, Chinese *	$1 00	94
Aluminum, 98 to 99 per cent	Govt price †33 00	Govt. price †33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	23 50 to 24 00	23 50 to 24 50
Brass, heavy	14 50 to 15 00	14 50 to 15 00
Brass, light	12 00 to 12 25	11 50 to 12 25
Lead, heavy	7.12½ to 7 50	7.12½ to 7 50
Zinc, old scrap	6.50 to 6.75	5.50 to 5.75

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* No Straits offering. † In 50-ton lots or more; carload, 33.10 cents per lb.; 1-ton to 14-ton lots, 33.20 cents per lb.

THE WEEK
IN TRADE

A POSSIBLE shortage and the difficulty of obtaining adequate supplies of staple electrical lines are causing concern in all sections of the country. Priority orders are being required on so many items that the exception is notable. Government restrictions on steel for the lesser essentials are interfering to an appreciable extent with the filling of commercial requirements.

Prices on a number of articles have again gone up, and these advances are becoming so frequent that very little, if any, comment is occasioned by the regularity with which the revisions are announced. There is no abatement of business, and heavy sales are predicted for the fall.

Washing machines are in strong demand everywhere. Sewing machines and vacuum cleaners are also selling very satisfactorily. The stock of fans is being rapidly depleted in certain of the larger sizes by the arrival of seasonable weather. Some sizes of lamps and all sizes of conduit are scarce.

Labor shortage East and West is a source of constant anxiety as well as the cause of curtailment in factory production. The first 600 plants to report their labor requirements to the Federal Employment Service asked for approximately 25,000 laborers in July and about 40,000 this month; the 25,000 wanted in July represent an actual shortage.

NEW YORK

With nearly every line of business finding it more and more difficult to obtain goods against future requirements, the electrical trade in this section is also beginning to feel the pinch. It has been apparent to even the casual observer for some time that such a situation existed. The majority of jobbers, dealers and contractors have, with few exceptions, denied that there was any difficulty in obtaining goods. Now it is frankly admitted that shortages in many staples exist, and their replacement is uncertain. In fact, conditions are such that nearly all merchandise, no matter what, is hard to get. During the past week several manufacturers have notified jobbers that unless they and their dealers sign up the requirements at once for everything of steel and iron, orders will not be filled. These advance pledges enable the producer to obtain the material from the mills on a priority preference.

Business is excellent, with commercial trade very light as compared with government transactions, which are being carried along in many instances on a huge scale. Prices are firm, with a tendency to harden, and a number of items of importance are on new high levels. Shortage of labor is rendering impracticable full capacity operation of factories. Dealers in new and second-hand machinery find a ready sale for all available stock.

Collections are reported fair to prompt and on the whole very satisfactory. The outstanding feature in this vicinity of late is the further restriction of credits.

ELECTRIC RANGES.—A heavy sale of ranges is anticipated this fall. One distributer has placed an order for two carloads in excess of last year's requirements, for October delivery.

GLASS INSULATORS.—Prices were advanced up 5 per cent on July 1 by an Eastern factory.

DOMESTIC APPLIANCES.—A Western manufacturer of sewing-machine motors advanced prices on July 1 on his entire line to the extent of $1 each on certain models.

POLE-LINE HARDWARE.—The government's requirements of steel are creating a shortage. On galvanized bolts and braces prices have gone up 10 per cent. One large distributer suggests to jobbers that on all line hardware in warehouse a net profit of 10 per cent should be added. This has been applied to his own stock.

COLLECTIONS AND CREDITS.—Jobbers and manufacturers are following a policy of demanding shorter terms of credit and giving preference in sales to those who make prompt payment.

WOOD POLES.—Forty-foot chestnut poles that sold four months ago at $6.85 now command $9.85. It is difficult to get chestnut poles of this size, and about three or four carloads are the only stock a leading jobber has on hand. Cedar, red and white, is in pretty fair supply. It is easier to obtain cars for shipping in the West than in the East, though transportation conditions have greatly improved everywhere. A shipper has been trying to get two and three cars of poles to Eastern points, but they are several weeks behind. The new freight advance of 25 per cent is taken care of by adding 6 per cent per 100 lb. on poles.

STEEL STRAND.—Stranded wire for guying poles went up 2½ per cent on July 15.

LAMP GUARDS.—On July 1 prices of the Matthews line were increased 5 per cent.

LIGHTING FIXTURES.—The government is taking a lot of goods, running heavily on Brascolite fixtures. There has been no change in prices since June 1. One prominent concern stated that sales are better than a year ago.

SCHEDULE MATERIAL.—An order for 25,000 pieces, averaging in cost about $8,000, was declined by a jobber last week because delivery was required in three weeks. This was said to be impossible. A resale price giving an extra 10 per cent discount is expected on Schedule B.

SWITCHES.—Following an order from a jobber an Eastern manufacturer notified his customer as follows: "We shall be unable to make very prompt shipment of this material if it is for commercial use. If, however, this is for government work and you can favor us with a government requisition covering same it will greatly facilitate delivery." These notifications are getting to be the rule on orders of all kinds.

PORCELAINS.—Cleats, knobs and tubes were advanced 10 per cent.

BELLS AND GONGS.—A further increase in price was announced as effective July 26.

CHICAGO

Signs that industrial business will continue to be good in the Chicago territory are to be found everywhere. Nearly every issue of the daily papers carries announcement of some new factory being started or some real estate being purchased for this purpose. The unified traction plan, which now stands at a critical stage, may at any minute become a reality, bringing one step nearer the great construction program which it would necessarily entail. The appointment of a committee on power unification for Illinois this week is also looked upon as an omen favorable to the business of those who manufacture tie-line apparatus, as it is probable that the number of industrial plants which will be shut down in the coming months will exceed the usual number considerably. The jobbers' business in general has been good.

PORCELAIN.—Prices have advanced on some standard porcelain.

POLE-LINE HARDWARE.—There has been a slight advance in the Joslin line of pole-line hardware.

COPPER WIRE.—Rubber-covered copper wire and lamp cord still remain on the 34-cent base, and the weatherproof is now sold at 32 cents.

SCHEDULE MATERIAL.—Sales of schedule material are confined largely to industrial plants. The market here is good.

FANS.—While the weather has been extremely hot, a great volume of fan business has not materialized.

OIL FILTERS.—One Chicago manufacturer is in a position to make prompt deliveries on all of the more common sizes of oil filters.

WASHING MACHINES.—The washing-machine business in the territory continues to be in good volume. As indicative of the condition, one manufacturer, whose company is eleven years old and has sold about 300,000 machines, has stated that his business so far this year is some 300 per cent better than during the same period for 1917. His 1917 business was almost 100 per cent larger than his 1916 business.

SECOND-HAND MACHINERY.—Chicago second-hand electric machinery dealers are reported to have an unusually desirable and complete stock of machines. These dealers say, however, that this condition will not obtain for long, and regular customers have been advised to select quickly from this stock and order by wire, as the demand is greater than the supply. In the second-hand trade there is a large demand for good leather belting, and an appeal is being made for beltings free from rivets and rivet holes, not burned, oil-soaked, stretched on the edges or scarred. The offer second-hand machinery dealers are making is that if such belts are sent to them for examination they will make high cash offers and remit by return mail, with the understanding that they also return, freight or excess charges prepaid, all belting rejected as not up to specifications. One company is offering 80 cents per pound and up, depending on the condition of the belting.

ATLANTA

The precipitation at Southeastern watersheds has been light and not in sufficient quantity to supply normal water-power requirements, and as a result of the continued drought the large power companies in this section are suffering. The Southern Power Company and the Georgia Railway & Power Company have asked some of their customers to discontinue the use of power temporarily, while the Central Georgia Transmission Company and the Columbus Power Company have arranged for power curtailment by their customers.

The new order of the Fuel Administration regarding "lightless nights" goes into effect this week, and while the amount of curtailment will be small it will tend to relieve those power companies that are now supplementing water power with steam power.

It has been announced that Fayetteville, N. C., has been selected as a site for an artillery camp. There is a rumor that a good portion of this camp will be made up from Anniston, Ala. Unconfirmed reports are out to the effect that Columbus, Ga., will be selected as a site for the firing school now at Fort Sill, Okla.

Investments in textiles and shipping are active this week. The George A. Fuller Company of New York City will construct piers and warehouses for the Quartermaster's Corps, costing $10,000,000. The Burger Steam Ways Company, Tampa, Fla., will expend $200,000 to increase present facilities. The Roger & Crawford Spinning Company, Lincolnton, N. C., will build a 10,000-spindle mill and use electric power.

BOSTON

Little change is to be seen in the volume of trade this week. Collections remain good, on the whole, and prices hold firm at previous levels. Stocks are substantial in most lines. Railroad conditions do not show much improvement, and deliveries are correspondingly handicapped. The trade in appliances is being well maintained. Plans have been announced for the further enlargement of army base facilities at Boston, and the war market seems to increase without limit. Labor conditions show some improvement, and employees at the Lynn plants of the General Electric Company who left without notification are now returning in considerable numbers. Factory stocks of electrical equipment used in industrial and war work are running low in general. The supply of raw materials to manufacturers is now governed almost exclusively by priority regulations, and the industry is rapidly getting adjusted to these unprecedented conditions. Credits are being watched closely, but there is no evidence of underlying instability.

WIRE AND CABLE.—Bare wire is being quoted at 28¾ cents base price and rubber-covered wire at a 34-cent base. Deliveries range from five to ten weeks, and little change is noted in these. About 75 per cent of the orders now being filled are for government work. The anticipated increase in street-railway wire purchases, following recent fare developments, has not yet materialized.

VACUUM CLEANERS.—Manufacturers are very busy filling orders, and in some cases desirable business has to be turned down for the present on account of lack of facilities for production. There is prospect of a price increase, according to a representative manufacturer. Factory stocks are very low. The jobbers report a falling off in the cleaner sales account, which however, is not likely to outlast the summer.

SWITCHES AND PANELS.—Manufacturers' stocks are very low. An enormous output is going into government work. More labor could be used to advantage if it could be obtained. The demand for standard and special equipments is very heavy. Raw material is in hand at the factories in reasonably good quantities.

FANS.—Seasonable weather has resulted in a heavy movement of fans to the ultimate consumer, but not enough to lower seriously the existing supplies in the warehouses. Some reordering of sizes sold out in the last few days of the hot weather is being cared for. The increased prices of the larger fans this year are unquestionably retarding retail purchases.

FLASHLAMPS. —A good business is being handled in connection with night watchmen's service in munition and other industrial plants doing war work. Stocks are somewhat below normal, prices remaining firm, and the military demand is not up to former levels.

MOTORS.—Apart from the handicaps of railroad congestion and embargoes the flow of motors into New England is being well maintained. The factories are speeding up to meet the demand in general better than formerly. Shipments are being quoted in some cases as low as three to five weeks from the factory. Stocks of single-phase motors up to 5 hp. are in good volume at Boston just now, and up to 10 hp. three-phase motors are fairly plentiful. Prices are steady and inquiries are coming in at a brisk rate.

WASHERS.—The demand is heavy, and it is no easy matter to build up a satisfactory stock at this time.

MINIATURE LAMPS.—Special lamps and miniatures are running short in the open market. The civilian trade has no conception of the magnitude of the government demand and is inclined to wonder at times why the supply of candelabra lamps and other shapes beyond the ordinary does not increase faster. Under present conditions the industry is fortunate to obtain the so-called bread-and-butter sizes in ample quantities for its needs.

SEATTLE

Seattle jobbers and dealers report no abatement in general business activity. The more optimistic predict that heavy sales are in prospect for the fall. Along domestic lines washing-machine sales were easily the leader. The total volume of sales was about the same as the previous week. Orders in Seattle for several vessels for the Emergency Fleet Corporation swelled the volume noticeably. Government buying for the Puget Sound Navy Yard and the cantonment in the Puget Sound district is very light. Power apparatus sales show no noticeable increase over the past month. Inquiries for power apparatus for lumber mills to be electrified have not culminated in orders; in fact, mill building in the Puget Sound territory is very limited, consisting mainly of extensions to existing plants and rebuilding plants destroyed by fire. The Gray's Harbor country and certain districts in Oregon report considerable activity in mill building, particularly in plants of medium capacity. Central-station buying shows no particular change over the last three or four months, consisting of staples, which move well. Central stations report the movement of electric ranges satisfactory, but the demand is not large. Strictly commercial business shows no decided change, the volumes maintaining the level established in the early spring.

The survey of housing facilities in Seattle shows that approximately 5000 residences must be built to meet imperative war housing needs. The Chamber of Commerce has appointed a committee to conduct an organized campaign to obtain pledges from corporations, firms and individuals for the immediate building of a definite number of houses within the next four months. Portland authorities state that the city has a serious housing problem to meet and steps will be taken immediately to meet the demand for housing employees. At the Standifer shipyards, Vancouver, Wash., it is proposed to erect immediately a 600-room hotel and 100 cottages.

The Pacific Power & Foundry Company of Portland, Ore., and Seattle, Wash., plans the immediate expenditure of $100,000 in extensions and betterments.

VACUUM CLEANERS.—The summer demand has kept up well, with the expectations of both jobbers and dealers realized. Indications are that the fall business will be comparatively heavy.

PORCELAIN.—During the past week the demand was rather light. However the demand fluctuates with orders from the shipyards and central stations. Stock is in fair condition and prices remain the same.

RUBBER-COVERED WIRE.—The demand is steady with no change in prices. Stocks have been maintained fairly well by advised ordering.

LAMPS.—It is exceptionally hard to obtain larger sizes, and the demand for these is heavy—shortage is expected to continue. Smaller and standard sizes are coming through nicely.

CONDUIT.—Pipe is still very hard to obtain with a constantly increasing demand from shipyards.

SAN FRANCISCO

From all sides come reports of excellent business, which soon will be augmented by even more ambitious plants. For instance, the already considerable plant of the Bethlehem Steel Company of San Francisco is to be doubled by the purchase of nearly fifty acres, giving excellent rail and water facilities. The great yard of the Pacific Coast Shipbuilding Company near Baypoint is near completion, and soon will follow the construction of necessary workmen's housing. The present Potrero yards of the Bethlehem Steel Company are to be fitted with a cafeteria to cost over $100.000. New schools for Oakland and San Francisco are announced. New United States government construction includes sixty-one cantonment buildings at Fort MacArthur, near San Pedro, costing $120,000.

CONDUIT.—Both black and sherardized or galvanized conduit and fittings took another advance of 10 per cent during the last two weeks.

WEATHERPROOF WIRE.—All sizes of weatherproof copper wire have just advanced 3½ cents a pound for Pacific Coast delivery in conformance with the new factory quotations. Deliveries are quite ample to take care of the local situation.

GALVANIZED-IRON WIRE.—A small advance of 1 cent per pound in price has just become effective. A feature of the last week was a large order for size 10 of B. B. galvanized-iron wire from the Northern California Power Company, aggregating 15,000 lb.

SCHEDULE MATERIAL.—Dealers, jobbers and manufacturers report a greatly increased demand for staple wiring devices, such as sockets, switches and cut-outs.

ELECTRICAL APPLIANCES.—Standard 6-lb. irons now list at $6 each, standard upright toasters with racks at $6.50 each, and all other small heating appliances, comprising electrical grills, percolators, disk stoves, air heaters, water heaters and the like, have advanced from 5 to 10 per cent. Manufacturers and jobbers report large sales of these devices prior to the advance. The present large stocks, coupled with present public apathy, means that vigorous fall campaigns will be made.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List Per 1000 ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95 00
No. 8 stranded	115 00
No. 6 stranded	160 00
No. 4 stranded	205 00
No. 2 stranded	266 00
No. 1 stranded	315 00

Twin-Conductor

No. 14 solid	104 00
No. 12 solid	135.00
No. 10 solid	185 00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	57 25

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	66 75

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	97.75

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	126 80

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20%
Coil to 1000 ft	5%

	No. 12 Solid
Less than coil	+20%
Coil to 1000 ft	5%

Twin-Conductor

	No. 14 Solid
Less than coil	$115 00 to $80 00
Coil to 1000 ft	80.00 to 75 00

	No. 12 Solid
Less than coil	+20%
Coil to 1000 ft	5%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	12%
1/5 to std. pkg	20%
Std. pkg	44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to 12%
1/5 to std. pkg	List to 20%
Std. pkg	25% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	32
Barrel lots	28	29

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	35	35
50 to barrel	.322	.332
Barrel lots	.292	.302

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5 00
3/8	250	7.50
1/2	100	10 00
3/4	50	13 00
1	50	21 00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45 00
2½	25–50	52 00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75.00	$69.75
3/8-in. double strip	75 00	72.00
1/2-in. single strip	100 00	93 00
1/2-in. double strip	100.00	96 00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75 00	$64 25
3/8-in. double strip	78 25	71 25
1/2-in. single strip	100 00	85 00
1/2-in. double strip	105.00	95 00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0.05½	1	$0 25
1/4	.06	1¼	.33
3/8	.09	1½	.40
1/2	.12	1¾	.47
5/8	.15	2	.55
3/4	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$55 00	$24.45	$21 50
1/4-in.—	30.00	27.00	23.50

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$60.00	$30.00	$26.50
1/4-in.—	$65.00	$32.50	$29.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
1/4	$0.08½
3/8	.08½
1/2	.08½
3/4	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
1/4	$0 05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1 10
2½	.40	1 80
3	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	12%	14%
2500 to 5000 lb	15%	17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 to 1/2 In.	3/4 to 3 In.
Less than 2500 lb.	+5% to 1½%	+3% to 3½%
2500 to 5000 lb	+2% to 4½%	List to 6½%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5 00
Discount	30%

CHICAGO

List price	$5 00 to $6.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std Pkg.	List
3-amp. to 30-amp	100	$0.25
35-amp. to 60-amp	100	.35
65-amp. to 100-amp	50	.90
110-amp. to 200-amp	25	2 00
225-amp. to 400-amp	25	3.60
450-amp to 600-amp	10	5.50
600-Volt		
3-amp. to 30-amp	100	$0 40
35-amp. to 60-amp	100	.60
65-amp. to 100-amp	50	1 50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5.50
450-amp. to 600-amp	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	50%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$5 00
1/5 to std. pkg	4 50

Standard packages, 500. List, each $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$7 00
1/5 to std. pkg	5 75

Standard packages, 500. List, each, $0 07

LAMPS, MAZDA

105 to 125 Volts

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.30
60-watt—B	100	.35
100-watt—B	24	.70
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30	24	.77
Round Bulbs, 4⅜-in., Frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$35.90
Coil to 1000 ft	26.95

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $35.00
Coil to 1000 ft	25.00 to 26.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24.00

CHICAGO

Net per 100	$30.00

OUTLET BOXES

Nos.	List, Per 100
101—A, A 1¼, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1¼, 4 S.	30.00
103—C.A., 9, 4R, B 1¼	25.00
106—F.A., 7, C.S., 1¼, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25%	20%
$10.00 to $50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$38.00
1/5 to std. pkg	19.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$15.80 to $24.15
1/5 to std. pkg	14.80 to 21.00

Standard package, 2200. List per 1000, $20.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500 5½ N.C.—Solid	Std. Pkg. 4000 Nail-it—N.C.
Less than 1/5 std. pkg	$20.00	$30.75
1/5 to std. pkg	15.60	24.00

CHICAGO

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.—Solid	Std. Pkg. 4000 Nail-it—N.C.
Less than 1/5 std pkg	$9.48 to $18.40	$30.75 to $36.80
1/5 to std. pkg	$8.88 to $16.00	24.20 to 32.00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
¼-in. cap key and push sockets	500	$0.33
¼-in. cap keyless socket	500	.30
¼-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	8%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List to 10%
1/5 std. pkg	16⅔%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0.80
60-amp. S. P. S. T	1.20
100-amp. S. P. S. T	2.25
200-amp. S. P. S. T	3.48
300-amp. S. P. S. T	5.34
30-amp. D. P. S. T	1.20
60-amp. D. P. S. T	1.78
100-amp. D. P. S. T	3.38
200-amp. D. P. S. T	5.20
300-amp. D. P. S. T	8.00
30-amp. 3 P. S. T	1.80
60-amp. 3 P. S. T	2.68
100 amp. 3 P. S. T	5.08
200-amp. 3 P. S. T	7.80
300-amp. 3 P. S. T	12.00
Low Grade:	
30-amp. S. P. S. T	0.42
60-amp. S. P. S. T	.74
100-amp. S. P. S. T	1.50
200-amp. S. P. S. T	2.70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T	1.22
100-amp. D. P. S. T	2.50
200-amp. D. P. S. T	4.50
30-amp. 3 P. S. T	1.02
60-amp. 3 P. S. T	1.84
100-amp. 3 P. S. T	3.76
200-amp. 3 P. S. T	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+5%
$10 to $25 list	11%
$25 to $50 list	14%
	Low Grade
Less than $10 list	5%
$10 to $25 list	16%
$15 to $50 list	24%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+15% to +5%
$10 to $25 list	List to 11%
$25 to $50 list	5% to 14%
	Low Grade
Less than $10 list	+5% to 5%
$10 to $25 list	8% to 16%
$25 to $50 list	16% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole	250	$0.28
5-amp. single-pole, ind	250	.32
10-amp. single-pole	100	.48
10-amp. single pole, ind	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+10%
1/5 to std. pkg	8%
Std. pkg	25%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg	List to 16⅔%
Std. pkg	25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	40%	30%
$2.00 to $10.00 list	50%	40%
$10.00 to $50.00 list	64%	52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list.	25% to 40%	15% to 30%
$2.00 to $10.00 list.	25% to 50%	15% to 40%
$10.00 to $50.00 list.	35% to 64%	25% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00
Discount	30%

CHICAGO

List price	$5.50 to $6.00
Discount	25% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$.434
No. 18, full spools	.384

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.69
No. 18, full spools	.575

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Broid

NEW YORK

No.	Price per 1000 Ft. Net Less than 500 Ft.	 500 to 1000 Ft.	 1000 to 5000 Ft.
14	$20.00	$15.00	$11.25
12	27.10	23.20	17.05
10	37.80	32.40	23.75
8	53.35	45.70	33.35
6	84.40	72.35	53.05

CHICAGO

No.	Price per 1000 Ft. Net Less than 500 Ft.	 500 to 2500 Ft.	 2500 to 5000 Ft.
14	$..... $21.00	$..... $16.00	$..... $13.25
12	27.53– 28.70	23.86– 28.70	22.02– 24.50
10	33.02– 40.10	30.48– 40.10	27.44– 34.23
8	46.09– 56.50	42.54– 48.23	38.99– 41.34
6	61.30– 91.18	61.76– 77.84	52.18– 66.72

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$38.40
25 to 50 lb	36.40
50 to 100 lb	32.40

CHICAGO

	Per 100 Lb. Net
Less than 25 lb	$39.50 to $39.72
25 to 50 lb	38.50 to 38.72
50 to 100 lb	37.50 to 37.72

NEW APPARATUS & APPLIANCES

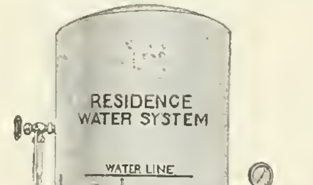
A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Alternating-Current Switches

Manually operated switches for starting small induction motors and protecting alternating-current light, power and individual motor circuits are now being manufactured by the Allen-Bradley Company, 495 Clinton Street, Milwaukee, Wis. The under-voltage release coil and mechanism on this switch are smaller than the coil and armature on the similar automatically operated switch. The switch contacts are of the copper-to-copper rolling type. Instantaneous or time-limit overload relays are mounted directly under the clapper switch. The time element of the overload relays may be adjusted so that the electrical equipment is not disconnected from the line with instantaneous fluctuations of load but is protected against serious overload. The instantaneous relays are of the hinged type and will not permit the starter to be closed when starting until the current has reduced to a predetermined value.

Self-Oiling Electric House Pump

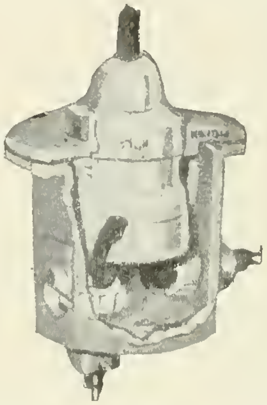
For pumping water from shallow wells, cisterns, springs, lakes and other sources and forcing it into pressure tanks, open tanks for water supply for private residences, public places, etc., F. E. Myers & Brother, Ashland, Ohio, are manufacturing a self-oiling electric house pump. The pump is driven by a 6-hp. direct-current or alternating-current motor through a simple power transmission with few working parts, these being fully inclosed and running in oil. The pump may be fitted with a 32-volt direct-current motor for use with a farm-lighting system. The operation is automatically controlled by the use of an automatic pressure controller, which, it is claimed, saves electricity, wear and tear on the pumps and time and labor in starting and stopping.



ELECTRIC HOUSE PUMP

Floor Box

Where an adjustable box is unnecessary for a floor outlet or where the conduits are not over ½ in. (1.2 cm.) in diameter, a floor box placed upon the market by M. B. Austin & Company, Chicago, can be well used. Each box is drilled and tapped for 4½-in. (11.4-cm.) conduits, and plugs are supplied so that the outlets not in use can be hermetically sealed. Boxes are galvanized inside and outside. The cover, nozzle and flush plug are polished brass.

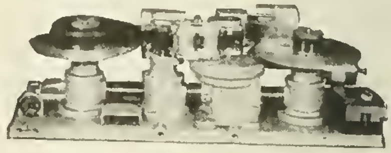


OUTLETS NOT IN USE MAY BE SEALED

Electric "Movie" for Show Windows

A new type of moving-picture machine for show windows or other display space has been brought out by the Attractograph Company, 220 West Forty-second Street, New York City. This machine displays pictures which can be readily seen in broad daylight as well as by night. One has been purchased by the government for forest service demonstration. Its operation is entirely automatic in all its functions. After the reel is projected it is automatically rewound and then displayed again, so that after the machine is arranged and started it will continuously operate for an indefinite period without any further attention.

The outfit consists of two separate parts, the moving-picture machine and the miniature theater in which the pictures are displayed. The moving-picture machine is operated by a standard-type Westinghouse universal motor, which will operate on either direct current or alternating current. Two horizontal disks carry the film, which passes in one direction for projection and in the opposite one for rewinding.



MOTION-PICTURE MACHINE APPROVED BY BOARD OF UNDERWRITERS

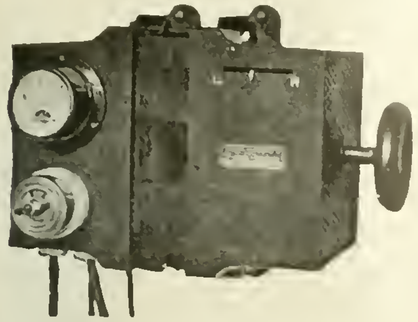
A 250-watt "mazda" stereopticon lamp, with concentrated filament, furnishes the light, which is automatically extinguished when the machine stops and during the process of rewinding. The machine is equipped with automatic safety switches, which stop the motion and put out the light in case of breakage of the film.

The moving-picture projector is placed about a foot from the miniature theater in which the picture is displayed so that the light enters an aperture in the base; here it strikes a mirror set at an angle of 45 deg. and is reflected upward upon a screen set on what would be termed a stage. Another 45-deg. mirror reflects an image of the screen, making the picture appear to the audience to come from a screen on the rear wall of the theater.

Standard non-inflammable films in lengths of 50 ft. to 500 ft. (15.2 m. to 152 m.) can be exhibited. This apparatus is approved by the National Board of Fire Underwriters.

Transformer for Motion-Picture Service

As shown in the accompanying illustration, the American Transformer Company, Newark, N. J., has developed a special type of transformer for motion-picture service in connection with incandescent lamps. The transformer is at the present time being marketed by the Precision Machine Company, 317 East Thirty-fourth Street, New York City. The control of the current in this transformer is obtained by means of a variable magnetic leakage path which permits a greater or lesser amount of the magnetic flux to pass between the primary and secondary coils, thus changing the secondary voltage. The adjustment is made by turning a knob placed at the right end of the transformer. An indicator in the slot marked *L* and *H* shows approximately the range that the current can be increased or decreased. At the opposite end of the transformer the ammeter and switch are mounted. All connections of the transformer are therefore made at one end and cannot in any way interfere with the regulating device.


STARTING SWITCH ALLOWS LAMP TO BE HEATED GRADUALLY

The regulating device is so constructed that it operates quietly and permits of adjusting the current to the exact value required. The starting switch is connected through a resistance to the primary winding so that at the starting point the voltage supplied to the lamp is only about half normal voltage. This permits the lamp to be heated gradually and prevents an excessive rush of current. The transformer is intended to be mounted on the wall within easy reach of the operator. The transformers are made in two sizes, one suitable for 600-watt lamps and the other for 1200-watt lamps.

Loom Fastener for Any Style Conduit Box

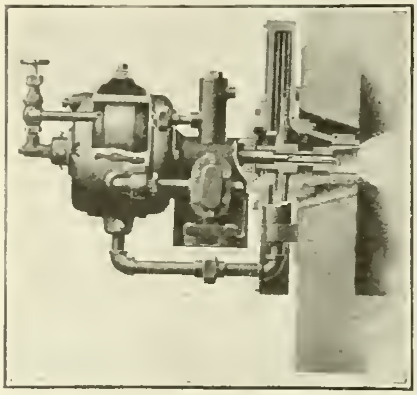
A fastener shaped in such a way that it will grip and hold firmly any size of non-metallic conduit is being manufactured by the Snover Electric Company of Toledo, Ohio. The manufacturers say that this fastener will not penetrate the tubing and tear the lining. The conduit cannot be drawn from the box when this fastener is in place because the greater the pull on the loom the greater the holding strength of the fastener. No tools are needed to install this device.

Motor-Driven Driller and Tapper

A multiple drilling head which houses four separate drilling spindles is the feature of a motor-driven drill press that is being manufactured by the Landau Machine & Drill Press Company, Inc., 19 West Forty-fourth Street, New York City. The multiple drilling head is composed of a stationary upper member rigidly affixed to the driller standard and a rotatable lower member which carries four drill spindles, each one having an independent means of adjustment for depth of feed. A collar and a handle serve to rotate the movable bonnet quickly and easily so that when one chuck has done its work a simple movement of the handle brings the next chuck into place. The entire machine occupies a floor space of approximately 12 in. by 28 in. (30 cm. by 66 cm.), and it is claimed that it will accomplish as much as a four-spindle drill press. The machine is operated by a motor of ¼ hp. and is arranged so that only one spindle operates at a time, the rest remaining idle until wanted.

Compact Burner for Fuel Oil

One way to help prevent a recurrence of the fuel conditions of the past winter is to use fuel oil more extensively in those sections of the country where it can be easily and cheaply obtained. For successfully burning fuel oil the apparatus must be simple. Machinery to drive pumps, air blowers and gear boxes complicates the problem, entailing initial cost and heavy expense for upkeep. The fuel oil, moreover, must be perfectly atomized, and at the same time sufficient air must be introduced to get thorough combustion.


OIL BURNER SUITABLE FOR FURNACES UP TO 500 HP.

The foregoing factors have been taken into consideration in designing the Ray oil atomizer. It consists of an open cup, lying horizontally and driven at 3450 revolutions per minute so as to force air at high velocity around the cup and in a direction away from the cup. By this method sufficient air is forced into the furnace to maintain proper compression and also direct the fire into the fire box. Since the air leaving the blower would have a tendency to turn in the same direction as the atomizer, causing the fire to be unsteady and throwing oil on all sides of the fire box, guide vanes have been inserted in a nozzle surrounding the atomizer, which direct the air from a revolving motion to a straight path.

The oil atomizer is driven by a Westinghouse totally inclosed motor having a hollow frame through which the fuel oil is allowed to pass continually. This lengthens the life of the motor by keeping it cool at all times and at the same time warms the oil somewhat before it it ignited. This arrangement also permits the use of the burner in a boiler room with a temperature so high that an ordinary open motor would overheat and burn out. Fuel oil as low as 14 gravity can be burned successfully, without smoke, soot or dirt, in all types of fire boxes, where high heat is needed, according to the manufacturer.

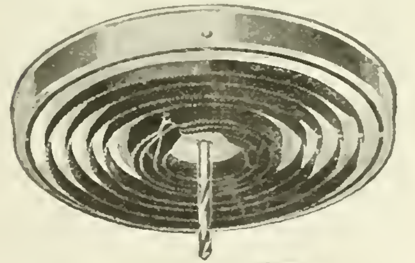
One man can supervise a large number of these oil burners, and they can be used in any furnace up to 500 hp. rating. The burner is made by the W. S. Ray Manufacturing Company, 220 Market Street, San Francisco, Cal.

Low-Voltage-Indicating Measuring Instruments

In the latest model of low-voltage and current instruments made by the American Ever Ready Works, Long Island City, N. Y., simple and strong construction has been well carried out to insure accuracy. Dead-beat movement of the pointer is obtained through the use of an aluminum vane, supported on hardened steel pivots, which moves in a partially closed air chamber. This allows the pointer to be governed by the smallest change of current flow. The sudden vibration of the car will not affect reading as the torque produced by the magnetic field is very high. Both of the new models are dust-proof and waterproof. The case diameter of these instruments is 2⅛ in., and the standard ranges are 15-0-15, 20-0-20 and 30-0-30 amp. They can be used in places where the voltage and current ranges are low and where they must stand considerable vibration. They are especially designed for use on automobiles.

Expanding Rotary Hack Saw

For cutting circular holes in metal, wood, slate, marble, etc., Barnes & Irving, Inc., Syracuse, N. Y., are marketing the Misener expanding rotary hack saw that is shown in the accompanying illustration. This tool consists of an outer rotary with circular grooves fastened on a shank. This shank has a centering drill at one end and is arranged at the other end to fit the ordinary brace. The grooves of the rotary are designed so that when sharp blades are placed in the grooves different pipe sizes can be cut.


HACK-SAW BLADES FIT IN GROOVES

Trade Notes

REVOCATION OF CANADIAN BLANKET LICENSE POSTPONED.—The War Trade Board, Washington, D. C., gives notice of the revocation of the general import license, covering the importation of commodities from Canada and Newfoundland as to the shipment of articles on the list of restricted imports, which, by a ruling of the board published July 8, was to have been effective from July 20. It has now been postponed until Aug. 15.

CATALOGS AND PRICE LISTS FOR CHILE.—John R. Bradley, United States Consul at Punta Arenas, Chile, S. A., suggests, in a report to the Department of Commerce, that catalogs and price lists, or at least approximate information as to prices, be furnished local firms and the consulate for the installation of electric light plants. It is desirable that the catalogs be in Spanish, although those in English will be of use to a number of firms that have English employees.

GERMAN TRADE AND THE WAR.—The Department of Commerce, Washington, D. C., in its "Miscellaneous Series, No. 65," has published in book form "German Trade and the War," by Chauncey Depew Snow, assistant chief of the Bureau of Foreign and Domestic Commerce, and J. J. Kral of the research division. It deals with commercial and industrial conditions in war time and the future outlook. Special attention is given to the subject of raw materials and the import trade. The price is 25 cents, and the pamphlet is sold by the Superintendent of Documents, Government Printing Office, Washington, D. C.

INCREASE IN WAGES AT BOSCH MAGNETO PLANT.—A flat increase of 10 per cent in wages to all employees of the Bosch Magneto Company, Springfield, Mass., who are classed as wage earners was announced, effective Aug. 1. Nearly 900 employees will receive the increase, which was voluntarily established by the company after an extended investigation of earnings and expenses. Piece-work and day-rate employees will share in the raise. The plant is now being operated under the presidency of Joseph A. Bower, Arthur T. Murray being general manager and F. D. Norman factory manager. It is the third largest German-owned concern which has been taken over by the United States government under the direction of A. Mitchell Palmer, federal custodian of enemy property.

GOVERNMENT CONTRACTS.—The government departments at Washington, D. C., have made purchases and awarded contracts since July 17 as follows: General Engineering Depot of the Army—Cutter Electric Company, single-pole circuit breakers; Sperry Gyroscope Company, spares for high-intensity searchlights; United States Electrical Tool Company, spares for type K-M motors; Cooper Hewitt Electric Company, mercury-vapor lamps; H. W. Johns-Manville Company, asbestos felted insulation; Carroll Electric Company, cone shades, fuse plugs, porcelain cleats, cut-outs; General Electric Company searchlamp motors of 5 hp. and 3 hp., floodlighting projectors; Star Electric Motor Company, spares for lathes, drill presses, tube expanders; Garford Motor Truck Company, magneto batteries, breakers, low-tension wire; Winton Company, parts of power plants for searchlamps; Robbins & Myers Company, spares for motors for grinders.

CAMPBELL COMPANY NON-STRIKE AGREEMENT.—The Campbell Electric Company, Lynn, Mass., manufacturer of X-ray apparatus for the American expeditionary forces in France, has signed an agreement with its employees providing that no strike or walk-out shall take place during the period of the war. The agreement was signed by the company and by 150 employees, representing 75 per cent of the total payroll, and it provides that all grievances or demands shall be submitted to the War Labor Board, with the understanding that its decision shall be final. Recognition of the important war work of the company and its force was inserted in the text of the agreement. This agreement was executed during the first days of the walk-out at the General Electric Company's Lynn Works, and widespread expressions of appreciation of the loyalty of the employees to the country's welfare in the face of outside pressure are being heard in the Lynn and Boston districts.

THE PYROLECTRIC INSTRUMENT COMPANY of Trenton, N. J., has moved from 148 to 636 East State Street.

THE LOCKE INSULATOR MANUFACTURING COMPANY has moved its general sales office from Rochester to Victor, N. Y., where the factory is situated.

JOHN H. BARKER of New York City is the sales agent for the Breco Electric Company of Toledo, Ohio, manufacturer of electric charging apparatus for storage batteries.

THE CRESCENT TRUCK COMPANY of Elizabeth, N. J., has purchased from the Bethlehem Shipbuilding Corporation Moore plant all right, title and interest in the Crescent electric industrial truck.

RUTHERFORD & UPTEGRAFF, in the First National Bank Building of Pittsburgh, Pa., have been appointed exclusive representatives in the Pittsburgh and nearby territory for the Electrical Engineers' Equipment Company of Chicago.

J. AUSTIN MURPHY, one of the directors of the Crane Company and manager of the city sales department of Chicago, has sailed for France to look after the interests of the company, and particularly the interests of Crane men with the American expeditionary forces. Mr. Murphy's temporary address is in care of the American Express Company, No. 7 Rue Scribe, Paris.

CRANE LIMITED, CANADA, on June 1 was taken over by Crane Limited. E. C. Townsend, second vice-president of Crane Limited, is general manager for the Dominion, with headquarters at 128 Bleury Street, Montreal. H. M. Agnew at Winnipeg and J. E. McIlreevy at Vancouver, formerly managers of the Crane branch houses in those cities, continue as managers for Crane Limited.

THE NATIONAL PIPE BENDING COMPANY of New Haven, Conn., announces that it has just entered into an agreement with Franklin Williams, Inc., of 39 Cortlandt Street, New York City, to act as that concern's representative in New York City and vicinity. F. N. Currier is president of the company and E. T. Franzen secretary and treasurer. Their experience as manufacturers and sales agents of steel specialties makes the connection especially desirable.

THE INTERNATIONAL WESTERN ELECTRIC COMPANY, INC., recently incorporated, has offices at 195 Broadway, New York City. The new organization will take over the Western Electric Company's export and foreign business. The officers of the new company follow: H. B. Thayer, president; H. A. Halligan, vice-president; Gerard Swope, vice-president and general manager; R. H. Gregory, comptroller and secretary, and J. W. Johnston, treasurer. W. E. Leigh will be assistant foreign manager, with J. J. Gilbert as export sales manager.

THE ROBBINS & MYERS COMPANY of Springfield, Ohio, has begun work on the new one-story frame warehouse on the property of the company just adjoining the bridge near the Big Four tracks. The building will be 158 ft. by 148 ft. and will be floored with concrete. The newstructure will accommodate the traffic department and also the storage which now requires three warehouses in various parts of Springfield. Disposition of the space left vacant in Plant No. 1, first floor, by the removal of the traffic department has not yet been definitely decided. Among the possibilities which will probably be considered is that of turning the space over to the engineering department for motor testing, thereby relieving congestion elsewhere in the plant.

WILLIAM BLAKE PIERCE has been appointed Eastern district sales manager for the Edison Electric Appliance Company, with offices at 147 Waverley Place, New York City. This district covers New England, New York, Pennsylvania, Maryland, Delaware and the District of Columbia. Mr Pierce was at one time sales manager of the Kansas City Electric & Telephone Supply Company. He was next employed by the Western Electric Company, being for seven years specialist in charge of appliance sales. Three years ago last November he became Eastern representative, covering New England, New York and Pennsylvania for the Hughes Electric Heating Company. Last September he went to Washington, D. C., and in January opened the government office of the Edison Electric Appliance Company. On June 15 he removed to New York City to take up his present work. Mr. Pierce will continue to supervise the government work, although P. L. Miles, formerly Southern district Hughes representative, is now the local government work representative at Washington.

Trade Publications

HOUSE PUMPS.—Electrically operated pumps, with automatic switches to cut in and cut out at predetermined pressures, are described in bulletin No. 45, issued by the Peters Pump Company, Kewanee, Ill.

ELECTRIC IRONS.—A folder entitled "C.-H. Electric Laundry Irons" may be obtained from the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Flatirons weighing 7½ lb. and 9 lb. are described and illustrated.

HYDRAULIC VALVE.—Large electrically operated and hand-operated valves suitable for hydroelectric plants are shown in bulletin No. 1, issued by the Larner-Johnson Valve & Engineering Company, Philadelphia. Standard sizes are also given.

BOILER ARCHES.—The Green Engineering Company, East Chicago, Ind., has issued a sixteen-page booklet describing and illustrating "Sealflex" arches, which are designed to increase boiler rating. The booklet tells the story of the development of these arches and illustrates features of their construction.

ELECTRIC GRAB-BUCKET HOIST.—Bulletin No. 48,938, being distributed by the Sprague Electric Works of the General Electric Company 527 West Thirty-fourth Street, New York City, describes and illustrates the application of its hoists, giving in addition engineering data concerning the various sizes.

WASHING MACHINES. — The Globe Manufacturing Company, Perry, Iowa, has issued a sixteen-page catalog illustrating and describing its "Quicker Yet" power-driven and hand-driven washers. The illustrations are shown in three colors. Descriptions and specifications of each machine are given.

LIGHTING FIXTURES.—C. G. Everson & Company, 70 West Lake Street, Chicago, has issued an eighteen-page catalog of its commercial lighting and ornamental lighting fixtures. The fixtures illustrated include those of the inclosing-bowl type, enameled-steel bowls and reflectors and ornamental pieces for decorative lighting.

MOTOR-OPERATED BRAKES.—"Motor-Operated Brakes for Alternating-Current Service" is the title of the new four-page booklet "A," being distributed by the Cutler-Hammer Manufacturing Company of Milwaukee. Dimensions, engineering data and the formula for determining the retarding torque required for any brake installation are given.

New Incorporations

THE ELECTRIC MOTOR CORPORATION of New York, N. Y., has been incorporated with a capital stock of $20,000 by G. Katz, S. Feldman and S. Wetzler, 583 Riverside Drive, New York, N. Y.

JOHN FORSYTH, LTD., of Kitchener, Ont., Canada, has been incorporated with a capital stock of $300,000 to manufacture engines, generators, machinery, etc. The incorporators are John D. Forsyth, Edwin W. Clement, William P. Clement and others.

A. A. GIDDINGS & COMPANY of Montreal, Canada, have been incorporated by Louis A. David, Louis P. Crepeau, S. H. R. Bush and others. The company is capitalized at $50,000 and proposes to manufacture electrical and mechanical appliances, machinery, etc.

THE SNOW-WHITCOMB COMPANY of New York, N. Y., has been incorporated with a capital stock of $50,000 by J. H. Westcott, Jr., R. E. Whitcomb and W. L. Snow, 3661 Broadway, New York, N. Y. The company proposes to manufacture and deal in electric lamps and fixtures.

THE MULTIX MOTORS COMPANIES, INC., of Chicago, Ill., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,000,000 to manufacture motors, engines, etc. The incorporators are Samuel C. Wood and A. D. Suess of Chicago, Ill.

THE SALISBURY ELECTRIC COMPANY of Toronto, Canada, has been incorporated by George E. McCann, 15 Washington Avenue, Francis A. Hammond, Arthur F. Ball and others. The company is capitalized at $100,000 and proposes to manufacture electrical equipment, machinery, engines, motors, etc.

New England States

BOSTON, MASS.—Bids will be received at the office of the lighthouse inspector, Boston, Mass., until Aug. 20 for generating sets and switchboard. Further information may be obtained upon application to the above office.

MARLBORO, MASS.—Plans are being prepared for the erection of a new power plant, 30 ft. by 40 ft., at the works of the Koehler Manufacturing Company on Howland Street, to cost about $20,000.

WILTON, MASS.—The Milford Light & Power Company has secured the contract for equipping the Souhegan Woolen Mills for electrical operation. The mills will also be heated by electricity next winter.

HARTFORD, CONN.—Plans are being considered by the Connecticut Electrical Steel Company to rebuild the foundry and model department at its works, recently damaged by fire.

Middle Atlantic States

BUFFALO, N. Y.—Plans have been filed by the Barber Asphalt Paving Company, 178 Walder Avenue, for the erection of a new boiler plant, about 30 ft. by 125 ft. and 50 ft. by 195 ft., at its works, to cost approximately $50,000. Contract has been awarded to the Charles Berricks Sons Company, 1151 Main Street.

JAMAICA, N. Y.—Plans are under consideration by the Jamaica Water Supply Company, 14 Union Avenue, for the construction of a new electrically operated pumping station on Gilman Avenue.

MECHANICSVILLE, N. Y.—The capital stock of the Half Moon Light, Heat & Power Company has been increased from $150,000 to $200,000, the proceeds to be used for extensions and improvements.

NEW BRIGHTON, N. Y.—Application has been made to the Public Service Commission by the Staten Island Rapid Transit Company for authority to issue $1,500,000 in bonds, the proceeds to be used, in part, for improvements, etc.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 12, under specification 3192, for furnishing and installing a plenum heating system, including motor-operated fans, heating stacks, ducts, piping, etc., at the structural shop, navy yard, New York.

NEW YORK, N. Y.—Bids will be received by the Interborough Rapid Transit Company at the office of the chief engineer, 165 Broadway, until Aug. 9 for completion of the passenger station, electric lighting and electric heating systems for portions of a rapid transit railroad in the boroughs of Brooklyn and Manhattan, as follows: Portion of Clark Street, Eastern Parkway and Nostrand Avenue lines. Further information, specifications, etc., may be obtained at the above office. George H. Pegram is chief engineer.

PEEKSKILL, N. Y.—Plans have been completed by the Weehawken (N. J.) Dry Dock Company for the construction of a shipbuilding plant at Peekskill, including machine shops, erecting shops, etc.

SYRACUSE, N. Y.—The capital stock of the Oswego River Power Transmission Company of Syracuse has been increased from $20,000 to $50,000.

MAY'S LANDING, N. J.—Contract has been awarded by the Bethlehem Loading Company for the construction of a new boiler plant, to cost about $16,000, to Albert Doak, 2138 Arch Street, Philadelphia, Pa. The company is erecting a large shell-loading plant here.

NEWARK, N. J.—The Public Service Railway Company is considering an extension of its system on the west side of the Hackensack River.

NEWARK, N. J.—Plans have been filed and contract awarded by the Northern Feather Works & Produce Company for the construction of a new power house at its plant on Backus Street.

NEWARK, N. J.—Bids will be received until Aug. 7 by the Board of Freeholders of Essex County, Newark, for construction of ten reinforced-concrete coal pockets and coal-conveying equipment for the Essex County Hospital at Overbrook. The cost is estimated at about $60,000.

PERTH AMBOY, N. J.—The Board of Aldermen is considering the construction of a high-pressure pumping plant on Carlock Avenue, near Pulaski Street in connection with the construction of a new reservoir for the water-works system. The station will be equipped with two units with a rating of 1,000,000 gal. daily each.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

POMPTON LAKES, N. J.—Bids will be received by the Borough Council, Municipal Building, until Aug. 7 for construction of power plant as follows: (1) For the erection of the foundation and all other work of hydraulic power station, except the superstructure; (2) erection of superstructure of building; (4) two vertical hydraulic turbines; (5) two electric generators and switchboards. Plans and specifications are filed with the borough clerk, from whom copies may be obtained upon deposit of $50. S. Firestone is consulting engineer.

WRIGHTSTOWN, N. J.—The Board of Public Utility Commissioners has granted the Wrightstown Utilities Corporation, recently incorporated, permission to take over the plant and property of the Wrightstown Water, Light & Power Company.

BETHLEHEM, PA.—A tract of land of about 300 acres has been obtained by the Bureau of Industrial Housing and Transportation on the outskirts of the city, just across the river from the plant of the Bethlehem Steel Corporation, on which it proposes to erect from 1200 to 1500 houses Contract has been awarded for construction of sewers, water supply, electric lighting, streets, etc. In addition to houses, certain community facilities, such as stores, moving-picture theater and recreation building, are necessary.

CONNERSVILLE, PA.—The Rex Company and the Central Manufacturing Company, it is reported, are each installing isolated electric power plants.

HARRISBURG, PA.—Permission has been granted by the Public Service Commission to several electric light and power companies to issue securities as follows: The Chester Valley Electric Company of Coatesville, $80,000; the Barnesborough-Spangler Electric Light Company of Philadelphia, $83,000, and the Hamburg (Pa.) Gas & Electric Company, $50,000.

HAZLETON, PA.—The Worthington Pump & Machinery Company is reported to be asking bids for the construction of an extension to its plant, 100 ft. by 200 ft., to cost about $25,000, and an electric power plant, to cost about $50,000.

MOUNT CARMEL, PA.—The Shamokin & Mount Carmel Transit Company has decided to close down its local power plant (to aid in the conservation of coal) and will purchase energy to operate its system from the Edison Electric Illuminating Company.

McKEE'S ROCKS, PA.—Work has begun by the Pressed Steel Car Company, Frick Building, Pittsburgh, on the construction of a new transformer building, 20 ft. by 20 ft., at its local plant.

PHILADELPHIA, PA.—Contract has been awarded by the United States government to Thomas Reilly, 1616 Thompson Street, for extensions to the transformer station at the aircraft plant at the local navy yard.

PHILADELPHIA, PA.—Plans have been prepared by the Department of Public Safety for the construction of a new municipal repair plant at Eleventh and Reed Streets, to cost about $40,000. New equipment, including motor-generators, boilers, air compressors and accessories, will be installed.

PITTSBURGH, PA.—Permission has been granted the Pennsylvania lines west of Pittsburgh by the Railroad Administration to erect a new locomotive repair shop and engine house at Stark, Ohio, to cost about $900,000, and for remodeling and improvements to shops and engine house at Wellsville, Ohio, at a cost of about $276,000.

TRENTON JUNCTION, PA.—Plans have been filed and contract awarded by the Philadelphia & Reading Railroad Company for the erection of a battery building, 20 ft. by 35 ft., at its local yards.

WASHINGTON, PA.—The Electric Reduction Company has awarded contract to the Austin Company of Cleveland, Ohio, for the construction of a two-story machine shop and boiler plant at its works, to cost about $15,000.

EDGEWOOD, MD.—Plans have been completed by the Ordnance Department, Washington, D. C., for new works at the Edgewood Arsenal at Edgewood, to be used for assembling, testing, etc., consisting of ten buildings, averaging 100 ft. by 200 ft. The cost is estimated at about $5,000,000. Contract for part of the work has been awarded to the Austin Company, Bulletin Building, Philadelphia, Pa.

INDIAN HEAD, MD.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 5, under specification 3193, for boilers and superheaters for the nitrate plant at Indian Head, Md. The cost is estimated at about $200,000. Bids will also be received until Aug. 25, under specification 3197, for mechanical stokers for nitrate plant at Indian Head. Further information may be obtained at the above bureau.

WHEELING, W. VA.—Improvements to the street lighting system are planned by the Street Lighting Commission and the Wheeling Commercial Association.

HUNTINGTON, W. VA.—Contract has been awarded by the Baltimore & Ohio Railroad Company for extensions and improvements to its local yards and car shops, to the Arnold Company, 105 La Salle Street, Chicago, Ill. The cost of the entire work is estimated at about $500,000.

ACCOTINK, VA. The War Department has authorized an expenditure of $2,934,400 for enlarging Camp Humphreys, located at Accotink, to accommodate 30,000 troops. The work is being done by the construction division of the army. The plans calls for 200 barracks, 55 mess halls, 16 officers' quarters buildings 4 medical buildings, 4 administration buildings, 4 post exchanges, 30 storehouses, 30 stables and sheds and 2 repair shops.

RICHMOND, VA.—Bids will be received by E. W. Trafford, superintendent of the municipal electric light plant, until Aug. 16 for surplus energy of the municipal electric plant. It is estimated that a maximum of 1000 kw. can be furnished between the hours of sunrise and sunset, and half of that amount during the rest of the 24 hours.

ST. JULIAN, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 12, under specification 3270, for construction of power house at St. Julian.

WASHINGTON D. C.—Bids will be received at the office of the purchasing clerk, Board of Awards, Department of Agriculture, Washington, D. C., until Aug. 9 for furnishing refrigerating machine at Rosslyn, Va.

WASHINGTON, D. C.—The United States Coast and Geodetic Survey has awarded contract to the Wils-Egelhof Company, 101 Park Avenue, New York, N. Y., for the erection of a building at South Capitol and New Jersey Avenues, to cost about $95,000.

WASHINGTON, D. C.—Bids will be received by the Department of Agriculture, Washington, D. C., until Aug. 9 for furnishing and installing a refrigerating machine at Arlington Farm, near Rosslyn, Va. Specifications, etc., may be obtained upon application to the chairman of board of awards, Department of Agriculture.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing apparatus and supplies at the various navy yards and naval stations as follows: Annapolis, Md., until Aug. 9, under Schedule 5097½—for furnishing 9600 ft. of steel conduit pipe. Eastern and Western navy yards, until Aug. 5, under Schedule 5108½—250 audible electric signal horns and howlers; Schedule 5134½—miscellaneous wire and cable; Schedule 5100½—1250 electric air heaters and 1250 electric foot warmers. Portsmouth, N. H., until Aug. 5, Schedule 5128½—one motor-generator set and one switchboard. Navy Yard, Connecticut, until Aug. 9, Schedule 5097½—for machine tools, including lathes, presses and motors, Brooklyn, N. Y., until Aug. 5, Schedule 5129½—for four generating sets; until Aug. 9, Schedule 5207½—300 ventilating sets. South Brooklyn, N. Y., until Aug. 5, Schedule 5132½—miscellaneous telephone equipment; Schedule 5200½—two air heaters and electrical wire and material. Philadelphia, Pa., until Aug. 5, Schedule 5131½—16 gasoline electric generating sets; Schedule 5158½—rubber-insulated electric wire and cable; Schedule 5167½—copper tubing; until Aug. 9, Schedule 5205½—350 battery charging panels. Washington, D. C., until Aug. 5, Schedule 5182½—eight electric hoists and spares. Various deliveries, until Aug. 5, Schedule 5165½, 255,000 ft. steel conduit; Schedule 5193½—floodlight projectors. Great Lakes, Ill., until Aug. 5, Schedule 5162½—8000 ft. steel conductor, 21,000 ft. rubber-covered wire and 425 lb. antenna wire. Further information may be obtained on application to the above bureau.

North Central States

BATTLE CREEK, MICH.—The plant of the Consumers' Power Company on Elm Street was recently damaged by fire, causing a loss of about $8,000.

ASHTABULA, OHIO. — Investigations are being made by F. R. Garver of Pittsburgh, Pa., engineer of a water-power development at Ashtabula. It is proposed to place three large dams in the Plymouth and Sheffield Gulfs, with the Ashtabula River as a feeder. The plans provide for the erection of a power plant at each dam.

BRYAN, OHIO.—The City Council has passed an ordinance authorizing an issue of $90,000 in bonds, the proceeds to be used for extensions and improvements to the municipal electric light plant and water-works system.

CANTON, OHIO.—The Timken Roller Bearing Company of Canton has awarded contract to the Canton Bridge Company for the erection of a new building, 90 ft. by 200 ft., to be used for storage purposes. It will be equipped with an electrically operated crane.

CINCINNATI, OHIO.—The War Department has selected the so-called Broadwell site for the half unit of the Air Nitrates Corporation plant to be located at Cincinnati.

CINCINNATI, OHIO.—William T. Johnson Company, Third and Vine Streets, it is reported, would like to receive prices on a 2000-kw., 220-volt direct-current generator directly connected to a Corliss engine.

CINCINNATI, OHIO.—Extensive improvements are contemplated in the equipment, properties and service of the Cincinnati, Dayton & Toledo Traction Company, which was recently taken over by the Cincinnati & Dayton Traction Company.

CLEVELAND, OHIO.—The Electric Products Company is contemplating the construction of a new factory, 90 ft. by 176 ft., at 1723 Clarkston Road.

HAMILTON, OHIO.—The proposed new tractor plant of Henry Ford & Son, to be erected in Hamilton, will be operated by hydroelectric power. The company, it is reported, has purchased the property of the Hamilton & Rossville Hydraulic Company and a five-acre site on the Baltimore & Ohio Railroad on which it will erect a 3000-kw. plant.

TOLEDO, OHIO.—Plans are being considered for the erection of a special pole line to carry the power cables from the new power plant of the Acme Power Company, controlled by the Cities Service Company, to the new government nitrate plant to be erected near Toledo. The proposed line will be erected under the supervision of the city authorities. The poles will be 7 ft. higher than those regularly in use. Telephone lines will strung on the poles at the regular height, while the power lines will be placed at the top.

LOUISVILLE, KY.—The Louisville Ice & Cold Storage Company, recently organized, has purchased from the Louisville Gas & Electric Company the two buildings on Bullitt Street formerly occupied by the Fetter Lighting Company, which will be operated as an ice plant. The ice company also took over the contract of the gas and electric company to supply ice to the Merchants' Ice & Cold Storage Company. The Louisville Gas & Electric Company has been making ice as a by-product since the plant was taken over from the Fetter company.

WILLARD, KY.—The Black Raven Coal Company is reported to be in the market for a 100-kw. or a 125-kw., 220-volt direct-current generator.

ARGOS, IND.—Plans are being prepared for rebuilding the Argos pumping station, which is to be equipped with electrically operated machinery. H. J. Fauber of South Bend is designing engineer.

GARY, IND.—Plans have been filed by the Union Drawn Steel Company for the construction of a boiler house, to cost about $8,000, which will enable the company to furnish power to operate its works.

HAGERSTOWN, IND.—The City Council is considering the purchase of a 150-hp. oil engine and a 75-kw., 220-volt direct-current generator, directly connected, for the municipal electric light plant. R. G. King is superintendent.

JEFFERSONVILLE, IND.—Among the improvements contemplated by the Pennsylvania Railroad Company to its local yards are included the installation of a 100-ft. turntable, to be operated by electricity; first section of machine shops, each unit to be 10 ft. by 160 ft.; a roundhouse, capable of housing 12 locomotives; a repair shop, new passenger station, etc.

CHICAGO, ILL.—Plans have been completed by the Atchison, Topeka & Santa Fé Railroad Company for the erection of a new power plant, 100 ft. by 100 ft., at Shopton, Ill.

CHICAGO, ILL.—Contract has been awarded by the Acme Steel Goods Company, Archer Avenue, Chicago, Ill., to the Morgan Construction Company of Worcester, Mass., for the construction of a building, 80 ft. by 100 ft., one story, on 130th Street, to cost about $100,000.

GREAT LAKES, ILL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 5, under specification 3210, for construction of mess hall and power house at the naval station at Great Lakes, to cost approximately $200,000.

MADISON, ILL.—The planing mill of the Kettle River Creosoting Works was recently destroyed by fire, causing a loss of about $50,000. Considerable machinery, including generators, will have to be replaced.

MONMOUTH, ILL.—Plans are under consideration by the Monmouth Plow Company for the erection of a five-story building, 60 ft. by 90 ft., with power plant, to cost about $40,000.

MANITOWOC, WIS.—Bids will be received by the Board of Public Works until Aug. 5 for a 1500-kw. turbo-generator unit, one 300-hp. vertical water-tube boiler and underfeed mechanical stoking equipment.

PALMER, NEB.—Bonds to the amount of $40,000 have been voted for rebuilding the municipal electric light plant and water-works system.

Southern States

LINCOLNTON, N. C.—The Boger & Crawford Spinning Company, recently organized, has purchased a site in Lincolnton on which it proposes to erect a mill, 184 ft. by 104 ft., to have a capacity of 10,000 spindles (3300 ordered); the remainder will be installed when obtainable. The plant will be operated by electricity.

RALEIGH, N. C.—Improvements will be made to the electric power and heating equipment of the Central Hospital for the Insane, to cost about $90,000. Contract for extension to power house has been awarded to T. M. Copeland of Raleigh, at $23,000; for boilers and heating apparatus, including installation, to the General Fire Company of Charlotte, at $46,000. Albert Sanderson is superintendent.

WILSON, N. C.—Plans are being considered to increase the water supply. It is proposed to raise the dam and develop same. Sufficient power may be secured to operate the municipal electric light plant at night and Sundays.

COLUMBIA, S. C.—The Carolina Public Service Company is planning to erect an addition to its ice plant, increasing the capacity to 250 tons.

SPARTANBURG, S. C.—According to a decision handed down by the court the South Carolina Light, Power & Railways Company is to extend its electric railway to Whitney and Converse.

ATLANTA, GA.—At an election held recently the proposal to issue $800,000 in bonds for improvements to the water-works system and in the installation of a municipal electric lighting plant was defeated.

DADE CITY, FLA.—The Dade City Ice, Light & Power Company is reported to be contemplating extensions to its electric plant and ice factory, including the installation of additional machinery.

JACKSONVILLE, FLA.—The nitrate plant of the American Agricultural Chemical Company, located near Jacksonville, was recently destroyed by an explosion, causing a loss of about $1,000,000.

FLORENCE, ALA.—Work will begin at once by the Muscle Shoals Traction Company on its proposed railway to connect Huntsville and Florence.

DE QUEEN, ARK.—The local electric plant of the Arkansas Light & Power Company has been purchased by the Commonwealth Public Service Company of Muskogee, Okla.

OKMULGEE, OKLA.—The Boston-Arkansas Mining Company is contemplating the purchase of friction clutch and transmission equipment, belt-driven air compressors, electric generators, pumping machinery, etc.

STILLWATER, OKLA.—Bids will be received by the city of Stillwater until Aug. 12 on one 250-kva., three-phase, 2300-volt generator with exciter and switchboard; one 16-kva., 6.6-amp. constant-current transformer, one 300-hp. boiler and one 400-hp. open heater. J. L. Moore is commissioner of revenue and accounting.

NEW ORLEANS, LA.—The Quartermaster Corps, Washington, D. C., has awarded contract to the George A. Fuller Construction Company, Fuller Building, New York, N. Y., for construction of a system of warehouses on the Mississippi River and industrial canal, to cost about $10,000,000. The plans provide for three concrete warehouses, 140 ft. by 169 ft., six stories, and a two-story wharf, 2000 ft. long.

DALLAS, TEX.—The Dallas Power & Light Company is contemplating an addition to its plant, to cost about $15,000.

LUBBOCK, TEX.—Contract will soon be awarded by the City Council for the construction of a municipal electric light and power plant, to cost about $35,000.

Pacific and Mountain States

SEATTLE, WASH.—The City Utilities Committee has voted to recommend to the Council that sealing operations be resumed at the Cedar River Dam. The work was recently stopped owing to the shortage of water.

SEATTLE, WASH.—The officials of the city of Seattle have petitioned the Capital Issues Committee for authority to issue $5,500,000 in bonds for extensions to the municipal hydroelectric power plants to enable the municipal electric system to provide electricity for shipbuilding plants, industrial, transportation, etc., requirements during the war.

SEATTLE, WASH.—J. D. Ross, superintendent of lighting, has announced that plans are under way for the construction of an additional steam-driven electric generating unit of 10,000 kw. capacity, to meet the increasing demands for electrical service. The plant will either be built as an addition to the present Lake Union steam plant or will be erected at a coal mine. As soon as Mr. Ross has completed investigations the Council will be asked to authorize $500,000 in bonds.

BAY CITY, ORE.—The Cummings-Moberly Lumber Company of Louisiana has begun work on the construction of its proposed sawmill in Bay City. The plant will have an eight-hour capacity of 150,000 ft. A machine shop, 40 ft. by 75 ft., is included in the plans. The mill will be operated by electrically driven machinery throughout.

FALL RIVER MILLS, CAL.—A movement has been started to secure electrical service in the Big Valley district. It is proposed to erect electric transmission lines from the plant in Fall River Mills to Bieber and Big Valley to supply electricity for lighting and irrigation purposes. Supervisor Harry E. Wood is interested in the project.

PORTERVILLE, CAL.—Plans are under consideration by the City Council for the construction of a municipal electric light plant. Estimates prepared by F. W. Pease, city engineer, place the cost at about $12,000.

SACRAMENTO, CAL.—Bids will be received at the office of the State Bureau of Tuberculosis, Forum Building, Sacramento, until Aug. 12 for construction of an administration building, service building, power house, porch buildings, two cottages, nurses' home, superintendent's cottage and septic system. The buildings will be erected about one-quarter of a mile from the Weimar Station in Placer County. Plans may be seen at the office of J. E. Stanton, Associated Forum Building, Sacramento.

SAN FRANCISCO, CAL.—The Board of Supervisors of San Francisco has under consideration an extension of the Municipal Railways over Army Street to Petrero Avenue to provide transit service to the Union Iron Works, Hunter's Point and other industrial plants in that section of the city.

DENVER, COL.—Bids will be received by the United States Reclamation Service, Department of the Interior, Denver, Col., until Aug. 12 for furnishing one direct pumping unit with extra repair parts for the Price-Stub pumping plant, Great Valley project, Colorado. Further information may be obtained from R. F. Walter, acting chief of construction, Denver, Col.

Canada

VANCOUVER, B. C.—Permit has been granted to the Defiance Packing Company for the construction of a packing plant, to be equipped with considerable refrigerating equipment. The cost of the plant is estimated at about $50,000. A. H. Sherman is general manager.

NIAGARA FALLS, ONT.—Work has been resumed on the Chippewa-Queenston power project by the Ontario Hydro-Electric Power Commission. The proposed station will be located at Queenston. About 300,000 hp., it is estimated, will be developed. G. B. Goodwin is construction engineer for the project.

SMITH'S FALLS, ONT.—The purchase of four electrically driven pumps, to cost about $20,000, by the town of Smith's Falls has been recommended by the Provincial Hydroelectric Commission.

Miscellaneous

PANAMA—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Aug. 11 for galvanized pipe, sizing wire, brass tubing, storage batteries, pipe covering, etc. Blanks and further information relating to this circular (1225) may be obtained at the above office.

Directory of Electrical Associations

Printed in the First Issue of Each Month

Alabama Light and Traction Association. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

American Association of Engineers. Secretary, A. H. Krom, 29 South La Salle St., Chicago, Ill.

American Electric Railway Association. Secretary, E. B. Burritt, 8 West Fortieth St., New York City. Annual meeting Atlantic City, N. J., Oct. 8 and 9.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

American Institute of Consulting Engineers, Inc. Secretary, F. A. Molitor, 35 Nassau St., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

American Physical Society. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

American Society for Testing Materials. University of Pennsylvania, Philadelphia, Pa.

Arkansas Public Utilities Association. Secretary-treasurer, W. J. Tharp, Little Rock, Ark.

Associated Manufacturers of Electrical Supplies. General secretary, C. E. Dustin, 30 East 42d St., New York City.

Association of Edison Illuminating Companies. Secretary, George C. Holberton, San Francisco, Cal.

Association of Iron and Steel Electrical Engineers. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa. Annual convention, Sept. 14-18, Baltimore, Md.

Association of Railway Electrical Engineers. Secretary-treasurer, Joseph A. Andreucetti, Chicago & North Western Railway, Chicago, Ill.

British Columbia Association of Electrical Contractors and Dealers. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C. Annual meeting, Sept. 13-15, Victoria, B. C.

Canadian Electrical Association, affiliated with N. E. L. A. Secretary-treasurer, W. Volkman, Toronto Electric Light Co., Toronto, Ont.

Colorado Electric Light, Power and Railway Association. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

Commercial Section, N. E. L. A. Secretary, Henry Harris, Pittsburgh, Pa.

Eastern New York Section, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

Electrical Manufacturers' Club. Secretary, Shiras Morris, Hart & Hegeman, Hartford, Conn.

Electrical Supply Jobbers' Association. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Meeting, Cleveland, Ohio, November.

Electrical Trades Association of Canada. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

Electrical Credit Association of the Pacific Coast. Secretary, Albert E. Elliott, 502 Flatiron Building, San Francisco, Cal.

Electric Power Club, Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

Electric Vehicle Section of the N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York City.

Empire State Gas and Electric Association. Secretary, Charles H. B. Chapin, 29 West 39th St., New York City.

Florida Engineering Society. Secretary, J. R. Benton, Gainesville, Fla.

Illinois State Electric Association. Secretary, R. H. Abbott, Petersburg, Ill.

Illuminating Engineering Society. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual meeting Oct. 10.

Indiana Electric Light Association. Secretary, Thomas Donohue, Lafayette, Ind. Annual meeting, Indianapolis, Ind., Aug. 7.

Industrial Electric Heating Association. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

Institute of Radio Engineers. Secretary Alfred N. Goldsmith, College City of New York, New York.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex. Annual convention, Atlanta, Ga., Sept. 24-27.

Oklahoma Gas, Electric and Street Railway Association. Secretary, L. W. W. Morrow, Norman, Okla.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). General secretary, C le Maistre, 28 Victoria St., Westminster, London, S. W., England.

Iowa Section, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

Jovian Order. Jupiter (president), Henry J. F. Strickland, Dallas, Tex.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

Kansas Public Service Association. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan. Annual meeting, Kansas City, Kan., Oct. 17-19, 1918.

Maine Electric Association. Secretary-treasurer. Walter S. Wyman, Augusta, Me.

Michigan Section, N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Monroe, Mich.

Minnesota Electrical Association. Secretary, H. C. Hoffman, St. Paul Gas Light Co., St. Paul, Minn.

Mississippi Electric Association. Affiliated with the N. E. L. A. Secretary-treasurer, L. D. Gordon, Jackson Light & Traction Co., Jackson, Miss.

Missouri Association of Public Utilities. Secretary-treasurer, F. D. Beardslee, 721 Locust St., St. Louis, Mo.

National Association of Eletrcical Contractors and Dealers. Secretary, H. C. Brown, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin.

National Association of Electrical Inspectors. Secretary-treasurer, William L. Smith, Concord, Mass.

National Electric Light Association. Executive secretary, T. C. Martin, 33 West 39th St., New York City.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

National Fire Protection Association. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

Nebraska Section, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

New England Electrical Credit Association. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

New England Section, N. E. L. A. Secretary, Miss O. A. Bursiel, 119 Tremont St., Boston, Mass. Annual meeting, Hotel Kimball, Springfield, Mass., Sept. 27 and 28.

New Mexico Electrical Association. Secretary-treasurer, Charles E. Twogood, Albuquerque, N M.

New York Electrical Credit Association. Secretary, Franz Neilson, 120 Broadway, New York City.

New York Electrical Society. Secretary, George H. Guy, 29 West 39th St., New York City.

Northwest Electric Light and Power Association. Affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore. Annual meeting, Sept. 11, 1918.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

Pacific Coast Section, N. E. L. A. Secretary, A. H Halloran, 618 Mission St., San Francisco, Cal.

Pennsylvania Electrical Contractors and Dealers' Association. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia, Pa.

Public Service Association of Virginia. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

Public Utilities Association of West Virginia. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

Radio Club of America. Secretary, T. J. Styles, 152 Beach St., Yonkers, N. Y.

Rocky Mountain Association of Municipal Electricians. President, Lawrence Stone, Denver, Col.

Society for Electrical Development, Inc. General manager, J. M. Wakeman, 29 West 39th St., New York City.

Society for the Promotion of Engineering Education. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

South Dakota Electrical Power Association. Secretary-treasurer, O. J. Gronsdahl, Hartford, S. D.

Southeastern Section, N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus, Ga.

Southern California Electrical Contractors and Dealers' Association. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

Southwestern Electrical and Gas Association. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

Southwestern Society of Engineers. Secretary, C. E. Barglebaugh, 703 First National Bank Building, El Paso, Tex.

Toronto Electrical Contractors' Association. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

Tri-State Water and Light Association. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

Vermont Electrical Association. Secretary-treasurer, A. B. Marsden, Rutland, Vt.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

Western Society of Engineers, Electrical Section. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill. Annual meeting, Chicago, Jan. 28-30, 1919.

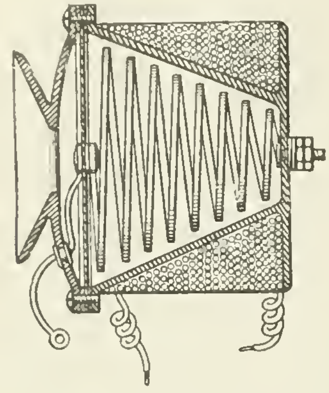
Wisconsin Electrical Association. Secretary, J. P. Pulliam, 1408 First National Bank Building, Milwaukee, Wis.

Record of Electrical Patents

Notes on United States Patents

1,270,785. Circuit-Interrupting System; Lewis W. Chubb, Edgewood Park, Pa. App. filed Nov 29, 1915. Means for automatically precluding the flow of current in a circuit, upon the occurrence of predetermined conditions, without opening the circuit.

1,270,789. Controller for Electric Vehicles; De Witt C. Cookingham, Lakewood, and John H. Hertner, Cleveland, Ohio. App. filed March 20, 1913. To provide a warning device whereby the operator cannot carelessly leave the car standing with the current flowing through the motor.



1,270,920—Transmitter or Receiver

1,270,804. Electrical System of Power Transmission and Regenerative Braking; Peter W. Rorsberg, Schenectady, N. Y. App. filed Oct. 29, 1917. Means for automatically regulating the current generated by dynamo-electric machines during the generator operation thereof.

1,270,805. Rectifier-Equalizing System; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed May 6, 1915. To provide means whereby a plurality of rectifying devices may each assume and maintain a definite portion of said load.

1,270,822. Circuit Interrupter; Rudolf E. Hellmund, Swissvale, Pa. App. filed July 6, 1917. An interrupter for an alternating-current circuit shall be tripped only when an overload current having a symmetrical wave shape traverses the circuit.

1,270,831. Static Protective Apparatus; Ray P. Jackson, Edgewood Park, Pa. App. filed July 29, 1913. The energy sustaining the flow of high-frequency currents in the disturbed circuit is absorbed and dissipated as heat.

1,270,843. Electric Lamp; Frederick G. Keyes, East Orange, N. J. App. filed June 26, 1914. For adequately supporting the filament and at the same time furnishing a convenient means for making connections inside the lamp.

1,270,885. System of Distribution; Karl A. Simmon, Edgewood Park, and Paul L. Mardis, Wilkinsburg, Pa. App. filed Feb. 3, 1916. Voltage corrections effected by automatically varying the active length of a voltage-generating winding.

1,270,894. Protective Device; Charles P. Steinmetz, Schenectady, N. Y. App. filed Sept. 17, 1917. To select the phase of an electrical system upon which there is fault to ground before such fault develops into one of low resistance.

1,270,917. Electric Regulator; Hamilton Baluss, Kennett Square, Pa. App. filed Nov. 22, 1915. For maintaining lamp circuit under variations of voltage in the supply circuit.

1,270,920. Transmitter or Receiver; Konrad Botz, New York, N. Y. App. filed June 28, 1917. Has operatively connected with the diaphragm a helical cone of magnetic and current-conducting material.

1,270,957. Adjustable Support for Commutator Brushes; Petrus van Santen Kolfe, Philadelphia, Pa. App. filed Dec. 10, 1915. To provide a support for a brush whereby the brush may lie flat against the commutator.

1,270,967. Armature for Dynamo-Electric Machine; Fred N. Mizer, Elyria, Ohio. App. filed Nov. 8, 1916. Relates to armatures which are to be rotated at a high angular velocity, as automobile horns.

1,271,001. Electromagnetic Switch; Paul H. Zimmer, Milwaukee, Wis. App. filed June 6, 1913. Adapted to hold open when the current in operating windings is high and to close when current decreases.

1,271,030. Ignition System; Harry F. Geist, Racine, Wis. App. filed Feb. 23, 1916. Mechanism suitable for operating an igniter plug and the magneto which provides electric current for the plug.

1,271,032. Automatic Telephone System; Bernard C. Groh, Chicago, Ill. App. filed July 19, 1915. Methods of toll supervision in systems containing one or more automatic exchanges.

1,271,037. Spark-Plug Intensifier; Henry W. Kakaska, Mandan, N. D. App. filed May 8, 1917. A device especially for use upon old or sooted spark plugs to renew the life and efficiency thereof.

1,271,050. Lightning Arrester; Clarence H. Martin, Endeavor, Wis. App. filed May 23, 1917. The type in which a magnet by attracting an armature produces a ground connection.

1,271,051. Smelting and Refining Furnace; Otto J. Martin, Vancouver, B. C., Canada. App. filed July 28, 1917. Enables the full percentage of values to be recovered from the crude ore.

1,271,061. Dynamo-Electric Machine; Robert V. Morse, Ithaca, N. Y. App. filed March 18, 1912. Machines having a continuous current flow not depending for its action on any periodic reversal of current in either the field or armature.

1,271,087. Thermal Circuit Closer; Ralph F. Schneider, New York, N. Y. App. filed May 15, 1914. Contact thermometer in which the mercury is instrumental in bringing about the electrical operation of an alarm.

1,271,093. Electric Furnace Contact; Frederick T. Snyder, Oak Park, Ill. App. filed March 1, 1917. So constructed as to permit of being withdrawn from the furnace quickly.

1,271,106. Trolley Catcher; George E. Waldo and Edward Fay Wilson, Chicago, Ill. App. filed Aug. 16, 1917. Adapted for operation by means of fluid under pressure.

1,271,124. Switching Device; William T. Booth, East Orange, N. J. App. filed Dec. 30 1916. A hook switch for use in subscribers' sets and which may be used indiscriminately in different types of sets.

1,271,127. Telephone System; William G. Britten, Fanwood, N. J. App. filed April 15, 1916. To maintain a nearly uniform working potential on the various energy-consuming circuits.

1,271,136. Process and Apparatus for Electrodeposition Under Compression; Edward G. Cook, Long Island City, N. Y. App. filed May 13, 1916. Whereby electrolytically deposited metallic articles of all forms may be solidly and homogeneously formed.

1,271,141. Printing-Telegraph System; Amos F. Dixon, Newark, N. J. App. filed April 15, 1915. A system particularly applicable where the various stations are separated by short distances.

1,271,148. Storage Battery; Bruce Ford, Philadelphia, Pa. App. filed May 21, 1917. A fitting between storage cells which affords a good foothold for workmen to walk on.

1,271,155. Ignition Device; Harry F. Geist, Sumter, S. C. App. filed Feb. 15, 1918. The current is supplied by a generator, the rotor of which is operated intermittently.

1,271,162. Mechanism for Controlling Carbon or Arc Lamps; Arthur W. Harris, Erdington, England. App. filed Feb. 25, 1916. Concerns automatic feeding of carbons.

1,271,164. Impulse Transmitters; Henry Hovland, East Orange, N. J. App. filed Feb. 8, 1917. Device simple in structure and operation by which impulses may be sent rapidly and accurately.

1,271,171. Telephone System; Lewis H. Johnson, Bloomfield, N. J. App. filed Jan. 22, 1915. For interconnecting common battery and magneto or local battery lines terminating at a central office.

1,271,183. Arc Oscillation Generator; Benjamin Liebowitz, New York, N. Y. App. filed Jan. 28, 1915. A simple and inexpensive generator for producing electrical oscillations.

1,271,185. Telephone-Exchange System; Alben E. Lundell, New York, N. Y. App. filed Dec. 22, 1915. Means at one office for supervising the establishment of a connection through a plurality of offices.

1,271,186. Telephone-Exchange System; Alben E. Lundell, New York, N. Y. App. filed Nov. 13, 1916. An operator's telephone set may be automatically associated with a calling subscriber's line.

1,271,190. Wireless-Telegraph Transmitter; Guglielmo Marconi, London, England. App. filed April 30, 1914. Means by which it may be possible to put a very large amount of power into the aerial.

1,271,200. Method of and Apparatus for Smelting Tin; Edmund N. Morrill, Warren, N. H. App. filed Nov. 27, 1917. The apparatus comprises an electric incandescent furnace of special construction.

1,271,215. Box Knock-Out; Clarence D. Platt, Bridgeport, Conn. App. filed Aug. 11, 1917. May be readily removed to provide an opening for the insertion of an insulating bushing.

1,271,216. Switch Box; Clarence D. Platt, Bridgeport, Conn. App. filed Dec. 21, 1917. To provide a practical and efficient boxing for protecting the meter connections.

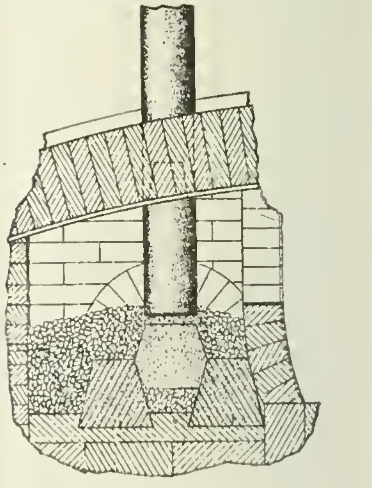
1,271,217. Electrical Receptacle; Clarence D. Platt, Bridgeport, Conn. App. filed Feb. 15, 1917. To facilitate the connection of the circuit wires to the terminals without cutting.

1,271,220. Electric Switch; Martin J. Quinn, Toronto, Canada. App. filed June 12, 1916. Relates to a pressure-motor-operated switch automatically opening and closing an electric circuit.

1,271,221. Electric Switch; Martin J. Quinn, Toronto, Ontario, Canada. App. filed Jan. 15, 1917. A combination for making and breaking an electric circuit.

1,271,226. Electrical Connector; James E. Rork, Kalamazoo, Mich. App. filed June 18, 1917. For use with terminals that may be applied or secured to other terminals of a variety of different shapes.

1,271,229. Process of Making High-Percentage Calcium Carbide; Duke R. Russell, Chicago, Ill. App. filed Feb. 4, 1918. Process of making a special pitch coke of 94 per cent or better in fixed carbon content and otherwise of a high percentage of purity.



1,271,280—Electric Furnace

1,271,245. Seal for Vapor-Electric Apparatus; Max von Recklinghausen, Suresnes, France. App. filed July 12, 1913. For a leading-in conductor through the walls of vessels of quartz or similar material.

1,271,280. Electric Furnace; Edgar F. Collins, Schenectady, N. Y. App. filed May 12, 1917. Suitable for industrial operations such as the melting of metals and the heating of steel for forging, annealing and tempering.

Electrical World

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Engineering Education Must Go On

PROBABLY there never was a time when it was so hard for undergraduate students in engineering to stick to their school work as it is to-day. Yet there could be few calamities for this nation greater than for our technical institutions to close for lack of students, and this in face of the tremendous demands of the hour for men for military and naval service. Whether the war goes on for years or whether it ends within six months, the need of technically trained men in the nation's life at home and abroad will be so great that the supply cannot possibly meet the demand. Fortunately, there is no immediate danger that our schools of applied science will have to shut up shop; but there is ground for apprehension that the registrations of the coming fall will be lower than need be unless the patriotic import of hard technical study becomes more generally appreciated.

A recent announcement of the War Department is significant in this connection. Students of the Massachusetts Institute of Technology, and presumably of other institutions of similar character, are to be on virtually the same footing as enlisted men in the United States service when they return for instruction next fall. This plan means that failure to meet the scholastic requirements will result in men otherwise in a deferred classification of the draft being taken from school and inducted into active service. It is directly in accord with that advocated by prominent alumni of the Institute who have felt strongly that the technical schools are of such vital need to the nation in the present emergency that their opportunities should not be trifled with. The plan consolidates more closely than ever the relations existing between technical schools and the country's needs.

When there is time to prepare it, the educational history of the great war as developed on this side of the ocean will show that the contributions of American professional and trade schools in intensive and varied training for service both at the front and behind the lines, from the listening post in No Man's Land to the factory bench and humble boiler room at home, have been of a value which it would be difficult to overestimate. It is none too early to begin to prepare for the immense tasks of reconstruction and expansion of world interests in business and trade which this country will have to accomplish when hostilities are at an end, and in a large sense, indeed, all personal study in the field of applied science and in related economic branches must go forward with its high responsibilities and opportunities in mind. To some will come the call for immediate service; to others the opportunity to be of maximum use will be postponed until the benefits of longer and deeper preparation can be rendered to the nation. Let no one fail because instant opportunities for great adventure must be held in abeyance, but let us all strive to equip ourselves better to serve our nation and our time by continuing and perfecting our studies, whether from the seasoned standpoint of maturity or from the point of view of the youngest matriculator in the class of 1922.

Reconstruction After the War

THE war caught this country unawares and there is a certain sense of pride in this unpreparedness as indicating our peaceful intentions. But there will be no such pride or satisfaction should peace also find us unprepared, and lead to a painful and wasteful reconstruction. The resources of the country, in so far as thinkers and scientists are concerned, have by no means been fully mobilized. We cannot say that we are too busy at the present time to consider peace problems. Thousands of capable and competent persons would welcome a call for organization to work on various problems of reconstruction, political, economic, scientific, technical, cultural and legal.

It is an open secret that Great Britain was on the verge of a great political and economic change before the war began. The stress of the military situation has helped to stave off the troublesome domestic problems, but the far-sighted British government has realized early in the war the necessity for a thorough-going reconstruction which must be carried on simultaneously with the war and not considered only after the conclusion of peace. The Ministry of Reconstruction has been made a separate and quite active branch of the British government, and the reports that appear from time to time in the technical press bear ample witness to the fruitful and thorough-going activity of this new child of the great war. This ministry has some ninety committees working on various general and specific problems that have arisen or will arise after the war. These activities comprise all the important branches of industry and science. Extracts from some of the reports that bear directly or indirectly upon the electrical science and industry have been mentioned on one or two occasions in our research section.

Up to the present time no such organized branch of government has been formed in this country to deal broadly with problems of reconstruction when this world war is finally ended. It may be more in accordance with the spirit and the traditions of the United States to have this problem first tackled by various scientific and industrial bodies, each working upon its own problems of reconstruction, and only later have the government or some specially organized national body take a hand in it for the purpose of unifying the activities and the results of the special committees.

The electrical industry will have a large number of reconstruction problems to consider, and some of these problems are sufficiently clear and pressing at the present time to bear investigation without further delay. As such may be mentioned the unification of power supply, finding places for employees now in the military service, readjustment of rates, etc.

There is no single body that could undertake a solution of all such problems for the whole electrical industry, but it may be well for the separate bodies, such as the National Electric Light Association, American Institute of Electrical Engineers, the Engineering Council, the Power Club, the Associated Manufacturers of Electrical Supplies, the Electrical Supply Jobbers Association and others to appoint committees for a preliminary report on the forthcoming reconstruction problems. These are partly international in so far, for example, as competition in foreign markets is concerned, and partly national and even local to be considered by each small lighting company or retail dealer in electrical supplies, but they all need attention.

Motors for Wood-Working Machinery

PROFESSOR CLEWELL'S article on this topic gives a very comprehensive view of the requirements to be met in fitting a wood-working plant with electric drive. That such motor equipment is desirable under present-day conditions is very well understood, in almost any case of manufacture, but in wood-working machinery there are certain particular advantages in facilitating the orderly progress of work through the shop. One of the familiar characteristic advantages of motor-driven machines over any system of shafting and belting is that the position of a given machine is in no wise dependent on the fixed position of a drive, so that every item of the equipment can be placed where its relation to the others is thoroughly convenient. Thus the transfer of work from one operation to another is greatly facilitated and both space and labor economized.

For driving wood-working machinery the induction motor possesses such characteristic advantages that practically nothing else would be considered on its merits even were there a choice of direct-current and alternating-current service. The immunity of induction motors from the ill effects of dust and dirt, and freedom from danger of fire through the misbehavior of a dirty commutator, form sufficient reasons for abandoning any machine that has a commutator. Only in very rare instances, where extreme variation of speed is required for special operation, has the direct-current motor any claim to consideration. Most wood-working machines are conveniently driven by motors of the squirrel-cage type. If the squirrel-cage rotor has low slip it drives ahead with remarkably good speed regulation and so holds up the output. If only a small amount of flywheel effect is desired the same type of motor designed for larger slip meets the requirement, but wherever great flywheel effect is necessary it is generally thought desirable to install a slip-ring motor with an external resistance, preferably adjustable, to meet the requirements of flywheel working, although a fixed resistance is frequently all that is necessary. The latter arrangement is a common practice in operating the large bandsaws for timber sawing. These saws may run at speeds up to 10,000 ft. (3048 m.) per minute and the band wheels themselves may weigh several tons. In such instances the flywheel effects are very powerful, and there must be heavy starting effort and reliance on stored energy to drive through peaks of load.

With certain other classes of wood-working machinery, such as planing mills, cases also occur where the slip-ring type of motor with wound rotor is advisable on account of the necessary heavy starting torque. Push-button control, often from more than one point, is found to be a very important feature in the operation of certain machines, saving much time and electrical energy as well.

The Transmission of Light Through Water

THE law of the transmission of light through various thickness of approximately transparent media is well known, the total transmission through any thickness, say *n* units, being the *nth* power of the transmission through unit thickness. There is every reason to expect that this relation holds for any medium in which the stoppage of light is, so to speak, homogeneous, and in which there is no marked selective action to change the effective luminosity. There have been but few attempts to verify the law experimentally, and the recent experiments reported by Mr. Rose in the current number of the *General Electric Review* are therefore of particular interest. The substance used was water, especially convenient on account of the ease with which it may be obtained homogeneous and in great thickness. The major cause of the lack of transparency in water is the presence of suspended matter, which may, however, be assumed to be quite uniformly distributed. The test was made by actually measuring the absorption of light from a metallic filament lamp slid along a tank filled with water and properly screened, at the end of which just below the surface rested the photometer test plate. The water was ordinary city water obtained from artesian wells. The result as regards the effect of relative thickness was precisely what was to be anticipated, the exponential law being verified well within the limits of experimental error.

The particularly interesting feature of the results from a practical standpoint is the very considerable cut-off of light produced by a substance apparently so transparent, amounting for a single foot (0.05 m.) of water to 27.5 per cent. On this basis the transmission through 50 ft. (15.2 m.) of water would be only about one part in 10,000,000 of the incident light. These figures are sufficient to show the difficulty of carrying out any experimental or practical work with light where considerable thicknesses of water are involved. Sea water is probably on the average somewhat less transparent than even these figures would indicate, particularly where the apparent hue of the water is greenish or turquois blue, which tints bespeak a fairly considerable amount of suspended matter and consequently increased opacity.

On the other hand, water, either of lake or sea, sometimes is extraordinarily free from suspended matter, except in very fine particles, so small in comparison with the wave length of light as to exercise a strong selective action on the blue, which in itself would show a high absorption coefficient, while the general absorption for white light would be conspicuously lower than in the case tested. It is well known, for instance, that in very clear water, particularly in the tropics, small objects can be seen on the bottom by means of a water telescope at depths of 40 or 50 ft. (12.2 to 15.2 m.). It is apparent, however, that the transmission coefficient of water under ordinary circumstances is rather surprisingly low, and only reaches high values in cases where nature or art has freed the liquid from most of its suspended matter, or at least left it comparatively free of particles large enough to affect considerably the brighter part of the spectrum.

A Genuine High-Voltage Plant

NOW is the time when, in order to attract any perceptible amount of attention, a new power transmission plant must be characterized by some features still unusual. This merit certainly belongs to the new Michigan plant of the Consumers Power Company described in our current issue. It is the latest feeding plant on that great network which covers the central part of the State of Michigan, and which came to special notice some years ago as being almost the very first system on which the working voltage passed 100,000. The present installation is not only the largest in Michigan, but operates regularly at 140,000 volts with a main transmission slightly more than 100 miles (160.9 km.) long. This voltage has been used before on the system, but not on so extensive a scale.

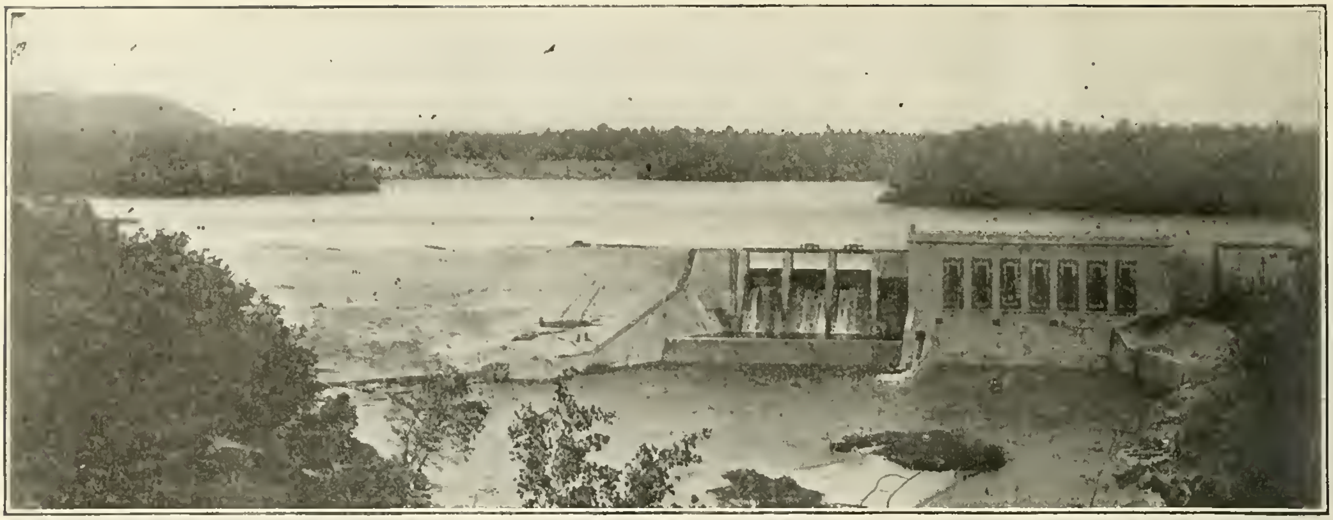
The hydraulic plant possesses some features of interest in that it involves a concrete dam on a foundation of clay hard-pan, although the working head is about 50 ft. (15.2 m). There are several similar dams on the system, but this is quite the largest and most important. The location is on the Manistee River, which is extremely free from heavy floods, so that the construction chosen was well justified by the hydraulic conditions. During development of the plant the river was diverted and power for building the new hydraulic works was derived from a power plant a few miles up the stream built particularly for this purpose and of 800-kw. capacity. The power house, nearly 150 ft. (45.7 m.) long, stands in the old river channel. The three concrete penstocks present an interesting feature in their slightly flexible joints reinforced by corrugated metal strips, a type of construction which has stood the test of some years' use in other plants. On account of the severity of the winter climate provision is made for heating, by steam radiators, one of the spillway gates so that it can be quickly opened if necessary. All the gates are operated by motor-driven worm-geared hoists, which are operated from the power-house switchboard. The whole capacity of the plant is concentrated in three vertical direct-connected units with single-runner wheels coupled to generators of 5500-kw. capacity at 75 r.p.m.

It is worth noting that the full efficiency of the turbines under test slightly exceeds 90 per cent, with an efficiency above 80 per cent all the way up from 0.4 load. The frequency adopted for this plant is 30 cycles, which was already employed in part of the system in northern Michigan, although the general frequency is 60, to which the power delivered from this station is to be for the most part changed at the receiving end of the line. The power-house equipment is of the simplest possible character, the whole high-tension equipment being placed in an out-door substation. Being part of a large network with a long transmission line to serve as buffer the station needs, and has, no elaborate protective system at all. The working low-tension switchboard is installed at the end of the station, where the control for the high-tension switches outside is also situated. The cables for the step-up transformers pass through a concrete subway from the basement of the power house to an out-door substation with three 5000-kva. single-phase transformers, delta connected for 7500 to 140,000 transformation. They are of the water-cooled type and are provided with taps to give from 120,000 to 140,000 volts as required. Provision is made for readily shifting the transformers to open-delta connection in case of accident, no spare transformer being deemed necessary considering the connection of this station to the rest of the system. The high-tension oil switches are non-automatic solenoid operated, and are worked from the station, in charge of an operator responding to the calls of the load dispatcher, who manages the whole network. The high-tension buses consist of galvanized-iron pipes supported on strain insulators.

The whole plant has been built with simplicity, efficiency and economy constantly in mind, with full realization of the fact that it is not the sole reliance of a great network, but one of many plants, and used especially in taking up peak load. In all such cases the whole aggregate of plants must be taken into account in making provision for adequate reserves, so that each unit may be, and for sound economy should be, comparatively simple.

The Coming Issues

FURTHER details regarding the operating problems involved in the proposed interconnection of New England public utilities will be given in an early issue of the ELECTRICAL WORLD, together with an outline of the methods used in solving them. Industrial subjects will also be discussed, such as the application of motors and control apparatus to printing machinery and features and performance of an electric furnace installation in New Jersey. Opinions on how to conserve fuel will also be presented.



New Plant Added to Michigan System

Junction Development, the Largest Hydroelectric Plant in Michigan, Has Several Hydraulic Features and Is Model of Simplicity—Connected with Grand Rapids by 140,000-Volt Line

THE Consumers' Power Company, which operates a large interconnected electric service system in the lower peninsula of Michigan, has recently completed the largest hydroelectric plant in that state. It is situated on the Manistee River about 3.5 miles (5.6 km.) from Wellston and is called Junction Development, since a river known as the South Branch joins the Manistee near the site. The plant, which is rated at 16,500 kw., is being operated in parallel with the rest of the company's system as a peak plant, a 140,000-volt transmission line connecting it with Grand Rapids, 101 miles (162.5 km.) away, while other lower-voltage lines join it with nearer places. In general the plant will utilize all of the flow of the river, although the capacity of the pond, which covers 1560 acres (631.3 hectares), permits considerable flexibility. The plant will be used to meet the requirements of the 30-cycle system (the part south and east of Grand Rapids operating at 60 cycles) so that no definite daily program of operation may be expected. However, it will usually be possible to avoid wasting any water over the spillway.

Among the hydraulic features of the plant are the following: The head is 51 ft. (15.5 m.), which is an unusual height for a dam resting on an earth foundation. The flow of the Manistee River is remarkably uniform, the extreme flood being only about four times the ordinary low-water flow. The 452,500 cu.yd. (345,963 cu.m.) of sand fill in the embankment which comprises part of the dam was deposited by a sluicing process during the winter of 1917-18 with very satisfactory results as to water tightness and settlement, the seepage being only 0.46 cu.ft. (13 cu.dec.) per second and practically constant for two months. Special hydraulic joints are used in the various structures, and provision is made to prevent the gates freezing fast in any position. The dam construction employed to prevent erosion of the river bed by the water tumbling over the dam and for other reasons is also interesting.

Electrically the plant is about as simple as could be imagined, this being a feature which dates back to the beginning of the system. It will probably be remembered that this system was one of the first (under a different name at that time) to attempt real high-voltage transmission (110,000 volts) and that oil switches, lightning arresters and insulators suitable for 110,000 volts were hardly known at the time. The interior of the station contains little more than the generators and the low-voltage oil switches, the cables running to outdoor equipment, including 140,000-volt transformers, aluminum-cell lightning arresters and oil switches controlled from within the station. Having relatively small rating compared with some hydroelectric plants in the West and being tied in with the rest of the system by long transmission lines that act as dampers to any surges that may occur, the station has no elaborate protective equipment in the form of relays, reactors, etc.

Two conditions made it particularly desirable to locate a station at the site chosen. One was that the Manistee River valley in general is broad, while here was a narrow part across which a dam could be easily erected. Secondly, this site is the farthest downstream where a clay bottom exists and at which a dam of reasonable height would back up the water to the next good site above.

Within the last fourteen years the owners and designing engineers of this development have built several other successful dams upon similar clay hard-pan foundations with heads ranging from 26 ft. to 40 ft. (7.9 m. to 12.2 m.), seven being on the Au Sable, Muskegon and Grand Rivers in Michigan. Where the hard-pan is compact and continuous no round or sheet piling has been used. At Junction Dam a line of sheet piling extends across the valley and to a depth of about 40 ft. (12.2 m.) below normal river surface.

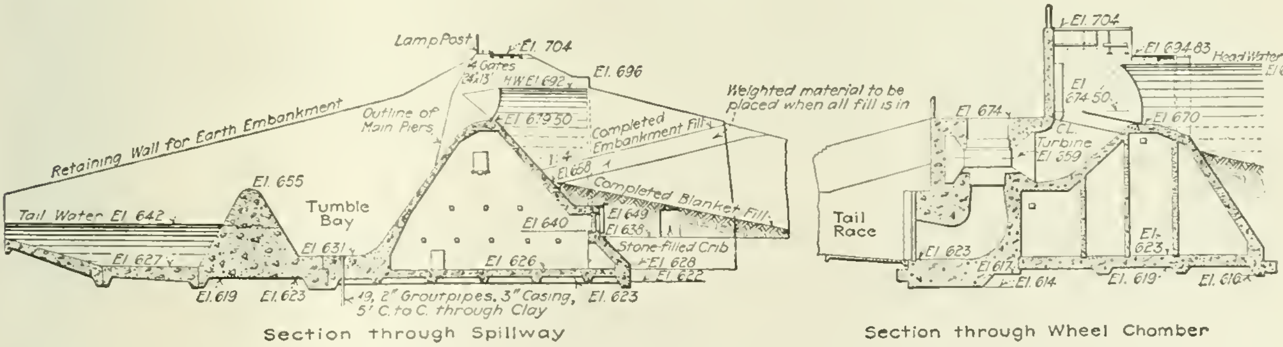
The watershed above Junction Dam is 1451 sq. miles (376,000 hectares), and at its maximum elevation Junction Pond has an area of 1560 acres (63.1 hectares). The dam backs up the water in the main river about 8 miles (12.9 km.), and in the South Branch, which enters

1.5 miles (2.4 km.) above the dam, a total distance of about 4.5 miles (7.2 km.) to the Stronach Development built in 1912 by the same owners. Stronach Development was built primarily to furnish power for the construction of the larger dam and contains two 400-kw., 7500-volt, 30-cycle generators, which feed into a transmission line operating at 40,000 volts and extending from Manistee to Cadillac, a distance of 50 miles (80.5 km.). A 7500-volt line extends to Junction Development.

The Junction power house and spillway were placed immediately in the old river channel, the river having been diverted during construction. The power house is 145.5 ft. (44.3 m.) in length and 40 ft. (12.2 m.) in width. Beyond this is the spillway, consisting of four motor-operated 24-ft. by 13-ft. (7.3-m. by 4-m.) steel Tainter gates surmounting a hollow concrete structure.

The ordinary flood is about 5000 cu.ft. (141.5 cu.m.) per second, and the maximum flood on record for the past twenty years is 7500 cu.ft. (212 cu.m.) per second. Two of the gates will, therefore, safely discharge the maximum flood on record without causing rise of headwater. The freeboard on the embankment is 12 ft. (3.7 m.), to provide for the possible failure of any future dam upstream.

Water passing through the Tainter gates is received in a tumble bay 24 ft. (7.4 m.) deep, formed by a solid concrete weir of this height across the spilling channel, the crest of this weir being 13 ft. (4 m.) above tailwater. The spillway operates successfully to deliver the water at low velocity. In passing 5000 cu.ft. per second through the spillway sand lies undisturbed on the last 50 ft. (15.2 m.) of concrete apron.



Section through Spillway

Section through Wheel Chomber

FIGS. 1 AND 2—SECTION OF DAM THROUGH SPILLWAY, SHOWING TUMBLE-BAY AND SECTION THROUGH WATERWHEEL CHAMBER

POWER HOUSE AND PENSTOCK JOINTS MADE WITH GREAT CARE

Special attention had to be given to the design and construction of joints in the power-house structure to prevent leakage from water, since a total head of 42 ft. (12.8 m.) exists at the wheel pit. Below this level the greater thickness of concrete and absence of necessary joints made the problem simpler, although a higher head exists. The construction joints in the penstocks have been made as few as possible and where necessary have been made water-tight by specially bent copper or corrugated galvanized ingot-iron strips, these strips crossing the joints and permitting by their special corrugations movements at the joint. With sufficient care to prevent injury to the strips during construction this type of joint has proved quite satisfactory after using for a number of years in heads up to 60 ft. (18.3 m.). This type of joint is also used at intervals in the embankment core walls, the water-tightness of which is in a great measure due to the care taken with the joints. Construction plans were prepared in detail, indicating exactly where joints were allowed, and no departure from this joint program was permitted without thorough consideration by the designing engineers. The maximum length cast without joints was 114 ft. (34.7 m.) for the downstream wall of the three penstocks.

There is a curtain wall of smooth, hard, dark-colored brick along the upstream wall of the power house, the object being to exclude any dampness and hide any unsightly small leakage which might come through the concrete on this side of the room. However, practically no leakage or dampness has resulted.

STEAM-HEATED TAINTER GATES

Aside from the greater height at which the gates are set, the four-Tainter-gate spillway at Junction Dam does not differ essentially from numerous similar spillways built in various parts of America. However, the severe winter conditions of this locality require that one of the spillway gates be provided with a heating system so that there will be no delay in opening a gate. When one of the gates has been opened and water allowed to flow for a few hours the circulation will thaw the ice on the remaining gates. The scheme of heating is to warm an inclosed chamber between the gate piers, having such shape and size as to permit the opening of the gate within the chamber. The steam radiators are supported on the upper radial struts of the gate and swing with it, the connection to the steam main being by a 2-in. (5.1-cm.) flexible hose. Steam is supplied from the low-pressure boiler of the power-plant heating system.

This foregoing scheme of heating has the advantage of applying heat directly to the surface of headwater about 2 ft. (60.9 cm.) in width between the curtain wall and the gate itself. The detail plan would not be applicable to a dam at which the headwater was allowed to rise above a fixed elevation, but at this plant the uniform flow of the Manistee River permits maintaining the headwater at a constant elevation.

Each of the three wheel chambers is closed by a steel Tainter headgate 30 ft. (9.1 m.) wide by 22 ft. (6.7 m.) in vertical height. Like the spillway Tainter gates, these headgates are hoisted directly by motor-driven worm-geared hoists without the aid of any counterweights. The hoists are operated from the power-house switchboard, where telltales in sight of the operator indicate the position of the gate. Owing to the large size of these headgates the water can pass at a velocity of 2.57 ft. (78.3 cm.) per second. From the racks to the turbines the form of the water passages is such that the water moves very smoothly, making it possible to use turbine current meters very successfully for measuring waterwheel efficiencies. For making such tests the current meter sections are taken 4 ft. (1.2 m.) downstream from the racks at the headwater level, the vertical being 10 ft. (3.05 m.) from the racks at the bottom.

How Sizes of Units Were Chosen

The entire rating of the power house is now provided for by three vertical direct-connected generating units. The turbines, which are of the single-runner type, were built by the Wellman-Seaver-Morgan Company. At 47-ft. (14.3-m.) working head and when all three units are running full load 1700 cu.ft. (48.3 cu.m.) of water is used per second per unit. With the size of units chosen one of the three turbines will utilize the entire flow of the river at low water, and the three will take care of the ordinary flood flow.

Although the guaranteed efficiency of the water wheels is 88 per cent maximum, careful field efficiency tests indicated that they exceed this amount by 4 per cent. A very flat curve was obtained, the efficiency of the generators being 96.7 per cent maximum and 96.5 per cent at full load. From 0.4 load to full load the waterwheels show an efficiency above 80 per cent. No shop tests were made, owing to war conditions; that is, the shops were so crowded that time could not be taken to make tests.

The generators, which are rated at 5500 kw., 30-cycle and 75 r.p.m., and all electrical equipment were furnished by the Westinghouse Electric & Manufacturing Company. The rotor spiders are cast steel and guaranteed to stand 100 per cent overspeed. The flywheel effect is 3,400,000 ft.-lb. (469,000 m.kg.) at 1 ft. (0.305 m.) radius. A frequency of 30 cycles was selected because that is the periodicity in the northwest portion of Michigan, although 60 cycles is the frequency of all plants of the Consumers' Power Company south and east of Grand Rapids.

On top of each generator is a Kingsbury thrust bearing, which supports the rotating elements of both generator and turbine. On the shaft above the thrust bearing is a direct-connected compound-wound exciter rated at 55 kw. and 250 volts. The speed of the units is controlled by hydraulic governors built by the Lombard Governor Company, each having a capacity of 60,000 ft.-lb. (8270 m.kg.). The actuators are of a special new type operated by oil pressure, both for direct application and through the hand control directly from the actuator as well as on a separate stand. A central oil-

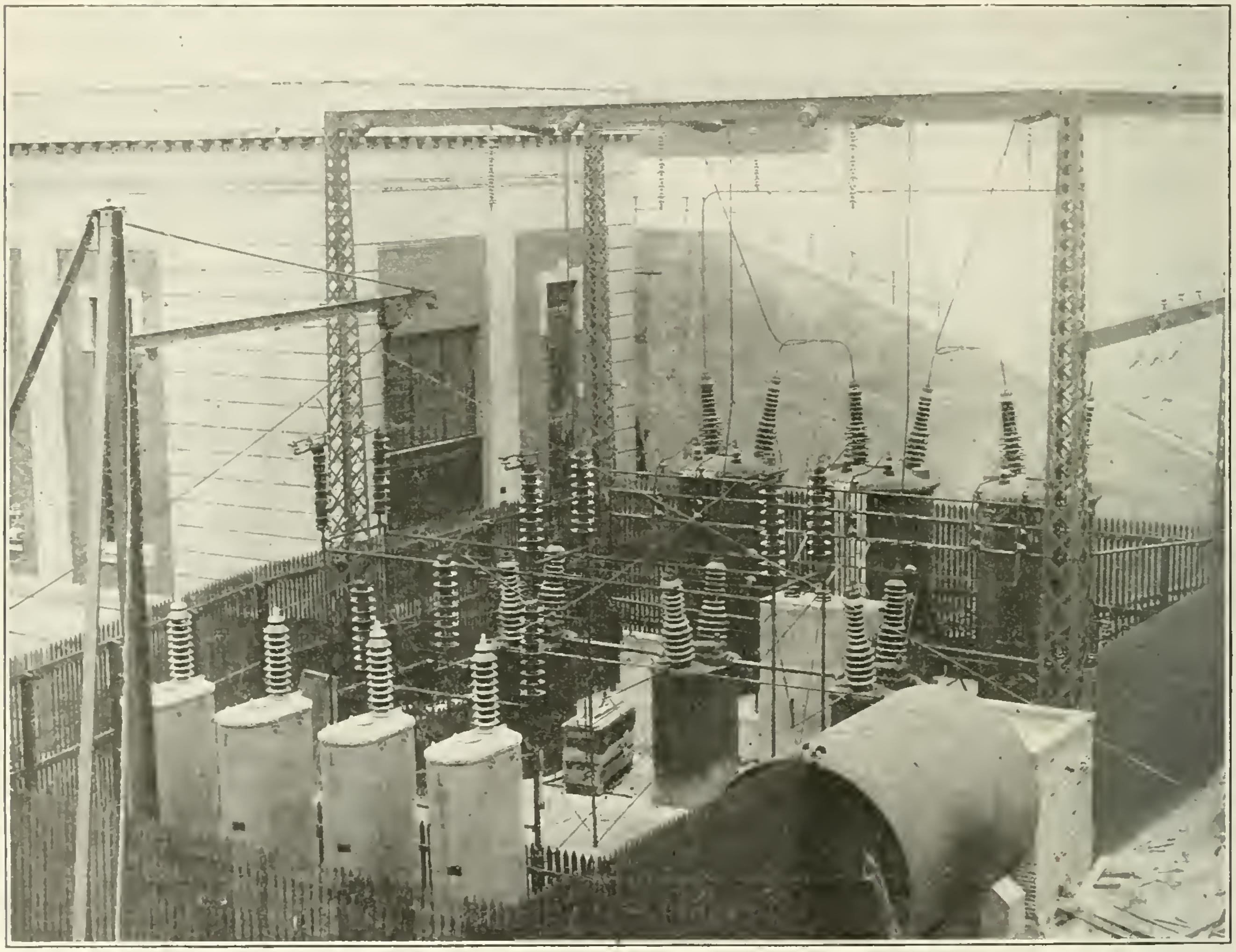


FIG. 3—OUTDOOR TRANSFORMING, SWITCHING AND LIGHTNING ARRESTER EQUIPMENT CONNECTED WITH 140,000-VOLT LINE TO GRAND RAPIDS

pressure system is used, two pumps being provided, either of which is sufficient for the three units. For filtering the oil used for this purpose as well as for lubrication, Richardson-Phenix equipment rated at 100 gal. to 200 gal. (378.5 l. to 757 l.) per hour is provided.

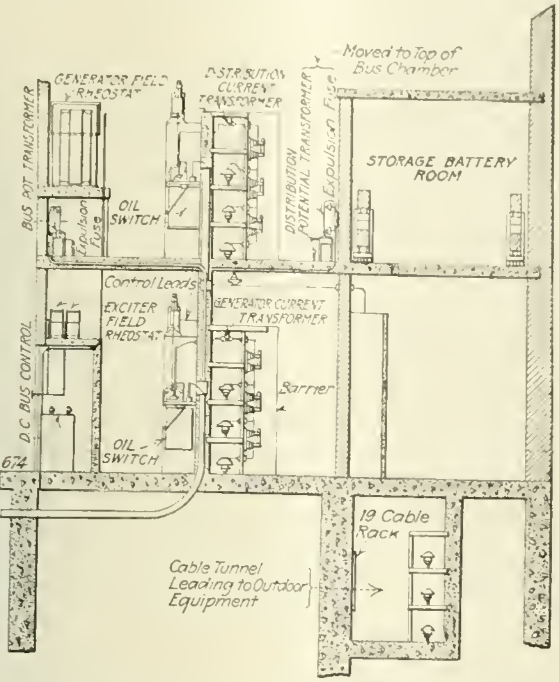


FIG. 4—DETAILS OF BUS AND SWITCH STRUCTURE WITH CABLE TUNNEL LEADING TO OUTDOOR EQUIPMENT

Keeping oil clean and conserving oil are considered so important by the engineers connected with this development that they even go so far as to say that all large water and steam power plants should have adequate oil-filter systems. The system mentioned has been quite satisfactory in other plants which the same engineers have designed.

The power hous is served by a 30-ton Whiting crane, which can be used at 50 per cent overload for occasional handling of the generator rotors. The heaviest parts of the transformers are lighter than the rotors.

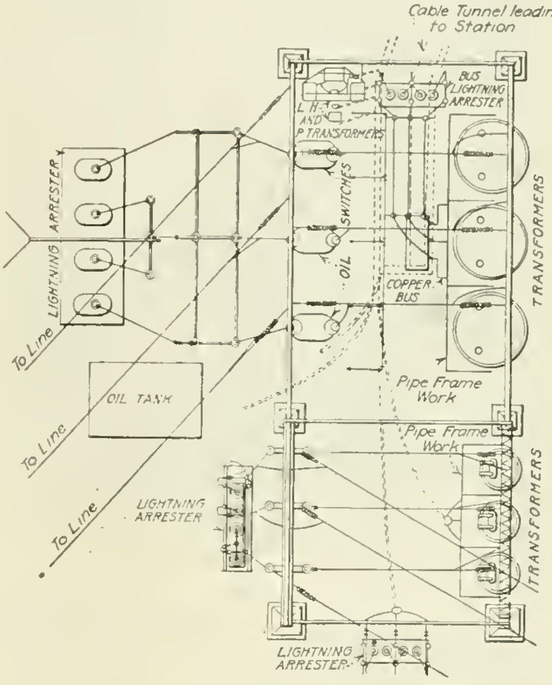
Switching and Bus Layout to Save Expensive Building Construction

At the shore end of the power house is an inclosure, on the first floor of which, immediately back of the switchboard, are the generator-bus and oil-switch compartments. Back of these against the outside wall of the building is a small shop for repair work. Over the shop on the second floor is a storage-battery room, and next to it are the distribution bus and switch compartments and generator-field rheostats. The switchboard, which as mentioned before is at the end of the generator room, is made up of ten panels, of which two are for future outgoing lines.

The exciter rheostats are hand-operated and are situated on a platform to the rear of and immediately above the switchboard. The generator-field rheostats are motor-operated and are on an elevated platform on the second floor, above the switchboard. The storage battery, which is used only for energizing control circuits, consists of sixty cells rated at 112.5 amp.-hr. It is charged by a 2.25-kw. motor-generator set, the control panel of which is on the main floor to the right of switchboard.

The entire layout of the station switchboard and switching apparatus was arranged principally to save space and to avoid the unnecessary expense of enlarging the power house on the downstream side, where to support it over the tailrace would be expensive. With but three units it was entirely feasible to install the switchboard at the end of the station and still provide an ample passageway to the main entrance without unduly widening the power house.

All cables are carried in wrought-iron pipe conduits placed mostly in the concrete floors and walls. From the main generator to the oil switches the circuits are 500,000-circ.mil. lead-covered cables. The switches are type E-6 Westinghouse solenoid-operated 7500-volt, 600-amp. units. Cables run from these through the wall in the rear to current transformers mounted vertically and thence to "disconnects" and the main buses. The buses are separated by freestone barriers, these being used in place of concrete or "asbestocel," as they are cheaper and at the same time fully as satisfactory if not more so. Usually, thin concrete work, the engineers believe, is



Plan

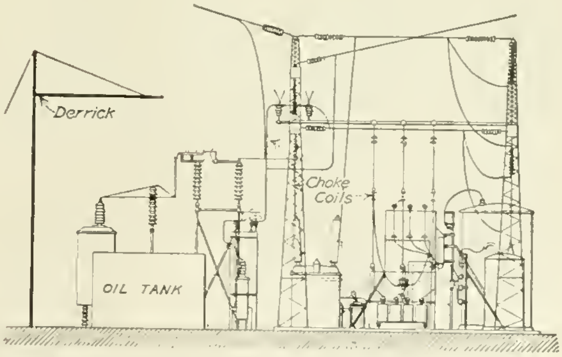


FIG. 5—ULTIMATE LAYOUT OF OUTDOOR EQUIPMENT, SHOWING DERRICK FOR HANDLING ARRESTER CONES

much more expensive to build and finish in an attractive manner than is figured in the drawing room. The generator-bus potential transformers are located on the second floor, above the switchboard.

Various circuits are taken off from the generator buses through "disconnects" and current transformers to Westinghouse type E-6 solenoid-operated oil switches, which are immediately above the generator bus. The distribution potential transformers are above the busbar compartment. The circuits extend from their respective oil switches to a concrete subway running from the basement of the power house to an outdoor substation. This subway is 6 ft. (1.8 m.) wide by 9 ft. (2.7 m.) high. On one side are compartments with freestone barriers for 7500-volt circuits, 2000-amp. feeding the Croton-Grand Rapids 7500/140,000-volt transformers. On the other side are cable racks for other circuits which are carried in fiber conduit.

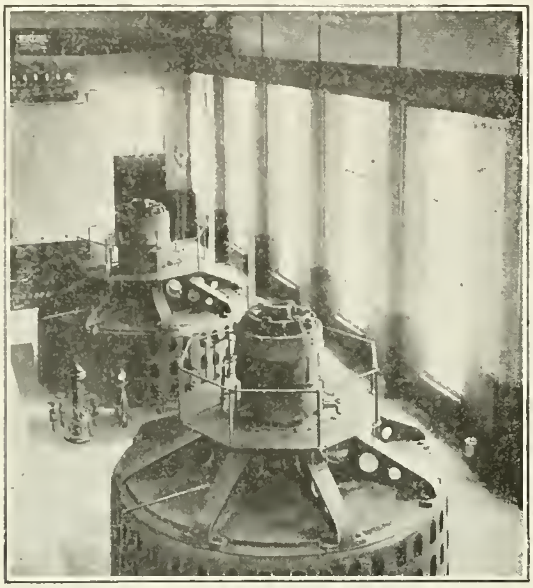


FIG. 6—TWO 5500-KW. WATERWHEEL GENERATORS; SWITCHBOARD IS IN BACKGROUND AGAINST WALL OF BUS AND SWITCH COMPARTMENT

The outdoor substation is situated to the landward and partly downstream from the generator house on the same level as the main floor. Here are installed three Westinghouse delta-connected 5000-kva., 140,000/7500-volt, 30-cycle, single-phase, oil-insulated, water-cooled transformers. On each transformer are 120,000-volt to 140,000-volt taps arranged in 5000-volt steps. This is in accord with the standard transformer specifications of the Consumers' Power Company, which are made essential by the fact that it is sometimes necessary to adjust voltages in order to secure best results in delivery of energy. "Disconnects" are placed at transformers in the 7500-volt leads.

The transformers are mounted on trucks supported on slightly elevated concrete platforms. To permit repairing and inspecting the transformers without exposing them to the weather a transfer-lorry track is provided between the substation and the power house. In the latter is a pit into which a transformer may be lowered before removing the core. With this arrangement extra headroom is not necessary.

None of the recent large stations of the Consumers' Power Company has a spare transformer. When repairs are made it is the custom to operate the transformers in open delta, readily separable joints being provided to permit their disconnection. All high-tension buses consist of galvanized-iron pipe mounted on a galvanized-steel structure with strain insulators for supports.

The 140,000-volt oil switches, which are type G-2 300-amp. units, are non-automatic, solenoid-operated and are set on concrete foundations. Automatic switches are undesirable in this case because the Consumers' Power Company employs the load-dispatcher method of operating its plants. However, the generator switches become automatic during the process of synchronizing on the insertion of synchronizing plugs. The 140,000-volt electrolytic lightning arresters with their horn-gap structure are set on concrete foundations and are served by a cone-stack derrick. Provision has been made for extension of the outdoor station to care for a 40,000-volt Manistee-Stronach-Cadillac transmission line.

The transformer cooling water is provided by a 2-in. (5.1-cm.) centrifugal pump having a capacity of 125 gal. (473.2 l.) per minute. It is directly connected to a 5-hp. motor installed in the machine shop and takes water from the penstocks. All piping to and from the transformers is laid in concrete trenches where necessary and is covered to prevent freezing. The transformer cooling-water indicator is a cast-iron box with a water-tight glass cover.

Oil for the transformers and oil switches can be supplied by an 1.5-in. (5.9-cm.) centrifugal pump having a capacity of 70 gal. (265 l.) per minute, directly connected to a 5-hp. motor. It is connected with a storage tank holding 8800 gal. (331 l.), and the pipes and valves are so arranged that oil can be pumped into the transformers or oil switches from the storage tank or oil barrels, or vice versa. All of this equipment is installed in the outdoor substation. A portable oil-filter press with a transformer attached is available and is used at other plants in the system. Three 25-kva., 7500/220-volt, 30-cycle, single-phase transformers are also installed in the outdoor substation to supply power for small station auxiliaries and local lighting.

ORGANIZATION OF PROJECT

Junction Dam was built by the Consumers' Power Company with its own forces and equipment. This company is a subsidiary of the Commonwealth Power, Railway & Light Company, which is managed by Hodenpyl, Hardy & Company of New York and E. W. Clark & Company of Philadelphia. B. C. Cobb, vice-president of Hodenpyl, Hardy & Company, is president of the Consumers' Power Company and represented these companies in connection with this work; Frank Silliman, Jr., of E. W. Clark & Company, represented that company. J. B. Foote, chief engineer of the Consumers' Power Company, was in general charge of the design and construction of this plant. G. S. Cochran was general construction superintendent, and the resident superintendent was Fred B. Taylor. George F. Stecker was in charge of the electrical part of the design and construction. The hydraulic and structural design and engineering supervision of construction, except for electrical features, was in charge of the Fargo Engineering Company of Jackson. H. N. Tuley was resident engineer.

Characteristics of Iron and Steel Conductors—II

Stringing Tables Are Based Upon Extreme Weather Conditions, but Present Tendencies Toward Economy Dictate Cheaper Construction Where Warranted by Local Conditions of Climate and Service

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THE mechanical characteristics of iron and steel wire and their bearing on the proper sags and tensions which should be used with such wire have received insufficient attention in the past, and it is thought that a discussion of these characteristics would be opportune. While the wire-stringing tables accompanying this article are based on extreme weather conditions, a method is given for obtaining sag or tension with less factor of safety by a simple calculation, using the standard stringing tables. This is an essential feature of such tables under war-time conditions.

In order to insure a reasonable return on the investment in iron or steel lines, which usually serve sparsely settled territories, cheap construction must be resorted to and span lengths increased to as great a length as will be justified when due consideration is given to the safety of the public and the service to be rendered. Since a great portion of these lines lies in rural districts or on private rights-of-way, the utility is given almost a free hand in construction, the principal places where special requirements for strength of construction must be observed being those where such lines cross railroads, signal lines or other power lines, or where poles are used in common with other utilities. In these special situations certain strength requirements should be met, and it is particularly for these cases that the following sags and tensions are given.

TABLE V—MECHANICAL DATA FOR IRON AND STEEL WIRES AND CABLES

Size, Nominal	Actual Diameter (In.)	Area (Sq In.)	Elastic Limit				Modulus of Elasticity	
			E.B.B	B B	Ordinary Grade Steel	Siemens-Martin	E.B.B and B B	Ordinary Grade Steel and Siemens-Martin
Stranded:								
3/8-in....	0.36	0.0792	1900	2100	2500	3400	19×10^6	21×10^6
5/16-in....	0.327	0.0654	1550	1700	1900	2400	19×10^6	21×10^6
1/4-in....	0.249	0.0379	900	1000	1150	1500	19×10^6	21×10^6
Solid B.W.G.:								
No. 4...	0.238	0.0445	1014	1135	1216	1670	26×10^6	29×10^6
No. 6...	0.203	0.0324	737	826	885	1200	26×10^6	29×10^6
No. 8...	0.165	0.0214	486	546	585	800	26×10^6	29×10^6

The coefficient of linear thermal expansion for iron and steel per degree F = 0.67×10^{-5}. The elastic limit was taken as one-half of the ultimate strength.

A method is also given by which stringing tensions for use on parts of the lines where no special hazard is involved may be obtained by the application of simple rules, using the sags of Table VII. The factor of safety based on the assumed conditions of loading given below may, by the application of these rules, be varied at will, although the computation of the factor of safety under these new conditions is difficult because the wire will usually be stressed beyond the elastic limit.

Not only should lines be given a sag such that the tension in adjacent spans will be approximately equal at the time of stringing, but for the smaller spans at least the sags should be about the same for all conductors, regardless of size. In every case an effort should be made to avoid giving the conductors on the lower crossarms the smaller sags.

The mechanical characteristics given in Table V have been used as the bases of calculations. The moduli of elasticity for the solid wire given in the table are the generally accepted values. The fabrication of the wire into cables will result in a somewhat different modulus for the stranded type of conductor. The effect of the wires lying together more closely under load also affects the resulting modulus of elasticity. From tests on one hundred samples made by the American Telephone & Telegraph Company on seven-strand steel cable, an average value of 21×10^6 for this cable resulted. Tests on seven-strand iron cable (E. B. B. and B. B.) conducted at the Bureau of Standards resulted in a value of 19×10^6. The loading under the most adverse condition was assumed to be the resultant loading at 0 deg. Fahr., due to the weight of the conductor plus the added weight of a layer of ice 0.5 in. (1.27 cm.) in radial thickness, combined vertically with a wind pressure of 8 lb. per sq.ft. (39 kg. per sq.m.) on the projected diameter of the ice-covered conductor.

Table VI gives the loadings under the above assumptions for different-size conductors, while Tables VII and VIII give sags and tensions for various temperatures under which the wire might be strung. The sags are computed on the assumption that the maximum stress in the wire will be 0.9 of the elastic limit of the wire under consideration when under the most adverse condition defined above.

It is obvious that under this condition the tension in the wire will be as large for the short spans as for long ones. The strength of the structures for such spans must, in order to withstand these stresses, be comparable to the strength of structures for long spans. Consequently the advantage of using short spans is lost. The sags for the shorter spans should therefore be increased. Further reasons for this will appear later.

When considering sags for short spans, attention should be given to the possibility of later replacing the iron-wire lines by copper lines and also to the probability of using iron and copper conductors on the same pole structure. In order to eliminate a ragged appearance in the line, all conductors should be given about the

TABLE VI—CONDUCTOR LOADINGS

Nominal Size	Weight of Conductor in Lb. per Ft.	Resultant Loadings in Lb. per Ft. at 0 Deg. Fahr., 8-Lb Wind and ½ In. of Ice Plus Weight of Conductor
3/8-in.	0.295	1.25
5/16-in.	0.21	1.142
1/4-in.	0.125	1.022
Solid B.W.G.:		
No. 4	0.153	1.027
No. 6	0.112	0.972
No. 8	0.074	0.917

TABLE VII—STRINGING SAGS FOR IRON AND STEEL CONDUCTORS (IN INCHES)

Size of Wire	Temp. (Fahr.) at Which Wire Is Strung	EXTRA BEST BEST (E.B.B.) IRON WIRE Length of Span (Feet)											BEST BEST IRON (B.B.) Length of Span (Feet)										
		100	125	150	175	200	250	300	400	500	600	700	100	125	150	175	200	250	300	400	500	600	700
No. 8 B.W.G.	0	25.5	43	65.5	92	123	199						19	35.5	55.5	79	106	173.5					
	30	27	45	67.5	92.4	125	202						21.5	38	57.5	81	108	175					
	60	29.5	47	68	95.5	127	203						24	40	59.5	83	110	177					
	90	31.5	48.5	71	97	128	204						26	42	61.5	85	112	179					
	120	32.5	50.5	72.5	99	130	206						28	44	63.5	87	114	181					
No. 6 B.W.G.	0	12	25	40.5	59	83.5	132	196					7.7	18.5	32.5	49	66.5	113.5	175.5				
	30	15.5	28	43.5	61.5	86	134	199					11	22	36	52	70	116.5	176.5				
	60	18.5	31	46	64.5	88.5	137	201					14	25.5	39	55	73	119.5	181				
	90	21	33.5	48.5	67	91	140	202					17.5	28.5	41	58	75.5	122	182				
	120	23	35.5	51	69	93	142	205					20	31	44.5	61	78.5	125	184.5				
No. 4 B.W.G.	0	6.1	14.5	26.5	40.5	59	96	143.5	269				4.1	9.4	19	32.5	46	82	123.5	234	379		
	30	9.2	18.5	30.5	44	63	99.5	147	272				6.1	13.3	24	37	50.5	85	127	237.5	383		
	60	12.5	22	33.5	47.5	66	102	150.5	275				9.2	17.5	27.5	40.5	54.5	88.5	131.5	241.5	386		
	90	16	26	37	51	69.5	105.5	153.5	278.5				12.7	21	31.5	44.5	58.1	92	135	244	390		
	120	18.5	28.5	40	54	73	109	156.5	281				16	24.5	35	48	61.5	96	138.5	248	394		
¼-in. seven-strand cable	0	5.1	13.5	27	43	61.5	105.5	159.5	301				3.6	8.3	18.5	33	50	89.5	138	265			
	30	7.3	17	30.5	46.5	64.5	109	162.5	305				4.8	11.4	23	37	53.5	93	141	268.5			
	60	10.2	21	34	49.5	68	111.5	165.5	308				6.7	15	27	41	57	96.5	144.5	271.5			
	90	13.5	24	37	53	71	116	168.5	310				9.5	18.8	30	44.5	61	100	148	275			
	120	16.5	27	40	56	74	117.5	171.5	313				12.5	22	34	48	64	104	152	278			
5/16-in. seven-strand cable	0	3	5.5	9.9	17.5	28	56	92.5	179	295	439		2.5	4.4	7.6	12.6	20.5	45	76	157	261	392	550
	30	3.8	7.2	13	22	33	61	95.5	183.5	300	444		3.1	5.6	9.7	16.5	25.5	50.5	81.5	161.5	266	398	555
	60	5.1	9.9	17	26.5	38	66	100	188	304	448		4	7.4	12.8	21	30.5	55.5	87	166.5	271	403	560
	90	7.4	13.4	21.5	31	42.5	70.5	105	193	308	453		5.6	10	17	25.5	35.5	61	92	171.5	276	407	564
	120	10.1	17	25.5	35.5	47	75	109	197	313	457		8	13.5	21	30	40.5	65.5	96.5	176.5	281	412	469
⅜-in. seven-strand cable	0	3.2	5.6	9.4	15	21	47	77.5	155.5	258	385	540	2.7	4.5	7.4	11.6	17.5	36.5	63	133	225	339	479
	30	4	7.1	12	19	28.5	52.5	83	160.5	263	390	546	3.2	5.7	9.3	14.5	21.5	42	69	139	231	345	483
	60	5.2	9.3	15.5	23.5	33.5	57.5	88	165.5	268	395	549	4.2	7.3	11.8	18	26.5	48	75	144.5	237	351	489
	90	7.2	12.5	19	28	38	62.5	93	170.5	273	399	554	5.6	9.6	15	22.5	31.5	53	80.5	150.5	242	356	493
	120	9.9	16	23.5	32.5	42.5	67.5	98	176	278	405	559	7.8	12.5	19	27	36	58.5	86	155.5	248	352	498

Size of Wire	Temp. (Fahr.) at Which Wire Is Strung	ORDINARY GRADE STEEL Length of Span (Feet)											SIEMENS-MARTIN STEEL Length of Span (Feet)												
		100	125	150	175	200	250	300	400	500	600	700	100	125	150	175	200	250	300	400	500	600	700	800	1000
No. 8 B.W.G.	0	17	32.5	51	73	98.5	160	238					3.5	11.3	25.5	42	60.5	105.5	160	304					
	30	19.5	35	53	75	100.5	162	240					5.4	15.4	29.4	46	64	108.5	163	307					
	60	22	37	55.5	77.5	102	164	242					8.5	19.5	33	49	67.5	111.5	166	310					
	90	24.5	39.5	57.5	79.5	105	167	244					12.1	23	36.5	52	70.5	114.5	169	313.5					
	120	26.5	41.5	59.5	81.5	106.5	169	246					15.5	26	39.5	55	73.5	117.5	172	315.5					
No. 6 B.W.G.	0	6.1	16	29	44.5	62.5	105.5	153	294				2.1	4.3	8.9	18	31	62.5	101	201	329				
	30	9.4	20	33	48	65	108	160	296				2.9	6	12.7	23	36.5	67.5	105.5	205	334				
	60	13	23.5	36.5	51	69	111.5	163	299				4	8.9	17.5	28.5	41	72	110	209	337				
	90	16	26.5	39.5	54.5	72	114	166	303				6.6	13	22	33.5	45.7	76.5	114	213	341				
	120	19	29.5	42	57	74.5	117.5	169	306				9.7	17	26.4	36.4	50	80.5	118	217	345				
No. 4 B.W.G.	0	3.5	7.9	16.5	28	41.5	74	114	215	350			1.8	3.2	5.3	8.8	14.5	35	64	138	232	349			
	30	5.3	11.7	21	33	46	78.5	118	220	354			2.3	4.2	7	11.6	19.5	42	71	144	238	356			
	60	8.4	16	25.5	37	50.5	82.5	122	224	358			3.2	5.6	9.8	16	25	48	77	150	244	361			
	90	12	20	29.5	41	54.5	86	125.5	228	362			4.4	8.2	14	22	31	54	82	155	250	367			
	120	15.3	23.5	33	44.5	58	90	129	231	366			6.9	12	17	27	36	59	88	160	255	371			
¼-in. seven-strand cable	0	2.6	5.3	12.5	21.5	36	71	113	221	358			1.6	2.8	4.5	7.3	11.8	31	63.5	147	250	387			
	30	3.3	7.1	16.5	26.5	41	75.5	117	225	362			1.9	3.3	5.4	8.9	14.9	37	69.5	152	258.5	392			
	60	4.5	9.8	21	31	45.5	79.5	121	230	366			2.2	3.4	5.7	11.4	19	43.5	74.5	158	264	397			
	90	6.4	13.5	25	35.5	49.5	83.5	125	233	370			2.7	5	8.6	14.8	24	49	81	164	269	402			
	120	9.4	17.5	27.5	39.5	53.5	87	129	237	374			3.5	6.5	11.5	19	29	54.5	85.5	168	274	405			
5/16-in. seven-strand cable	0	2.2	3.7	6	8.9	15	34	62	139	226	342	482	1.6	2.6	3.9	5.7	8.1	15.5	29.5	81.5	154.5	245	357		
	30	2.6	4.6	7.7	11.5	19.5	40	68	147.5	232	348	487	1.8	3	4.8	6.8	9.7	19	36	89	162	252	360		
	60	3.4	6	10.1	15	24.5	46.5	74	152	237.5	353	492	2.2	3.6	5.6	8.2	12	23.5	42.5	97.5	170	260	367		
	90	4.6	7	13.7	19.5	29	52	80	156	243	359	497	2.7	4.5	7	10.4	15	29	49.5	105	177	267	374		
	120	6.7	11.6	18	24.5	35	57.5	85.5	162	249	364	502	3.4	5.8	9	13.5	19.4	35	56.5	112	184	274	381		
⅜-in. seven-strand cable	0	2.2	3.6	5.5	8.2	11.8	23.5	42.7	100	177	271	384	1.5	2.4	3.5	5	6.7	11.5	18.5	44.5	87	159.5	236	335	566
	30	2.6	4.3	6.7	10	14.5	28.5	49.5	107	184	277	391	1.7	2.7	4	5.9	7.7	13.5	21.5	51.5	102.5	169	250	345	576
	60	3.2	5.3	8.4	12.5	18	34	56	114	190	284	398	1.9	3.1	4.6	6.5	8.9	15.5	25.5	59	111	178.5	260	354	586
	90	4.1	6.9	10.8	16	22.5	40	62.5	121	197	291	404	2.2	3.6	5.4	7.7	10.5	18.4	30	67	124	188	268	363	594
	120	5.6	9.3	14.2	20.5	27.5	45.5	68.5	127	204	297	411	2.7	4.4	6.5	9.3	12.7	20.5	35.5	75	129.5	197	278	372	602

TABLE VIII—STRINGING TENSIONS FOR IRON AND STEEL CONDUCTORS (IN POUNDS)

Size of Wire	Temp. (Fahr.) at Which Wire Is Strung	EXTRA BEST BEST (E.B.B.) IRON WIRE Length of Span (Feet)											BEST BEST (B.B.) IRON WIRE Length of Span (Feet)										
		100	125	150	175	200	250	300	400	500	600	700	100	125	150	175	200	250	300	400	500	600	700
No. 8 B.W.G	0	44	41	39	38	37	36						58	49	45	44	43	41					
	30	41	39	38	37	36	36						51	46	44	43	42	41					
	60	38	37	37	36	36	36						47	44	42	42	41	40					
	90	36	36	36	36	36	36						43	42	41	41	40	40					
	120	34	35	35	35	35	35						40	40	40	40	40	40					
No. 6 B.W.G	0	137	105	93	88	82	81	80					218	142	116	106	102	94	89				
	30	109	94	87	84	79	80	79					155	119	105	99	97	91	88				
	60	91	86	83	81	77	78	78					118	104	97	94	93	89	86				
	90	80	79	78	78	75	77	77					97	93	91	89	90	97	85				
	120	73	74	75	75	73	76	76					84	85	85	85	87	85	84				
No. 4 B.W.G	0	367	246	195	174	163	151	146	141				569	380	269	217	199	178	168	161	157		
	30	250	193	171	160	153	146	143	139				378	270	219	192	183	170	164	158	156		
	60	181	162	153	148	145	141	140	138				250	207	186	173	169	163	159	156	155		
	90	145	139	140	139	138	137	137	136				181	170	164	159	159	157	155	154	153		
	120	123	126	129	131	132	133	134	135				145	146	148	148	150	151	151	152	152		
¼-in. seven-strand cable	0	366	208	157	134	123	112	108	103				528	351	227	175	152	132	124	117			
	30	258	169	138	124	119	109	106	102				396	257	185	155	141	127	121	115			
	60	183	141	124	116	113	106	104	101				281	195	158	141	132	122	118	114			
	90	140	132	114	109	107	104	102	101				197	156	139	129	125	119	115	113			
	120	114	108	105	104	102	101	100	100				148	132	125	121	118	114	113	112			
5/16-in. seven-strand cable	0	1069	898	713	556	450	353	315	285	272	267		1255	1110	940	763	615	442	375	325	307	297	292
	30	832	682	541	440	380	323	299	278	268	265		1015	876	731	593	494	392	349	315	301	294	290
	60	611	499	413	364	332	300	285	272	265	262		779	661	552	465	412	354	328	305	296	290	288
	90	426	368	332	310	296	280	272	266	262	260		564	482	422	381	354	324	310	297	291	287	286
	120	311	287	278	273	269	264	262	259	258	258		392	358	336	322	312	302	295	289	286	284	283
⅜-in. seven-strand cable	0	1404	1244	1060	891	752	590	517	458	435	426	418	1633	1500	1340	1171	1005	759	633	533	497	480	468
	30	1117	975	832	710	623	529	483	445	428	420	414	1342	1219	1073	938	815	656	577	512	485	472	464
	60	847	740	645	578	532	481	455	431	420	415	410	1057	950	840	746	671	579	533	491	474	465	459
	90	614	555	518	485	465	443	431	418	412	412	407	794	720	652	602	565	520	497	473	464	458	454
	120	445	433	426	420	417	413	409	407	406	405	404	570	544	519	503	490	474	467	457	454	451	450

Size of Wire	Temp. (Fahr.) at Which Wire Is Strung	ORDINARY GRADE STEEL Length of Span (Feet)											SIEMENS-MARTIN STEEL Length of Span (Feet)												
		100	125	150	175	200	250	300	400	500	600	700	100	125	150	175	200	250	300	400	500	600	700	800	1000
No. 8 B.W.G	0	66	54	50	47	46	45	44					316	154	98	81	74	67	64	61					
	30	57	50	47	46	45	44	43					207	112	85	74	70	65	63	60					
	60	50	47	45	44	44	43	43					131	89	76	70	66	63	61	59					
	90	46	44	44	43	43	43	43					92	75	69	66	64	61	60	59					
	120	42	42	42	42	42	42	42					72	66	64	62	61	60	59	59					
No. 6 B.W.G	0	276	164	130	116	109	101	98	95				772	605	425	287	218	168	150	136	131				
	30	178	132	116	108	103	98	96	94				586	440	298	218	185	156	144	134	130				
	60	130	112	105	101	98	95	94	93				414	295	218	182	163	147	139	131	129				
	90	104	99	97	95	94	93	93	92				266	203	172	155	147	138	134	129	127				
	120	89	90	90	91	91	91	91	91				173	154	144	141	135	131	129	126	126				
No. 4 B.W.G	0	653	453	316	252	221	195	183	173	169			1269	1132	973	800	633	406	323	269	250	241			
	30	431	306	247	215	199	184	177	170	167			1011	881	737	591	472	344	294	258	244	238			
	60	274	226	204	190	183	175	171	167	166			759	644	525	431	365	299	271	248	239	233			
	90	191	181	177	172	170	167	166	165	164			525	438	371	328	298	267	252	239	234	231			
	120	150	154	157	158	159	160	161	162	162			333	299	276	263	274	243	237	231	229	228			
¼-in. seven-strand cable	0	719	553	336	264	208	166	150	138	135			1160	1053	931	788	635	376	268	206	191	179			
	30	566	415	254	216	183	156	145	136	134			1003	895	779	641	505	315	244	199	184	177			
	60	419	298	201	185	166	148	140	134	133			845	740	628	505	396	272	225	192	181	175			
	90	291	218	168	162	152	141	136	132	131			689	590	488	389	314	249	210	186	178	173			
	120	200	170	146	146	141	135	132	130	130			536	447	366	300	258	215	198	181	175	171			
5/16-in. seven-strand cable	0	1467	1330	1170	1082	830	579	460	365	353	338	331	2000	1920	1815	1696	1559	1257	958	621	513	467	445		
	30	1192	1070	924	840	649	491	416	351	345	333	328	1730	1650	1546	1430	1300	1030	794	567	488	454	436		
	60	931	819	698	640	514	426	384	338	336	328	325	1458	1378	1280	1172	1058	832	666	520	466	442	428		
	90	729	701	518	491	422	380	356	326	329	323	322	1189	1113	1025	931	830	675	573	483	447	430	421		
	120	468	426	396	392	360	344	334	315	321	319	318	928	859	786	717	651	560	504	452	431	420	414		
⅜-in. seven-strand cable	0	2050	1930	1798	1659	1499	1178	934	710	630	596	577	2950	2890	2818	2726	2632	2400	2134	1582	1198	1005	907	856	799
	30	1720	1616	1494	1360	1220	971	807	663	606	582	568	2620	2558	2490	2400	2306	2086	1840	1374	1082	946	872	832	786
	60	1398	1302	1194	1081	977	811	711	623	586	569	558	2288	2230	2160	2080	1990	1783	1569	1199	996	897	842	810	770
	90	1085	1003	923	848	783	692	639	590	567	558	548	1957	1901	1839	1761	1680	1500	1322	1058	921	852	814	790	762
	120	790	749	705	669	642	604	582	560	549	545	540	1630	1508	1522	1452	1389	1365	1114	945	857	813	787	772	751

same sag, which must be that of the smallest conductors. This will also prevent the conductors swinging together. It is recommended that for spans below 150 ft. (45.7 m.), where there is a probability of using iron and copper conductors on the same structure, the sags recommended by the National Electrical Safety Code for bare hard-drawn copper wire of the same or the nearest cross-section be used, except where the sags specified in Table VII are greater than those of the National Electrical Safety Code. In such cases the sags specified in Table VII should be used for both the iron and copper conductors.

The sags for the steel conductors, especially in the shorter span lengths, are very small and the corresponding tensions are large. While the stresses which would occur under the most adverse conditions would not exceed the elastic limit of the material, it is not practicable to pull the wires to such small sags. This constitutes still another argument in favor of using the sag tables for copper wire for such cases. A greater uniformity in line construction, which is most desirable, will thus be secured.

Inasmuch as iron wire lines are commonly built only in rural districts, so that continuity of service is not usually of prime importance, the sags specified above can be considerably reduced for long spans in other than the hazardous situations outlined earlier without reducing the factor of safety unduly. While a reduction of 25 per cent in the sags specified above will result in stresses which will be greater than the elastic limit of the material, provided that the loading assumed above is experienced, the stretch to which the wire will be subjected will immediately relieve the tension and the conductor will not break. However, it will suffer a permanent elongation and therefore a permanent increase in sag.

If it is desired to use a smaller sag on the portions of the line where no special hazard is involved, it will be necessary to compute the corresponding stringing tensions, using the tensions of Table VIII as a basis. The following method will prove sufficiently accurate for the purpose:

If the curve which the conductor takes is assumed as a parabola, the equation of the curve will be of the form $d = Wl^2/8P$, where d is the deflection, l is the span length, W is the loading per foot and P is the tension in the conductor at the lowest point. The stringing tension will never in the practical case reach the elastic limit of the material, so that in the above equation, if the weight per foot, W, and the span length, l, are constant, the sag will be inversely proportional to the tension in the conductor. Using this relation and the sag and tension tables, VII and VIII, stringing tensions for any chosen sag can be computed readily.

The increase in sag due to the permanent increase in length when the conductor is stressed above the elastic limit is usually not a serious matter, as there is seldom more than one circuit on such lines, and hence there is no danger of wires blowing together and creating a hazard. Recognition of such a possibility should be made, however, and attention should be given in the design of the line to the provision of adequate clearances. If the provisions of Rules 241 and 242 of the National Electrical Safety Code are complied with, no trouble will be experienced with this feature in the design of such lines.

Corrections for Tables I and II, "Characteristics of Iron and Steel Conductors"

The following corrections should be made in Tables I and II, printed in the Electrical World for July 27, 1918, page 150:

	Range of Current	a	b
TABLE 1:			
¼-in. seven-strand ordinary grade steel.	0-5	9.7	0.062
No. 4 B.W.G. solid, B.B.	0-2	7.1	0.65
TABLE II:			d
⅜-in. seven-strand ordinary grade steel.	0-5		0.24
$\frac{5}{16}$-in. seven-strand E.B.B	0-3		0.40
$\frac{5}{16}$-in. seven-strand B. B	0-7		0.186
$\frac{5}{16}$-in. seven-strand ordinary grade steel.	0-2		0.18
¼-in. E. B. B. seven-strand	2-20		0.104
	5-12		0.179
	12-18		0.228
¼-in. seven-strand ordinary grade steel	0-5		0.24
¼-in. seven-strand Siemens-Martin	0-1.7		0.71
No. 6 solid B. W. G., E. B. B	4-8		0.1

ELECTRICAL INDUSTRY IN THE ENEMY COUNTRY

Report of the Department of Commerce on Manufacturing Developments in Germany—Central Station for Hanover

A report on "German Trade and the War," by Chauncey Depew Snow and J. J. Kral, published by the Department of Commerce, says in regard to the electrical industry:

The electrical industry is concentrated in the hands of a few gigantic firms or combines which are related or have working agreements, so that the exploitation of foreign business is greatly facilitated. The Allgemeine Elektrizitäts-Gesellschaft of Berlin, capitalized at 155,000,000 marks, has branches all over the world and also working agreements with large electrical undertakings abroad, and the other large concerns, Siemens-Halske and Siemens-Schuckert, have similar connections. In 1913 the exports of electrochemical products from Germany were valued at $69,082,000. The chief products exported were appliances for illumination, transmission of power, electrolysis, etc., valued at $17,623,000, and incandescent lamps—chiefly metallic-filament lamps—valued at $11,451,000. In 1912 Germany produced 97,161,000 incandescent lamps, imported 2,294,000, and exported 58,339,000. The exports declined somewhat in 1913. The electric concerns have also worked for military needs, and the Allgemeine Electrizitäts-Gesellschaft was able to increase its net profits during the first year of the war to 26,570,000 marks, as against 18,163,000 in 1913-14. The net profits for 1915-16 were 26,487,000 marks, and for 1916-17 29,574,000 marks. The capital of the company was increased to 184,000,000 marks in 1916-17. The shares of the company were quoted at 232 at the end of 1917.

The electrotechnical factory of Max Schorch at Rheydt, which had been paying 8 per cent during the years 1910 and 1913, increased its dividend to 12 per cent in 1914. The factories of the company were fully employed during the war, night shifts being necessary at times. In 1915 the turnover was five times as large as in the preceding years, and the company distributed a dividend of 20 per cent with a bonus of one new share for every two old shares, thus really paying a dividend of 70 per cent.

In Bavaria and Saxony steps have been taken to make the production of electric power a state monopoly. This action would seem to make impossible the institution of an imperial monopoly of electricity.

In December, 1917, the government of Prussia announced its intention to build a large central plant in Hanover for the production of electric energy. The initial production is estimated at 50,000,000 kilowatt-hours. The state is ultimately to monopolize the production of electric energy, though not its distribution. The existing private and municipal works may remain in operation, and the state is to seek close coöperation with them.

Motor Drive for Woodworking Machinery

Induction Motors Are Used Extensively for the Purpose of Timber Sawing and Planing—Power Requirements of Typical Machines—Examples of Successful Motor Applications

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MOTOR and industrial controller manufacturers have done very much to compile accurate data and classify information regarding the most advantageous motor applications for various departments of woodworking establishments. In addition they have investigated and gathered convincing information on the economies which may be effected in such plants by the motor in contrast to line-shaft operation. In conjunction with the analysis of the characteristics of the woodworking appliances from the mechanical point of view and the design and adaptation of motors to meet them successfully corresponding attention has been given to the best control devices for the motor equipment. It is, perhaps, not an exaggeration to add that these investigations of the motor manufacturers have resulted in a comprehensive grasp of the details of the power requirements in this industry which is considerably more definite than that possessed by the operators of these plants themselves.

The information presented in what follows is largely drawn from this fund that has been collected by manufacturers and also from other authoritative sources. Specific cases to be discussed below point to special features of various machines, such, for example, as the band saw for timber sawing where the heavy-duty starting requirements and a large flywheel effect in the band wheels make the proper selection of the control equipment positively essential to the successful operation of the motor.

Automatic starting and stopping controllers are widely used for these equipments, standard types, as discussed in the earlier articles on controller practice, being adaptable to the various needs of these plants. The common use of push-button stations is a noticeable feature of many of the machines. The additional safety insured for the operator by having such stations at various important points of planing-mill machinery will be evident by a reference to the illustrations in the present article.

The well-known advantages of automatic control as compared with hand devices, which have been shown to apply so generally to other industries, apply with equal weight to most of the machinery in these mills. Fig. 1 illustrates a bank of automatic control apparatus which is compactly arranged for numerous machines at one point and shows the possibilities of ready access for repairs and adjustments to the accelerating switches and auxiliaries.

DIRECT-CURRENT MOTORS

Little attention need be given to the use of direct-current motors for this work, their use for strictly woodworking machinery being limited usually to those plants which for some special reason possess a direct-current supply only. Motors of this type, however, are in successful operation in woodworking plants, and the steel frames and dust-proof bearings employed make them practically as reliable under the special conditions in such mills as those of the alternating-current type.

Some woodworking establishments may also have quite an extensive department devoted to metal-working machinery, and here the advantages of the direct-current adjustable-speed motor may not only make this type particularly desirable where a direct-current supply is at hand but may even make the installation of a motor-generator set an advantage where alternating current is the only supply available otherwise.

ALTERNATING-CURRENT MOTORS

The acceptance of the induction motor as the standard for woodworking machinery is evidenced by the fact that practically no references are made to the use of direct-current motors in the handbook sections on this subject and that very little attention is given to any other than the induction type in standard manufacturers' bulletins which relate specifically to this industry.

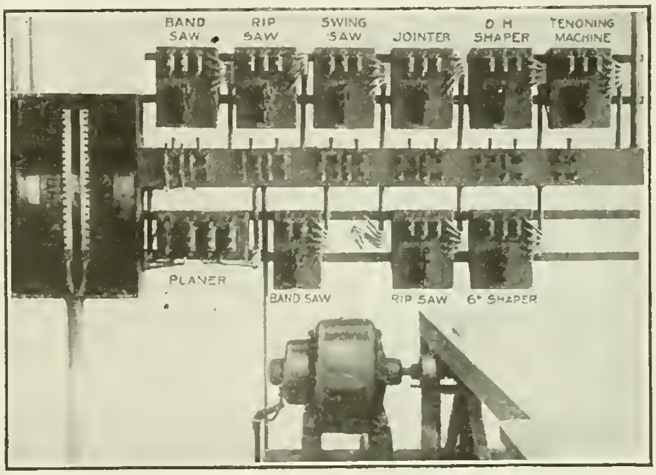

FIG. 1—BANK OF AUTOMATIC CONTROL EQUIPMENT IN A WOODWORKING ESTABLISHMENT

The reasons for this almost universal adoption of the induction motor in these plants, either the squirrel-cage type or the wound-rotor form, are, first, of course, that its characteristics meet the service conditions of the driven machinery, coupled, second, with the further special advantages of the induction motor due to its simplicity, the absence of a commutator. the facility with which dust protection is afforded and cleaning may be accomplished, and the like.

As will be pointed out specifically below, low-slip motors of the squirrel-cage type furnish a drive with high-speed regulation which has been found to be more reliable than straight-line shaft drives, thus adding to the other advantages of the motor the possibility of increased production. Obviously the squirrel-cage motor is preferable, where its characteristics meet the conditions, to the wound-rotor type.

Certain classes of woodworking machines, because of a high starting torque and the presence of large flywheel effect, are operated by the wound-rotor type because of its improved starting features both in high torque and lower starting current demands on the lines. Where fixed extra rotor resistance is required to insure the proper energy relations in the flywheel effect, an added advantage of the wound-rotor type is that this auxiliary resistance can be placed outside the motor, relieving the motor of just that much of the necessary heat radiation. The squirrel-cage motor may be equipped with additional internal resistance for accomplishing the same purpose, it is true, but here, conversely, the burden of extra heat radiation is thrown on the motor. Speed adjustment to a limited extent may be mentioned as an additional feature of the wound-rotor type which may prove useful in certain cases.

There are about fifteen or twenty distinct applications of the motor which may be made to the operations directly connected with, or auxiliary to, timber sawing. The use of band saws in preference to circular saws is one of the noticeable features of this part of the mill, and some of the characteristics of band saws may thus be taken as the basis for showing the corresponding characteristics of available motors for their successful operation. It is to be understood that any of the other more prominent machines in the timber-saving mill might be similarly treated and that the following notes are to be looked upon merely as typical.

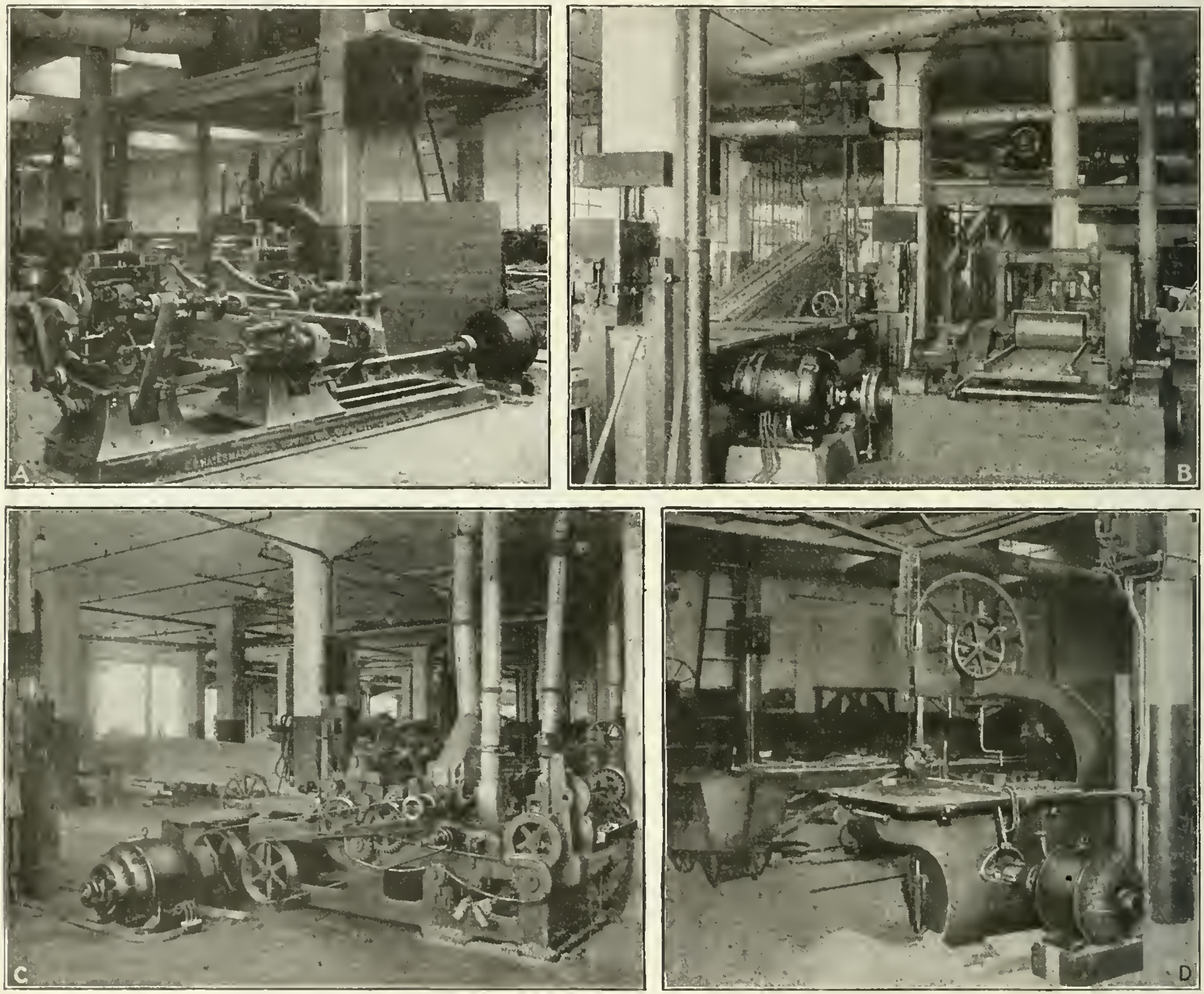

FIG. 2—VARIOUS APPLICATIONS OF MOTOR DRIVE TO WOODWORKING MACHINERY

A—Tenoning machine equipped with 15-hp., 750-r.p.m. direct-current motor and automatic push-button starter. B—Three-phase, 35-hp., 220-volt, 60-cycle, 850-r.p.m. induction motor driving double surfacer, in foreground; 40-hp. motor, in background, driving a timber band resaw. C—Matcher driven by a 30-hp. three-phase induction motor. D—Wood band saw driven by a 5-hp., 500-r.p.m. motor equipped with an automatic push-button controller for starting and stopping

Timber band saws operate with band wheels of great weight and may run at speeds of, say, 10,000 ft. (3000 m.) per minute. The large weight of the band wheels (a number of tons) and the high speeds result in heavy flywheel effects. Such mechanical features call for a large starting effort if the equipment is to be accelerated to its normal speed quickly. Even after normal operating speed is reached load peaks make it desirable to utilize the stored energy in the flywheel effect of the band wheel.

These characteristics may be met by a slip-ring motor with permanent resistance in the rotor circuit, after starting has been accomplished, to take care of the peaks of load, or a high-slip squirrel-cage motor may be used, with the disadvantages that there is no adjustment of the slip possible and that the starting current will usually be higher than when the slip-ring type is employed. The fact that the high slip is accomplished by internal resistance with the squirrel-cage type means, as stated above, a corresponding increase in the heat which must be radiated by the motor itself. Both types are used for band saws in timber sawing.[1]

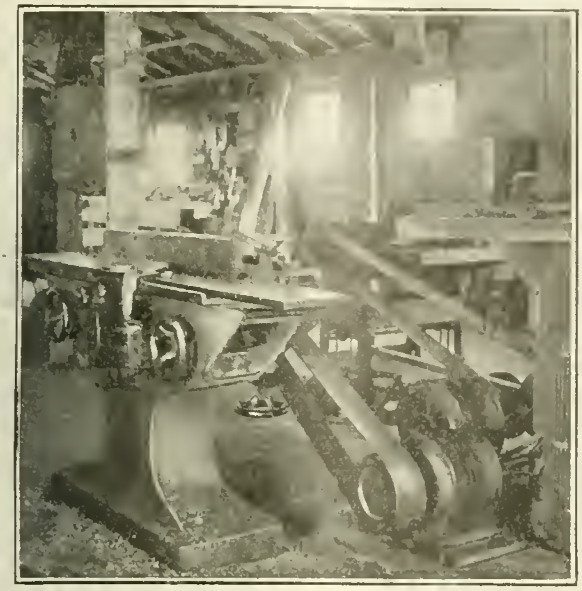

FIG. 3—PLANING-MILL INSTALLATION OF 3-HP., 720-R.P.M. INDUCTION MOTOR

PLANING-MILL OPERATIONS

About twenty classes of machines for individual motor applications are found in typical planing mills. Here, as in the timber-sawing applications, squirrel-cage motors are used for practically all planing-mill operations except those special cases like the band resaws, in the larger sizes, which possess large flywheel effect and where the slip-ring type is applicable for the reasons mentioned in connection with timber band saws.

Other cases have high friction typified, for example, by matchers, one of which is illustrated in Fig. 2C, and also wood planers. It is apparent, furthermore, that where the individual motors are large enough to constitute a fair proportion of the available generator capacity the lower starting currents of the slip-ring type form an important consideration.

Motor headstock equipments for woodworking lathes are commonly available both for three-phase alternating-current motors and for standard-voltage direct-current units.

EXAMPLES ILLUSTRATED

Specific cases of motor applications are shown in Figs. 2 to 4, which may be used as the basis of a further brief description of motor and control features as used in this industry. Fig. 2A is included to give an example of a tenoning machine (Hayes type) which is here driven by a 15-hp. direct-current motor. Automatic starting is employed. A special feature of this outfit is the use of a number of push-button stations for starting and stopping, only one of which is shown in the photograph in the foreground. Another station is placed directly opposite the one in the front, on the rear of the machine, and others are placed on the moving parts of the machine both in the front and in the rear. The complete control of his machine by the operator through such an arrangement is apparent. Power requirements of this machine and for some of the others shown in the subsequent views are given on the next page.

A wood band saw operated by a 5-hp., 500-r.p.m. Reliance motor fully equipped with an automatic starter and with start and stop push-button control is shown in Fig. 2D. The high mounting of the starting panel well overhead is illustrated by this view, and the large quantity of sawdust about the saw indicates the need for fairly frequent blowing out of the motor to free it from the accumulation of the dust. The necessity of dust-proof bearings is thus evident.

The use of small induction motors belted to planing-mill machines is shown in Fig. 3, these units being rated at 3 hp. and 720 r.p.m. In the foreground of Fig. 2B is shown a 35-hp., three-phase, 60-cycle, 220-volt, 850-r.p.m. motor directly connected to a Berlin double surfacer. This motor is automatically self-starting under heavy load. In the background a 40-hp., 1140-r.p.m. motor is shown belted to a 66-in. (1.67-m.) Mershon timber band resaw, equipped for feeding 18 ft. to 80 ft. (5.4 m. to 24.3 m.) per minute, and designed for 24-in. by 80-ft. (0.6-m. by 24.3-m.) timbers.[2] The control boxes are visible on the columns.

In Fig. 2C a Fay & Eagan matcher is shown with a directly coupled 30-hp., three-phase, 60-cycle, 220-volt, 850-r.p.m. Wagner motor, and in Fig. 4 a 10-in. by 20-in. (25.4-cm. by 50.8-cm.) Berlin double surfacer, at a different angle from the machine shown in Fig. 2B. The motors in Figs. 2C and 4 have the same ratings and speeds and are automatic, self-starting under heavy load in each case. In each of these views it is to be noted particularly that there is a distinct self-contained appearance in the machinery in contrast to that which would be possible with line shafts and belt drives.

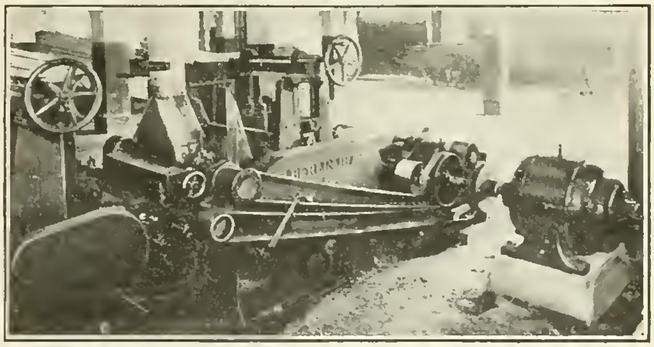

FIG. 4—DOUBLE SURFACER DRIVEN BY A 30-HP., THREE-PHASE INDUCTION MOTOR

The accompanying tables, I, II, III and IV, contain the average and maximum horsepower requirements of tenoning machines (Fig. 2A), band saws (Fig. 2D), surfacers (Figs. 2B and 4) and matchers and planers (Fig. 2C) respectively. These figures are based on the accumulated data of one of the larger motor manufacturers and are selected to accompany some of the machinery illustrated. As such, they are merely typical of a much larger amount of similar data on other machines in the industry which are now available. These four tables illustrate the form in which such other data has been tabulated.

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[1] See section on "Woodworking Machinery" by Chester W. Drake, "Standard Handbook for Electrical Engineers," fourth edition, p. 1201, which has also been referred to in connection with the next two paragraphs.

[2] To those interested in the specific types of equipment in these illustrations, it may be stated that Fig. 1 is due to the Electric Controller & Manufacturing Company, Figs. 2A and 2D to the Reliance Electric & Engineering Company, Fig. 3 to the Westinghouse Electric & Manufacturing Company, and Figs. 2B, 2C and 7 to the Wagner Electric Manufacturing Company.

TABLE I—TENONING MACHINES

Capacity, Inches	No. of Heads	No. of Copes	Feed-Feet per Min	Horsepower Aver.	Horsepower Max.	Remarks
4 x 24	1	2	9-18	10	20	
4½ x 54	4	0 or 2	10-13	10		Double-end
4½ x 54	8	6 or 2	10-13	15		Double-end
4½ x 78	4	0 or 2	10-13	10		
4½ x 78	8	0 or 2	10-13	15		
5½ x 14	1	2		3		
5½ x 15	2	2	Hand	5	10	
5½ x 20	2	2	Hand	7½	15	
7 x 24	2	2	Hand	7½	15	

TABLE II—BAND SAWS

Diam. of Wheel, In.	Max Saw Width, In.	Feed	Horsepower Aver	Horsepower Max
48	5	Power	20	30
48	2½	Power	15	25
42	4	Power	10	20
42	1	Hand	5	7½
36	2	Hand	5	7½
32	1	Hand	3	5
26	1	Hand	3	5

TABLE III—SURFACERS

Capacity, Inches	No. of Heads	No. of Rolls	Power Feed Feet per Min.	Horsepower Aver	Horsepower Max.
15-30 x 6	2	6	100-200	40	60
20-30 x 6	1	4	15-40	10	15
27-36 x 6	1	4	25-75	15	25
16-24 x 7	1	4	18-32	5	10
24-36 x 7	1	4	16-50	7½	15
27-36 x 7	2	6	14-50	10	20
24-30 x 8	1	4	20-35	7½	15
24-30 x 8	1	4	30-50	15	25
24-30 x 8	1	4	20-35	7½	15
24-30 x 8	2	4	20-35	10	20
26-30 x 8	2	4	40-80	20	35
26-30 x 8	2	6	40-80	25	40
30 x 12	1	2	25-70	10	20
30 x 12	2	4	46-90	35	50

TABLE IV—MATCHERS AND PLANERS

Size, Inches	No. of Heads	No of Rolls	Power Feed Feet per Min	Horsepower Aver.	Horsepower Max
30 x 6	4	6	125	75	
21 x 6 15 x 6	4	8	40-80	50	75
9 x 6	4	8	40-80	50	60
24 x 6	4	4	25-50	20	30
15 x 6 30 x 6	4	6	50-90	50	75
15 x 8 30 x 8	4	6	40-80	30	50
9 x 8	4	6	40-80	20	30
24 x 6 30 x 6	2	4	30-50	15	25
24 x 6	1	4	30-40	10	20

Some Results of a Change-Over

In conclusion, the following quotation is added from the opinion of a superintendent of a woodworking plant in which some of the reasons for changing over to individual motor drive in his plant are set forth. This quotation has been selected as containing in concrete form the substance of the inherent advantages of motor drive for woodworking establishments as viewed by those responsible for their operation.

While not more than 200 hp. is required to drive the machines by motors, the friction losses with line-shaft drive would be considerably more, so that a great waste of power is avoided. A large number of belts are eliminated with motor drive, greatly reducing belt maintenance. The speed of each machine is more easily maintained as belt slippage is practically eliminated. The company checks up speeds very carefully and will not tolerate a reduction in speed due to the overloading of too small a motor. If it is found that a motor on a particular machine is not of sufficient capacity, a larger one is put on. Thus maximum production is assured.

If one machine is shut down for repairs no others are affected. Individual motor drive permits arrangement of machines in almost any desired fashion in order to facilitate the passing of lumber from one workman to the other. Thus the sequence of operation is not broken and greater efficiency is obtained. It is almost impossible to accomplish this with line-shaft-driven machines arranged in parallel rows and requiring the lumber trucks to stand in the aisles. The fire hazard is greatly reduced owing to the fact that with motor drive there are no oily hangers. Lastly, individual motor drive makes the plant much cleaner, lighter, safer and more attractive in every way. The contrast between the motor and the engine-driven sections is very marked.

The advantages named in the abstract in the foregoing opinion have been rendered somewhat more definite by the motor manufacturers themselves. Their investigations into woodworking plants have shown the following points in favor of individual motor drive in certain cases: Increased production, 20 per cent; average maintained speed, 5 per cent higher than with line shaft and belt drive; saving in the 40 to 75 per cent power losses in line shafting, and insurance rates as low as 0.75 per cent from safety standpoint in electrically equipped buildings.

Bibliography.—"Standard Handbook for Electrical Engineers" and bulletins or data of Westinghouse Electric & Manufacturing Company, Electric Controller & Manufacturing Company, Reliance Electric & Engineering Company and Wagner Electric Manufacturing Company.

With but two small exceptions, no power developments and river improvements have been made by private capital upon navigable streams since 1912, and developments are prevented and held back aggregating over 2,000,000 hp. which would open over 1000 miles of additional inland waterways to navigation, through investment of private capital, and without taxation or appropriation of public moneys. The would-be conservationist has, in my judgment, been one of the greatest drawbacks to progressive water-power legislation we have in the whole country. Not one of them ever developed a water power or has had a particle of actual experience in this work. They simply advance fancied theories on the basis of state or government ownership and want all the benefits to accrue to the state, all the revenues; in fact, absolute control, even if built by private capital.—*Representative Bertrand H. Snell, New York, before the House of Representatives.*

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*Courtesy of Westinghouse Electric & Manufacturing Company.

New England Interconnection Plan Takes Shape

Representatives of War Industries Board, Massachusetts Commission and Fuel Administration Favor It—Committees Now Considering Financial and Operating Details—Propose Duplicate Line from Boston to Fall River

IN ORDINARY times the incentive for interconnecting electric service systems has been absent where each individual company has been able to meet its local requirements and at the same time maintain a sound financial condition. It has, therefore, been difficult to secure proper consideration of such propositions in a broad spirit of coöperation, simply because there has been no immediate need of any change from existing conditions.

Now, however, companies are at the parting of the ways in these matters. This country has undertaken a task which is to strain its resources to the utmost, not only at present, but for a material time in the future in certain lines of business. Facing power requirements which are with difficulty being met in certain areas, and with little prospect of the manufacturing companies meeting the demand with new production even within two or three years, every effort to increase the output of our plants should have the utmost consideration.

Again, the acuteness of the fuel situation for a long period in the future should cause attention to be directed to any methods of generation and distribution which will effect a reduction in fuel consumption.

Several companies in New England have concluded that both of these propositions can be met, in some measure, locally by a complete interconnection of the plants in eastern Massachusetts. As outlined in the June 8 issue of the ELECTRICAL WORLD, the execution of such a plan would save annually 70,000 tons of coal and would release about 50,000 kw. in generating capacity for other service.

This important matter is now in the hands of a finance committee of central-station interests headed by C. L. Edgar, president of the Edison Electric Illuminating Company of Boston, which is considering the best method of raising the necessary money for carrying out the program, at least in part, the project being regarded favorably by the public authorities and recognized as a war measure of vital economic interest. A sub-committee is considering the practical problems involved. Representatives of the War Industries Board, the Massachusetts Gas and Electric Light Commission and the conservation division of the United States Fuel Administration have been in conference with the representatives of the central stations, and the general consensus of opinion is that the plan should be carried out if it is possible to arrange the financial and operating details.

The greater part of the investigation thus far conducted by the central-station interests deals with southeastern Massachusetts, and various details of the project with reference to this section of the state are now available. Studies are being carried forward with respect to conditions on the north of Boston, both by the central stations represented and by the Bay State Street Railway, which operates a number of scattered steam plants in the territory.

The approximate location of generating stations and substations in the district southeast of Boston which are being considered with reference to interconnection is shown in the map (Fig. 1). This territory embraces the area from Boston to Newport, R. I., inclusive.

The principal plants operating in the territory, their generated outputs during 1917, unit coal consumption, total fuel burned, and estimated outputs and fuel consumption for 1918 are listed in Table 1. With the exception of the Quincy Point station of the Bay State Street Railway, all the plants listed are 60-cycle stations. It is estimated that by interconnection the fuel consumption in these plants would be reduced from an average of 2.38 lb. per kilowatt-hour to 1.93 lb., representing a saving of 38,586 tons for the southeastern district on the estimated 1918 consumption. At $8 per ton this saving would total $308,688.

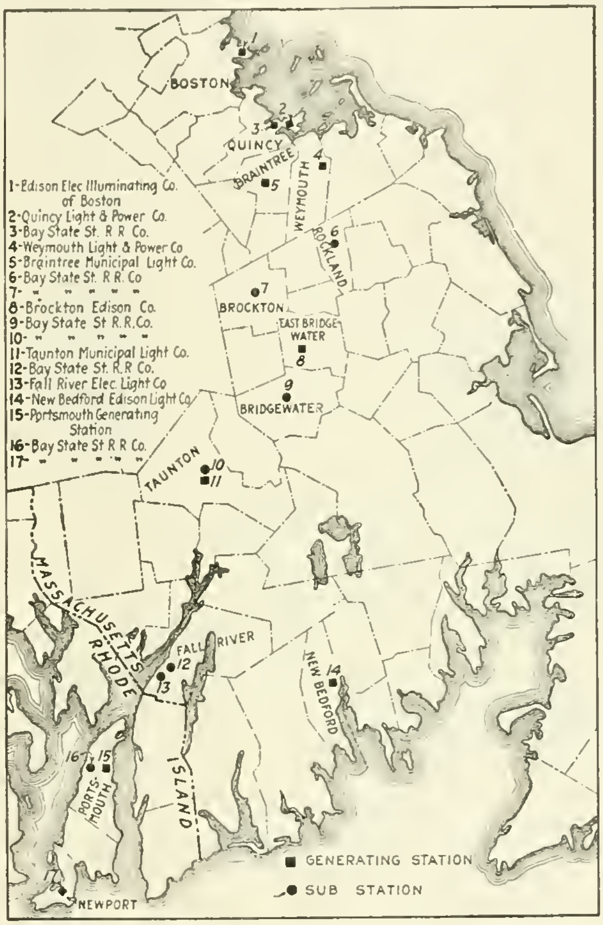


FIG. 1—EASTERN MASSACHUSETTS SHOWING APPROXIMATE LOCATION OF GENERATING PLANTS AND SUBSTATIONS TO BE INTERCONNECTED

Each of these plants is supplying its local area, with the exception of the Bay State Street Railway and the Edison Gas & Electric Light Company of New Bedford. The Bay State company operates a main generating station at Qunicy to supply such electric railway service as it provides in the communities between Boston and Fall River. A duplicate 25-cycle, 13,200-volt transmission system, constructed largely on a private right-of-way owned by that company, is employed to transmit energy from the Quincy station to the company's substations at Rockland, Brockton, Bridgewater, Taunton and Fall River. This transmission system, illustrated diagrammatically in Fig. 3, forms an important link in the proposed interconnected system.

The Quincy Electric Light & Power Company operates a 2300-volt generating station serving the city of Quincy. The heavy demands of the Fore River and Squantum shipyards for power have been met in this territory by the purchase of energy from the Bay State Street Railway Company's Quincy Point plant in the former case and by special submarine cable service from the Boston Edison system in the latter. The town of Braintree operates a 2300-volt plant of small rating and so far as is known has not been asked to supply any requirements in excess of its capacity. The Weymouth Light & Power Company operates a 2300-volt plant to serve a considerable area embracing several municipalities and is at present contemplating extensions to its plant in order to meet additional demands for service.

TABLE I.—COMPARISON OF GENERATED OUTPUT AND COAL CONSUMPTION FOR YEARS 1917-1918

	Kw.-Hr. Generated 1917	Lb. Coal, Kw.-Hr.	Lb. Coal Used 1917	Estimated Kw.-Hr. to Be Generated 1918	Estimated Lb. Coal, Kw.-Hr.	Estimated Lb. Coal Required 1918
		GROUP 1				
Edison Elec. Ill. Co. of Boston	265,000,000	1.97	522,050,000	305,000,000	1.93	588,650,000
Quincy Elec. Light & Power Co.	3,000,000	4.2	12,600,000	3,500,000	4.2	14,700,000
Bay State St. Ry. Co., Quincy	45,500,000	2.8	127,000,000	55,000,000	2.5	137,500,000
Braintree Municipal Plant	650,000	6.4	4,160,000	650,000	6.4	4,160,000
Weymouth Light & Power Co	4,400,000	3.0	15,400,000	5,300,000	3.5	18,550,000
Edison Elec. Ill. Co., Brockton	29,000,000	2.17	62,930,000	35,000,000	2.0	70,000,000
Taunton Municipal Plant	7,500,000	3.7	27,750,000	8,500,000	3.5	29,750,000
Fall River Elec. Light Co.	26,250,000	2.2	57,750,000	34,000,000	2.1	71,400,000
New Bedford Elec. Light Co.	49,000,000	2.07	101,430,000	70,000,000	1.9	133,000,000
Plymouth Elec. Light Co	2,000,000	3.3	6,600,000	....	....	....
Buzzards Bay Elec. Light Co	1,200,000	5.1	6,120,000	....	....	....
Total	433,500,000	2.18	944,190,000	516,950,000	2.065	1,067,710,000
Estimated average coal consumption of combined plants when interconnected	..	....	....	....	1.92	992,544,000
Estimated saving in coal consumption with plants interconnected	.	...	....	....	0.145	75,166,000
Value of coal saved at $8 per ton (37,583 tons)			....	....	...	$300,664
		GROUP 2				
Bay State St. Ry. Co.—Portsmouth, R. I	1,800,000	3.5	6,300,000	1,800,000	3.5	6,300,000
Bay State St. Ry Co.—Newport, R. I	4,500,000	2.8	12,600,000	5,000,000	2.8	14,000,000
Total	6,300,000	3.0	18,900,000	6,800,000	3.0	20,300,000
Grand totals—Groups 1 and 2	439,800,000	2.38	963,090,000	523,750,000	2.077	1,000,010,000
Estimated average coal consumption of combined plants when interconnected	....	....	....	....	1.93	1,010,837,500
Estimated saving in coal consumption with plants interconnected	....	....	....	....	0.147	77,172,500 lb.
Value of coal saved at $8 per ton (38,586 tons)	....	....	....	....	....	$308,688

The Brockton Edison company operates a 13,200-volt plant serving Brockton and a number of adjacent towns. Its generating station at East Bridgewater is in close proximity to the Bay State company's transmission line between Quincy and Fall River, and in addition, its own transmission lines intersect and parallel those of the Bay State company at a number of points. This generating station, situated as it is about midway between Boston and Fall River, affords a most excellent means of dividing the load of the system into three principal areas with resulting high efficiency of transmission.

The city of Taunton operates a 2300-volt municipal plant to serve that community and at present is unable to meet the demands of its customers, let alone others who desire service. This city is the center of extensive manufacturing interests, many of them engaged on government work and where the demands for additional service are urgent. When interconnected with the proposed system additional capacity will be available at once for local use. The city's plant is within a short distance of the Bay State line and can easily be connected to it by a short overhead extension.

The Fall River Electric Light Company operates a 2300-4000-volt plant to serve Fall River and vicinity. In addition to its own station there is now under construction a heavy 66,000-volt connection with the system of the New England Power Company, via Pawtucket, R. I., where connections are made with the Blackstone Valley Gas & Electric Company's system and with the system of the Narragansett Electric Lighting Company of Providence, R. I. The Fall River plant, situated as it is at the southerly end of the Bay State transmission system, is most favorably placed to form part of the main interconnected system. Its principal substation is almost adjacent to that of the Bay State company, and it is suggested that it may be desirable to install 60-cycle equipment in the Fall River company's substation and operate the local street-railway service from that point in the future instead of transmitting 25-cycle energy from Quincy Point to Fall River for that purpose.

The New Bedford Gas & Edison Light Company operates a 2300-volt generating station supplying New Bedford and a number of adjacent communities. In addition to its local business, it has established a 22,000 volt transmission system and now supplies energy to the Buzzards Bay Electric Company, the New Bedford & Onset Street Railway, the Marion Gas Company and the Plymouth Electric Company, these smaller stations being shut down at present, though available for use when required. Energy generated in New Bedford is now being transmitted through the central Cape Cod district from Buzzards Bay to Chatham, a distance of about 90 miles (144.8 km.), the naval aviation base at Chatham being the most distant consumer of energy.

The Bay State Street Railway's station at Portsmouth, R. I., is a 600-volt direct-current plant supplying railway service exclusively within its own area. The company has considered replacing this plant by a new substation supplied from a new 22,000-volt transmission line to be constructed from the Fall River substation of the trolley system to the Newport generating plant of the latter. At Newport the Bay State company operates a 2300-volt generating plant for the service of the local trolley lines and retail users of electrical energy, including the naval torpedo station and training station.

Plan of Interconnecting Plants

The scheme of interconnecting these plants which seems most practicable involves the establishment of a duplicate 60-cycle, 13,200-volt transmission system from Boston to Fall River, with suitable connections to the various plants en route at convenient points. The details of the proposed system, including all lines, switching arrangements, apparatus and metering arrangements, are clearly set forth in Fig. 2.

It may seem at first that this voltage is too low for the loads and distances involved, but a study of the actual loads to be transmitted from each center of distribution, coupled with the large capacity of the conductors in the existing line, indicates that the present operating voltage will be both economical and satisfactory for a considerable period in the future, even though heavier loads were involved than those at present under consideration. Further, by continuing to operate this line at the present pressure, certain complications due to limitations in the operating voltage over certain portions of the right-of-way will be avoided and no obstacles will be placed in the way of the proposed use of the line.

This transmission system will comprise suitable construction from the Boston Edison station at South Boston to the Bay State Street Railway station at Quincy, there connecting to the railway company's transmission line to Fall River. The proposed system will have an interchange capacity of at least 10,000 k.v.a. between all points on the main line, although under the operating conditions proposed the energy transmitted between any two points will not exceed 5000 kva. normally.

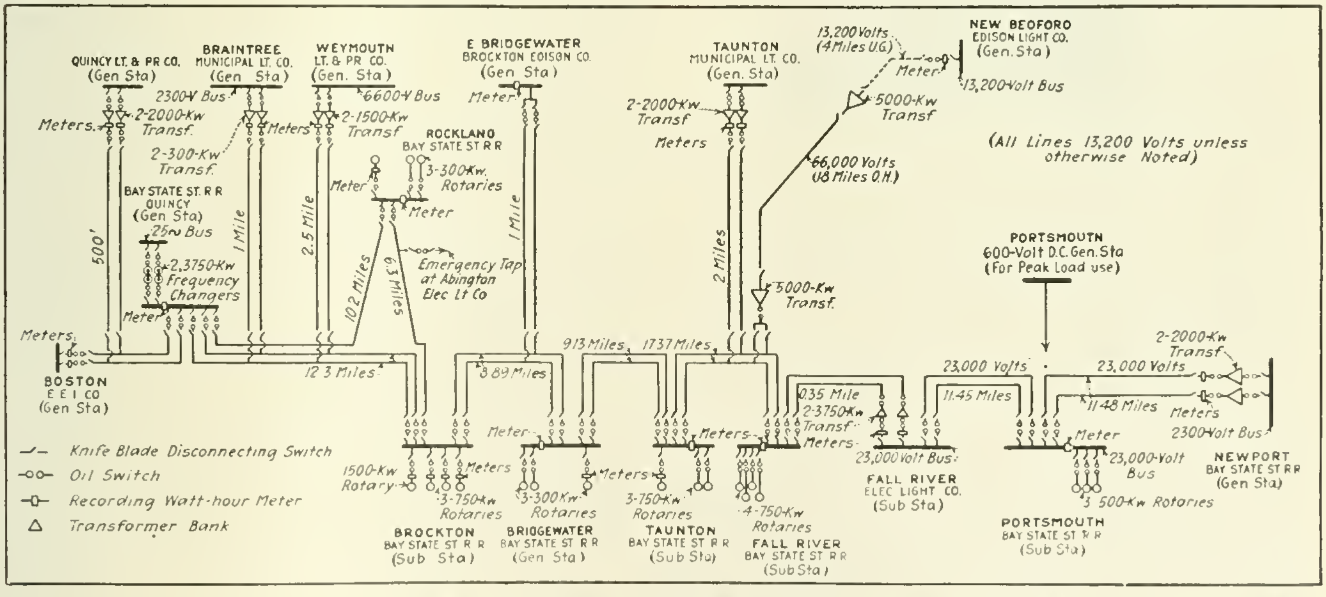

QUINCY LT. & PR CO. (Gen Sta)
BRAINTREE MUNICIPAL LT. CO. (Gen Sta)
WEYMOUTH LT. & PR CO. (Gen. Sta)
E BRIDGEWATER BROCKTON EDISON CO. (Gen Sta)
TAUNTON MUNICIPAL LT. CO. (Gen. Sta)
13,200 Volts (4 Miles U.G.)
NEW BEDFORD EDISON LIGHT CO. (Gen. Sta)
2300-V Bus
6600-V Bus
Meter
Meters
2-2000-Kw Transf.
2-1500-Kw Transf
2-2000-Kw Transf
13,200-Volt Bus
5000-Kw Transf
2-300-Kw Transf.
ROCKLAND BAY STATE ST R R
3-300-Kw. Rotaries
(All Lines 13,200 Volts unless otherwise Noted)
66,000 Volts (18 Miles O.H.)
BAY STATE ST. R R QUINCY (Gen Sta)
25~ Bus
2,3750-Kw Frequency Changers
500'
1 Mile
2.5 Mile
102 Miles
6.3 Miles
Emergency Tap at Abington Elec Lt Co
1 Mile
2 Miles
PORTSMOUTH 600-Volt D.C. Gen. Sta (For Peak Load use)
5000-Kw Transf.
BOSTON E E I CO (Gen Sta)
12.3 Miles
8.89 Miles
9.13 Miles
17.37 Miles
0.35 Mile
2-3750-Kw Transf
23,000 Volts
11.45 Miles
23,000 Volts
11.48 Miles
2-2000-Kw Transf
2300-Volt Bus
1500-Kw Rotary
3-750-Kw Rotaries
3-300-Kw Rotaries
3-750-Kw Rotaries
4-750-Kw Rotaries
23,000 Volt Bus
23,000-Volt Bus
3 500-Kw Rotaries
BROCKTON BAY STATE ST R R (Sub Sta)
BRIDGEWATER BAY STATE ST R R (Gen Sta)
TAUNTON BAY STATE ST R R (Sub Sta)
FALL RIVER BAY STATE ST R R (Sub Sta)
FALL RIVER ELEC LIGHT CO. (Sub Sta)
PORTSMOUTH BAY STATE ST R R (Sub Sta)
NEWPORT BAY STATE ST R R (Gen Sta)
Knife Blade Disconnecting Switch
Oil Switch
Recording Watt-hour Meter
Transformer Bank

FIG. 2—GENERAL ARRANGEMENT OF TRANSMISSION LINES, TRANSFORMERS, MACHINES, SWITCHING AND METERING EQUIPMENT FOR PROPOSED INTERCONNECTION

It is proposed to construct a transmission line from the New Bedford Gas & Edison Light Company's station underground at 22,000 volts and overhead at 66,000 volts to connect with the Bay State line a short distance south of Taunton. This line, in addition to the short extensions which will be required to connect to the Quincy, Braintree, Weymouth and Taunton stations, will complete the entire transmission system for the plants tabulated as Group 1.

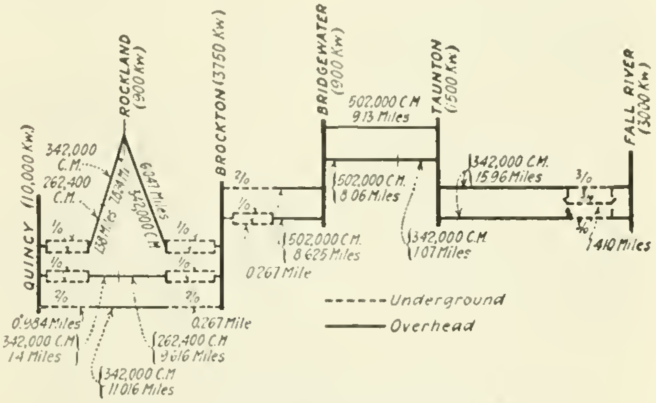


FIG. 3—BAY STATE STREET RAILWAY COMPANY'S TRANSMISSION SYSTEM

It is further proposed to replace all 25-cycle rotary converters with 60-cycle units in the Rockland, Brockton, Bridgewater, Taunton and Fall River substations. These stations are admirably arranged to enable such a change to be made without interfering with their regular service, and when changed over will naturally derive their supply from the generating stations in the area in which they are located.

At the railway generating station in Quincy frequency changers will be installed to enable that plant to operate in conjunction with the rest of the system and at the same time supply 25-cycle service to the Fall River Company and to the railway substation at Quincy.

It is proposed to meter all energy delivered to or received by any company. Further details will be given in a later issue of the ELECTRICAL WORLD

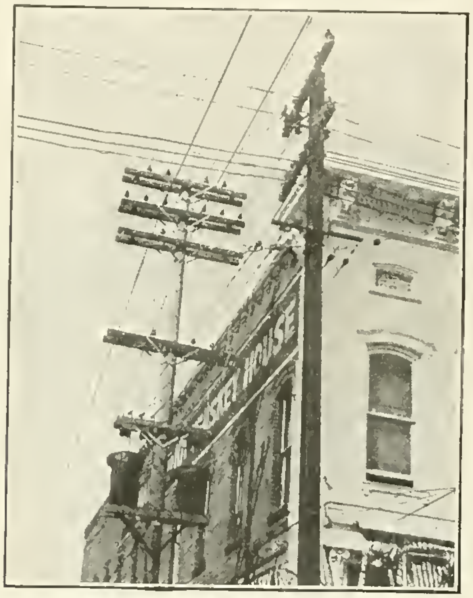
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

MOVING TRANSFORMERS OFF THE MAIN STREET

How Fort Smith Company Is Attempting to Beautify the Main Thoroughfare of the City Without Resorting to Underground Construction

Customers along the main street of Fort Smith, Ark., were formerly served from electric-service lines on wooden poles. These poles carried primary and secondary lines, transformers and span-wire supports for trolley wire. Down the middle of the street, which is a very broad thoroughfare, was another line of round, steel poles with double mastarms, supporting the overhead circuits of the electric railway. This construction is all being changed so that the steel poles will be removed from the center of the street and the primary mains for the most part will be on side streets. The secondary lines and the span-wire trolley supports will all be carried on Bates expanded steel poles on each side of the street.



SHORT-SPAN SECONDARY LINES WERE MADE IN UNITS ON THE GROUND AND MOUNTED IN SECTIONS

The accompanying illustration shows the method of getting the transformers, which constitute a large part of the unsightly equipment, off the main street. At street intersections where cedar pole leads cross the steel-pole leads, a short span has been erected between the adjacent steel poles and cedar poles. On the cedar pole which sets in the transverse thoroughfare, transformers and cutouts are mounted. The secondary wires of these transformers are carried from an arm which sets directly above the transformers to an angle-iron arm on the steel pole. From this short span taps are connected with the secondary wires above.

In erecting the short span, considerable time was saved by making up the unit sections of the span on the ground. Each unit section consists of an eye bolt and strain insulator at each end, together with the proper length of wire. After a unit had been made it was taken up the poles by a lineman and secured to the arms by screwing nuts on the ends of the eyebolts.

It is believed by the Fort Smith (Ark.) Light & Traction Company that this method of removing the major portion of the company's overhead lines and equipment from the main street will be nearly as effective in beautifying the thoroughfare as the adoption of underground construction.

MAXIMUM-DEMAND METER PRACTICE IN MINNEAPOLIS

Ideas That Are Found Useful by a Company Which Has Nearly 4000 Demand Indicators on Its Lines

The Minneapolis General Electric Company has more than 3000 Wright demand indicators, thirty Westinghouse type R. A. indicators and 387 General Electric type B-2 indicators on its lines. In addition all of its watt-hour meters have been equipped for use with demand indicators. The company buys the cams and springs and mounts them at its shop by use of a jeweler's staking tool. These attachments are made permanent, and special binding posts are put on the meter and the circuit is fused with a 1-amp. fuse. This fuse has proved very effective as a protective measure. The company does not advise the use of a standard cam wheel, since it has been found preferable to use a special cam contactor for each meter. While the factory sends out these indicators designed for overload capacity of 50 per cent, the Minneapolis company operates them only up to within 10 per cent to 15 per cent of the limit on the installations of certain customers where the load characteristics are well known. The reason for this is that it gives a higher degree of accuracy.

The first type "G" indicators received, gave considerable trouble due to vibration of the electromagnet. In this connection George W. Hewitt, foreman of the meter department, says that he found pivot points worn completely off during periods varying from ten to thirty days in service. These indicators were very noisy and could be heard 50 ft. (15.2 m.) away. This trouble has now been overcome by placing short-circuited shade coils over the tips of the magnet coils. On the new indicators the release springs are shortened from $\frac{1}{8}$ in. to $\frac{1}{4}$ in. (3.175 to 6.35 mm) as the setting is so loose that it causes shifting of the zero point due to the pen-point friction on the chart. The meter department has found that the protected-type clocks need to be cleaned every eighteen months while the indicators in which the clock is exposed need overhauling every six months. It is the practice to bring Wright demand indicators to the shop for testing.

SOLVING WAR ECONOMY PROBLEMS IN NORTHWEST

Groups of Power Customers Are Served from One Transformer Bank for Increased Diversity—Lines Not Absolutely Essential Are Removed

In order to care for an increase of power load at minimum expense the Puget Sound Traction, Light & Power Company, Seattle, Wash., is taking advantage of the diversity of load between power customers on its 2200-volt lines. Several customers, formerly served by separate transformer banks, are now supplied from one set of transformers with a combined rating of 200 to 300 kw. Larger transformers with the same combined rating formerly required now serve an increased load. In the case of some large customers, service is given directly from the 13,800-volt feeders.

Rather extensive changes in the transmission system have resulted from the removal of lines which were not absolutely necessary, the equipment being used for new lines needed to serve industries essential to the war program. On the whole, about 20 miles (32 km.) of 55,000-volt line have been taken down and about 15 miles (24 km.) of new line have been erected with only a small amount of new material. At the same time the rating of the lines has been greatly increased.

It should be noted, also, that this company has found outdoor substations built upon four wooden poles the least expensive. The company is also changing from oil to coal-burning equipment, storing a reasonable amount of coal in open yards. One station is being equipped for the use of powdered coal, according to John Harrisberger, general superintendent of light and power, who has kindly supplied the foregoing information.

CONSERVING OIL IN BOILER ROOM

Places Difficult To Keep Lubricated Are Fitted With Bottle-Type Oilers

On the eccentrics which are part of chain-grate stoker drive, on stoker bearings and on economizer bearings, the Topeka (Kan.) Edison Company is using bottle oilers of the type manufactured by the Nathan Manufacturing Company and distributed through the Vacuum Oil Company. These devices are small bottles with tight-fitting plungers through which oil is obliged to leak to the bearings which it lubricates. This scheme of oiling is especially satisfactory for bearings which have been taking large amount of low-grade oil and which can be converted to use a smaller amount of high-grade oil.

At this plant, it was formerly the practice to fill the oil cups on the stoker eccentrics twice a day. Moreover, it was always difficult to get the firemen to attend to this work. With the bottle oilers it is only necessary to renew the supply of oil once every two weeks, although the bottles are inspected by the firemen on each shift. While a higher grade of oil is used in lubricating the bearings with the bottle oilers, only one-fourteenth as much oil is required as was used under the former system.

CABLES COOLED BY FAN

Temperature Was Substantially Reduced and the Carrying Capacity of the Line Thereby Increased —Fan Serves Nineteen Cables

Increasing loads on a cable duct line leaving the Dutch Point station of the Hartford (Conn.) Electric Light Company recently caused overheating, and to overcome this the motor-driven fan shown in the accompanying illustration was installed at the plant. In this line there are nineteen occupied ducts carrying cables operating at 22,000, 11,000, 4800 and 2400 volts, and telephone lines of the company in addition. The duct runs underground from the plant to a manhole about 250 ft. (76.2 m.) distant, and the temperatures of the unoccupied sections were obtained by inserting maximum and minimum thermometers in a mandrel and pulling them through after sufficient exposure to running conditions. Air is circulated through the duct by a 30-in. (76.1 cm.) fan belt-driven by a 5-hp. Westinghouse 220-volt induction motor mounted on the ceiling of the power-plant basement. An emergency connection is also provided so that the fan can be used to exhaust air or smoke from a transformer room below if necessary. By continuous operation of the fan the duct temperature was reduced from a maximum of 150 deg. Fahr. to 80 deg. Fahr. (71.1 to 26.7 deg. C.), thus enabling the cable line to carry an increased load for a given duct temperature and conserving copper.

MOTOR-DRIVEN FAN FOR VENTILATING CABLE DUCTS

RAISING THE VOLTAGE TO INCREASE LINE RATING

A Substantial Reduction in Line Current Is Realized by Changing from Delta to Star Connection of Transformers at Small Expense

As a matter of economy and to conserve the use of material the Louisville Gas & Electric Company has reconstructed the distribution lines throughout the city, changing the voltage from 2300 to 4000 volts by connecting the transformers in "Y." This arrangement greatly increases the line rating with very small investment. A similar plan is being worked out for the heavy power lines, the voltage of which will be raised from 6600 to 13,200. The latter change will release considerable transformer equipment since the largest turbine in the generating plant is wound for 13,200 volts.

These methods of meeting demands for more energy at small expense were called to the attention of the ELECTRICAL WORLD by A. S. Witmer, manager of the commercial department.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

A NEW SET OF RATES FOR SUMMER BUSINESS

Advance Charge Based on Number of Outlets with Additional Energy Rate Made by Canadian Company

In the matter of rates for summer business it is a known fact, says the report of the committee on rate research of the Canadian Electrical Association, that no meter rate can properly produce enough revenue on the average summer customer to pay the interest on the investment.

One of the member companies of the association, the report states, has instituted a new type of summer rate this year with a view to getting at least fixed charges out of these customers. The rate is $1 per outlet for the first ten outlets, plus 50 cents per outlet for the excess over ten, payable in advance, plus 4.5 cents per kilowatt-hour. It is found, generally speaking, that summer customers get away without paying their last bill and are very difficult to trace. In the case of the above rate a good deal of the charges are being collected in advance, and the company does not stand to lose so much revenue from "skips."

MORE ECONOMY IN BILL DELIVERY IS NECESSARY

Discussion of Methods Used by About Thirty Indiana Companies, Pointing Out Changes Made to Reduce Cost

BY O. M. BOOHER

Chairman Commercial Section Indiana Electric Light Association

Phases of operation, such as the distribution of statements, which during pre-war periods received only passing attention, are to-day demanding greater consideration. All unnecessary expense is being eliminated and all necessary expense is being reduced. Long-established customs are now giving ground to different and more economical methods. This is especially true in the distribution of bills. During the pre-war period a very large percentage of this work was handled by mail; to-day many companies ask their patrons to call at the office for their statements, and many others deliver their statements in person. Most of these changes of methods have taken place at least since the recent increase in postal rates.

The acid test of a plan is the way it works out in practice. From the standpoint of economy a certain arrangement may be fine and at the same time prove to be very impracticable from other angles. Considering the plan of bill delivering in person, there arise the complaints from customers who are displeased because of not receiving the statement regularly or receiving the wrong statement, etc. Another phase of this plan which must be considered is the general public opinion regarding the evasion of the war revenue which would be derived from the increase in postal rates.

Our company (the Indiana Railways & Light Companies) believes the saving effected by personal delivery more than offsets a few scattered criticisms and complaints which are heard from time to time from our customers. During the pre-war period our company was mailing its bills for the exact cost of $11 per 1000. This includes postal cards and printing. We are to-day delivering in person at a cost of $10.60 per 1000, including paper stock, printing and labor. Had we continued to send our statements out by mail the cost would be $21 per 1000. In other words, we are saving $10.40 per 1000, and for 8000 accounts a saving is realized of $83.20 per month, or approximately $1,000 per annum. The labor item figures 0.74 cent per statement delivered. Our statements are delivered by our metermen.

The writer is of the opinion that, considering the utility as a highly important war-time essential, the operators are performing a patriotic duty in trying to maintain financial equilibrium in order that the utility may continue to remain a valuable war asset. And if $1,000 per year can be saved by changing this or that operating plan, the change should be made, for such a change would be more in keeping with the general war program than the purchase of a few postage stamps, which net the government an infinitesimal profit.

Questionnaires were forwarded to forty-three leading member companies of the Indiana Electric Light Association, representing fifty-six different properties. Twenty-eight replies, representing thirty-nine properties, were received. The first question was, "Do you deliver by mail, in person, or are bills held at office?" There were thirty-four replies, divided as follows: By person, 15; by mail, 8; bills held at office, 11. One reported that bills were made out and left by readers. Question number two asked for the cost per statement delivered by person. There were twelve answers. The average was 0.89 cent each. Question number three asked, "Do you have many complaints from customers where bills are delivered in person?" All answered, "A few." In seven cases the meter readers did the delivering, in two cases office clerks, in two cases young boys, and in one case an office girl. It is of interest to note that where boys were used the cost per statement averaged only 0.49 cent each.

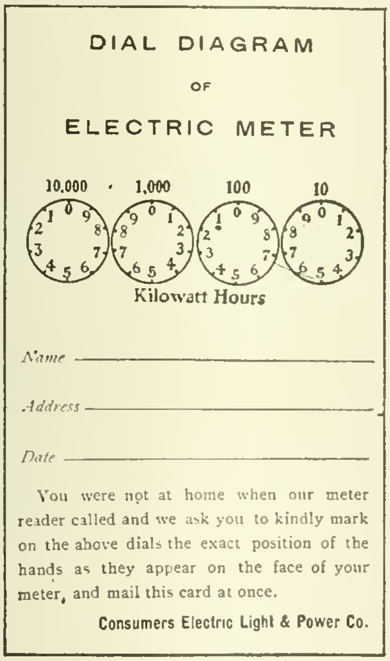
Because of the scarcity of men no doubt many companies which deliver the bills in person are considering the employment of women. So far as is known, this arrangement is not in use at this time to any extended degree. When the time comes there is no doubt that women will prove capable not only to deliver statements but to read and test meters and perform many other similar duties. The writer is of the opinion, however, that women should not be used for these duties until absolute necessity demands it.

Another plan which might be considered is that of placing bill delivery in the hands of outside agents. In some cases agents may contract with all other local utilities for the performance of this duty and consequently be able to make a very attractive price. The writer feels, however, that the work should be done by men inside of the company in order that all irregularities may be properly looked after. From the replies received from the various companies regarding bill distribution it would appear that this question has not received proper consideration in some cases, or that there exists a wide difference of opinion.

DELAYED METER-READING POST CARDS SAVE MONEY

New Orleans Company Finds that in a Short Time 75 per Cent of Cards Left by Meter Readers Come Back Filled Out

In order to save the meter readers from the need of making return calls, the Consumers' Electric Light & Power Company of New Orleans, La., has devised a delayed meter-reading post card. If when the meter reader calls he cannot get in, he leaves an addressed government post card, on the reverse side of which is a dial diagram of the meter on which the customer can mark the meter reading, and on which is also a place for the customer's name and address. The customer mails the card and is billed for the amount of energy shown to be used.


DIAL DIAGRAM
OF
ELECTRIC METER

10,000
1,000
100
10
Kilowatt Hours

Name ——————

Address ——————

Date ——————

You were not at home when our meter reader called and we ask you to kindly mark on the above dials the exact position of the hands as they appear on the face of your meter, and mail this card at once.

Consumers Electric Light & Power Co.

METER READING POST CARD MAILED BY CUSTOMER

This system was put into effect in January of this year, and as early as May 75 per cent of the cards left were being returned to the company with readings indicated. In July General Manager W. J. Aicklen stated that through the use of post-card delayed-meter readings the company was effecting a saving of approximately $50 a month in meter readers' salaries.

HOW HIGHER RATES AFFECT CENTRAL-STATION REVENUE

Experience of New England Utility That Put an Increase of Four Mills per Kilowatt-Hour on Large Power Customers Only

Are increased rates producing the revenue desired on central-station systems? At this time it is difficult to answer this question categorically, and it is pertinent to look into specific cases. That of a large Massachusetts central station serving a community of 100,000 persons indicates that the increased yield is nominal so far, for the reason that the advance in rates as established to date applies only to the larger power customers. This advance amounts to 4 mills per kilowatt-hour, but it applies to so few of the customers that the total additional revenue which it is bringing the company probably will not reach $10,000 a year but at present runs nearer $5,000. On this system the policy has been maintained of refraining as long as possible from advancing rates, but there is a prospect that in the near future the increase will apply to all power customers and will then yield probably $30,000 a year increased revenue. The cost of putting the 4-mill increase into effect is trifling, and there are signs that public sentiment would not oppose this advance for the period of the war. In fact, it is probable that the company may in the near future be obliged to increase its lighting rates, and this is now being considered by the management. If this is done, the prospect is that a flat addition of 1-cent per kilowatt-hour will be added to the regular bills of the customers as a surcharge, denominated as such and presumably to apply for the period of the war only. It is believed that the public will accept such an increase if made.

EASY TO MAKE CHANGE TO DEMAND SCHEDULES NOW

High Cost of Equipment and Slow Deliveries on Apparatus Make Demand and Energy Schedule Easy to Explain

Companies which are contemplating a change in type of rate schedules from a straight energy rate to a demand and energy type of rate should have very little trouble in explaining the fairness of that system to consumers under present conditions. This is the opinion of Ohio utility managers who have had experience with making changes in types of rates both in normal times and under prevailing conditions. For instance, it is easy for a power user to see the justice of a demand and energy charge when he learns what prices he would have to pay for isolated-plant equipment to duplicate his service and when he further is made to realize that the interest charges on that equipment would be going on twenty-four hours a day while his use of it would be limited to twelve or sixteen hours a day.

One central-station man who recently changed his rates to the demand type in two small cities experienced no difficulty. He showed the justice of the change in every case by pointing out that the demand charge was made to take care of those items that the power user would have to stand if he owned his own generating equipment and operated it only part of the time.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generation, Transmission and Distribution

Using Hogged Mill Refuse as Fuel.—The Portland Railway, Light & Power Company is storing a pile of hogged fuel which will contain the equivalent to 26,400 barrels of oil. The plant is adjacent to a sawmill where the fuel can readily be conveyed to the power station, which makes the use of this fuel especially profitable.—*Power*, July 16, 1918.

Ulco Hard Metal, a Substitute for Babbitt.—This metal, developed by Professors Frary and Temple of the University of Minnesota, contains 98 to 99 per cent lead and the remainder is barium and calcium. It was originally prepared for use in shrapnel shells, where it was of particular value owing to the scarcity of antimony. For replacing babbitt metal its principal advantage is in the saving of tin. Test data are given showing the comparative hardness, melting point, friction losses, etc., between ulco hard metal and babbitt metal.—*Engineering and Mining Journal*, July 20, 1918.

Getting a High Vacuum at the Turbine Exhaust.—HARTLEY LE H. SMITH.—The author calls especial attention to the fact that high vacuum in the condenser does not always give high vacuum in the exhaust nozzle of the turbine, which is the vital necessity. He discusses the design and arrangement of condensers, the effect of air in the condenser, etc.—*Electric Railway Journal*, July 20, 1918.

Large Hydroelectric Power Schemes.—C. FRED HOLMBOE.—In consideration of the possible coal shortage in the British Isles, the author points out the fact that there is a considerable opportunity for the development of hydroelectric energy. But it appears that the study of stream flow has not had sufficient consideration in England, with the prevailing idea that steam electric power generation is more economical there. On account of the increasing cost of coal, however, it is apparent that a greater investment per horsepower than formerly is now economical. The study of stream flow should, therefore, be carried on without further delay. The writer also discusses important considerations in hydroelectric design, such as the economical size of the reservoir, tunnels and pipe lines. Although hydraulic power cannot be developed as economically in Great Britain as in Norway and Sweden or the United States, the author cites the cases of two or three plants in Norway and Sweden to show what may be attained under most favorable circumstances. In the case of the Svalgfos power station, Norway, where the fall is 36.5 meters, the expenditure per horsepower is said to be £5. In the case of the Tysso plant, where the fall is 400 meters, the cost of development per horsepower was £5 10s. For the Trollhättan plant, in Sweden, the investment per horsepower is said to be less than £5. The author does not state any specific upper limit for the cost of economical development of water power in England per horsepower, but points out that this figure is undoubtedly increasing on account of the increasing cost of coal.—London *Electrician*, June 21, 1918.

Installations, Systems and Appliances

Development of Hydroelectric Power in New Zealand.—L. BIRKS.—A complete discussion is given of the considerations leading up to the development of the Lake Coleridge project. This development is owned by the state and energy sold in bulk at the load centers. The chief market for the energy is at Christchurch, where the electric railways are supplied as well as the light and power loads. Lake Coleridge, covering about 13 sq. miles (3360 hectares) form an excellent storage reservoir 1667 ft. (507 m.) above sea level and about 65 miles (104 km.) from Christchurch. The site offers opportunity for the utilization of 20,000 kw. continuous load, with a head immediately available of 480 ft. (146.3 m.). The plant at the present time has four Francis turbines of 2000 hp. each, directly connected to 1400-kw. alternators. The transmission line is of aluminum at 66,000 volts and was put in service in 1914. When the transmission system was first put in operation in 1914 the load increased very slowly until the customers realized the reliability of the service. A load then grew rapidly, consisting principally of railways, refrigerating plants, flour mills, tanneries, creameries, quarrying operations, hospitals, etc. The steam generating plant formerly used by the railway system now serves as a standby plant and will supply the load for a short time if the transmission system should be out of service. By means of economies effected by the operation of the Lake Coleridge plant prices for electrical energy have been reduced to less than one-half their former value. It is estimated that savings of coal of 15 to 25 tons per year per horsepower have resulted. By replacing kerosene and petrol with the electrical energy the saving in these fuels amounts to about £10,000 per year and shipping space is also saved. This cheap energy makes possible a supply of vital chemicals formerly purchased from Germany but at present unavailable in New Zealand. As soon as the present plant can be extended the development of electric furnace, electric welding processes, domestic heating and railway electrifications is confidently predicted. It is also a notable fact that at this time the load factor is between 50 and 60 per cent. The growth of load would undoubtedly continue rapidly if the plant could be extended, but just now steel for pipe lines for a new 3000-kw. generator cannot be obtained.—*New Zealand Journal of Science and Technology*, January, 1918.

Hog Island Ship Erection Equipment.—A description is given of the assembling plant of the American International Shipbuilding Corporation at Hog Island. The use of 400 tower derricks for the fifty shipways is explained, this method being found more applicable than the use of traveling cranes. Alternating-current motors operate the hoisting engines. They are induction motors with the resistance control through slip rings. The main transformer substation receives energy from a high-voltage transmission line from Philadelphia and steps it down to 440 volts for underground distribution to the derrick towers.—*Engineering News-Record*, July 11, 1917.

Electric Butt Welding.—J. B. CLAPPER.—This method is largely used in the automobile and other metal industries, particularly in welding tubes, shafts, wheel rims, etc. Although the load drawn by one welding outfit fluctuates greatly during a small interval of time, the characteristics of a considerable number of such machines will overlap sufficiently to smooth out the demand. The outfit required for work of this sort consists of (1) a transformer, (2) means of connecting the pieces to be welded, (3) primary control switches, (4) means of forcing the pieces together. Either alternating or direct current serves this purpose. The secondary voltage may be from 2 volts to 6 volts and the current as high as 20,000 amp. Both the transformer and clamping blocks are commonly water-cooled. Tests show that this welding process gives very satisfactory results as it produces a joint nearly as strong as the normal section of metal. The author also calls attention to the so-called spot welding, replacing riveting of sheets, and the lap and seam welding for such work as putting a spout on a coffee pot. This method is applied to copper, brass and aluminum as well as to iron and steel with the same success.—*Journal Cleveland Engineering Society*, May, 1918.

Electrophysics and Magnetism

Luminescence of Uranyl Salts Under Cathode Ray Excitation.—FRANCES G. WICK and LOUISE S. MCDOWELL.—Irregularities in the fluorescence spectrum of uranyl salts under light excitation are discussed. Data are also presented concerning the persisting phosphorescence produced in these salts by cathode rays.—*Physical Review*, June, 1918.

Ionization Potentials for Electrons in Cadmium Vapor.—JOHN T. TATE *and* PAUL D. FOOT.—The authors state that the entire spectrum of cadmium is probably radiated at potenials above 8.92 volts as indicated by the appearance of a visible glow around the hot wire at 9.2 volts. Results obtained for the resonance and ionization potentials for electrons in mercury and cadmium vapors are regarded by them as a striking proof of the fundamental accuracy of conclusions based upon Bohr's theory of atomic structure.—*Bureau of Standards Bulletin*, June 24, 1918.

Wave Lengths of Tungsten X-Ray Spectrum.—The accurate determination of the number of spectrum lines and their wave lengths for tungsten was carried out. The Coolidge tube was utilized for obtaining X-Ray emission.—*Physical Review*, June, 1918.

Electrochemistry and Batteries

Electric Storage Batteries.—A consideration of their construction, theory of operation, care, installation and application. The article deals with the chloride accumulator, Exide battery, Willard plate, Gould plate and Edison alkaline battery.—*Power Plant Engineering;* Chicago, June 1, 1918.

Units, Measurements and Instruments

Water-Testing Apparatus.—An electrical instrument to indicate the presence of salt in boiler-feed water is described. An alarm is automatically given in case of considerable increase of salt.—London *Electrical Review*, June 28, 1918.

The Foot-Candle Meter.—C. F. SACKWITZ.—The article contains a description of a small portable self-contained device for measuring illumination which has been developed from a design originated by Dr. Clayton H. Sharp. The device is read directly in foot-candles. —*Transactions I. E. S.*, July 20, 1918.

Telegraphy, Telephony and Signals

Protective Devices for Cables.—A spiraled copper conductor may be wound on the cable insulation with a slight amount of insulation between itself and the lead sheath. If the cable is injured, this outer insulation will become weakened and the injury to the cable may be determined before damage occurs. By the use of suitable electrical devices this system may be equipped with an automatic alarm attachment.—London *Electrical Review*, June 28, 1918.

Miscellaneous

Elastic Coupling of Prime Movers and Generators—O. OHNESORGE.—This author describes the main features of an elastic coupling having the property of causing the forces to act on a comparatively large volume of the working fluid that provides the elasticity. A defect of most commercial couplings is due to the fact that there is not sufficient space within the coupling to bring enough working fluid into action. In the design shown the coupling consists of two parts connected by pistons working in cylinders that contain oil kept under pressure by connection with an air receiver to which the cylinders are joined by an oil-filled pipe passing through a hollow shaft. The elastic forces can be adjusted, even during running, by means of the pressure and volume of the air-receiver. *Science Abstracts, Section B*, May 31, 1918 (abstracted from *Zeits. Vereines Deutsch*, Feb. 16, 1918).

Gas and Electric Heating.—C. ORME BASTIAN.—It is well known that of the heat produced by gas only a small amount can be utilized on account of the escape of unused energy in the air draft. In electric heating devices, on the other hand, there is but small waste of energy. As an example of the efficiency of electrical heating the author cites the test of an electric furnace for tempering steel. The furnace was maintained at 900 deg. C. for one hour with 6000 heat units when heated electrically, but when gas was used to fire this furnace 75,000 heat units were required to maintain this temperature. Thus it may be seen that 30 lb. (13.6 kg.) of coal was required for the gas heating against about 6 lb. (2.7 kg.) for electrical operation. Fortunately, gas works have valuable by-products such as coke, but for straight heating purposes the electrical operation is evidently more efficient, says the author. Attention is called to the better atmosphere surrounding electrical heating devices, particularly in the home.—London *Times Engineering Supplement*, June, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

GOVERNMENT OPERATION OF ALL POWER PLANTS

Measure Framed to Stimulate Production of War Material Submitted by War Industries Board to Congress

A war emergency bill authorizing the President to acquire, construct and operate power plants of all kinds with a view to stimulating production of materials and commodities essential to the prosecution of the war, has been drafted by the War Industries Board and was submitted last week to Chairman Sims of the House interstate commerce committee.

Mr. Sims said the proposed legislation was designed to take advantage of steam power as well as water power during the war, and that, if introduced at all, it would be offered as an amendment to the pending administration water power bill now before the House.

The bill as first drafted by the board, would have been a substitute for the pending water power bill, which is a permanent power development measure, and it would have carried an appropriation of $200,000,000. As a result of the conferences between the board and Mr. Sims, however, the draft was revised and the appropriation eliminated, leaving that subject to later consideration.

In its present form the bill provides for compensation for property taken and also provides that the power to operate and maintain the plants taken over or constructed shall be exercised "only for such time as the President may deem necessary or advisable in the interest of the United States."

A NATIONAL UTILITIES RATE BOARD IS URGED

Initiative for Such a Body Comes from the National Association of Railway and Utility Commissioners at Washington

The establishment of a national public utilities administration to recommend rate increases for certain utilities as a war measure has been suggested to President Wilson by the National Association of Railway and Utility Commissioners representing practically all states commissions.

The association's proposals contained in a letter to the President were as follows:

> Establishment of a national administrator, or board of three, with power of recommendation, advice or requests to the state and municipal authorities.
>
> No disturbance of the rate and service powers of the state commissions or the contractual powers of the municipalities, except as the state or local authorities may subordinate these to the federal recommendations for the war time emergency, as we believe would uniformly be done.
>
> Use of the state commissions by the federal administrator, or board, for all purposes of inquiry, investigation, ascertainment and report of facts and co-operation in recommendations where needed to the local authorities.

An increase in rates granted by local utilities commissions or by other local governing bodies at federal instance should be for the war only, it was suggested. The President was told that each application of utilities for rate increases must be considered separately, and that consequently it would be inadvisable for any federal authority to order a general rate advance.

SHORTAGE OF WATER POWER IN NORTHERN GEORGIA

Industrial Plants in North Georgia Have Difficulty in Obtaining Supply of Electricity—Severe Drought the Cause

A large number of industrial plants near Atlanta and in the northern section of Georgia have received notice from the Georgia Railway & Power Company that discontinuance of hydroelectric service has been necessary owing to extreme drought and the heavy demands upon power facilities by essential war industries. The communication sent out by the company reads as follows:

> We regret very much to announce that, due to the extremely long drought and the consequent extremely low level of the rivers upon which our waterpower developments are located, and due to the tremendous demands made on our plants and reservoirs by customers working on war industries, it may be necessary for us to ask you to discontinue temporarily taking electric service, all or in part, from our lines, commencing with Aug. 1, 1918, and continuing temporarily until thereafter modified.
>
> This letter, therefore, is to be taken as a preliminary notice to the effect that you may be requested to discontinue service beginning on the above-mentioned date unless we have such rains between now and that date as will, in our judgment, allow us to run water-power plants at nearer their normal capacity.
>
> It is needless for us to say that we regret the necessity of serving this notice on you, but with the water level falling as rapidly as it is now in our reservoirs and with the same conditions existing in other water-power companies in this section, it may be impossible for us to carry the load longer than the date mentioned.
>
> You will receive notice during next week, not later than July 29, 1918, if we do not get sufficient rain on our water sheds in the meantime to obviate the necessity.

The secondary customers of the company are still without power, although the company was enabled to carry all its primary load with some difficulty. Heavy rains on the lower levels during last week helped to swell the streams on which the plants of the Southern Power Company, Columbus Power Company, and the Central Power Company of Georgia are located. The Georgia Railway & Power Company was thus enabled to get some flood water from the plant of the Southern

Power Company and store it in its Mathis reservoir. The Dunlop and Bull Sluice plants also received enough water to operate.

The water of the Chattahoochee River after passing through the wheels at the Georgia Railway & Power Company's station was caught by the station of the Columbus Power Company farther down the river, and the latter company was thereby enabled to supply the former with some electricity over the tie lines.

There were light showers on the watersheds serving the Tallulah Falls station, but the flow in the main river at present is only about one-tenth normal. Up to Aug. 1 there was a decrease in the rainfall of about 25 per cent, or approximately 10 in. of water.

RELIEF FOR INDIANAPOLIS LIGHTING COMPANIES

Rate Increases Permitted by Commission, Which Also Urges a Pooling of Systems During the War

The Indiana Public Service Commission in an order entered late Tuesday granted war-time relief to the Indianapolis Light & Heat Company and the Merchants Heat & Light Company by a revision of rates affecting larger domestic consumers and all users of electricity for power purposes. The principal change in the domestic lighting schedule order by the commission is an increase of what is known as the secondary rate in the schedules used by the majority of domestic consumers from a rate of 5 cents a kilowatt-hour to a 6-cent rate.

The principal changes in the power schedules include the addition of 7 mills surcharge for each kilowatt-hour of energy consumed and the establishment of a monthly minimum bill on power rates of 1.65 cents a kilowatt-hour of energy consumed. A surcharge of 5 mills a kilowatt-hour on municipal lighting energy also is provided and this provision and that increasing the secondary rate for domestic consumers becomes effective on Aug. 10 and will continue in effect for the duration of the war or until Dec. 31, 1920. The increase to 7 mills a kilowatt-hour surcharge on power rates is 2 mills a kilowatt-hour above the 5-mill surcharge granted the companies by the commission last year. This increase is effective for the same period as the lighting-rate increases.

The establishment of a minimum monthly rate for power is to become effective on Aug. 10 and be permanent in nature. The order allows the companies 50 per cent surcharge on all bills for steam and hot-water heating, and this represents 100 per cent increase in the surcharge above the relief granted last year, when the commission allowed a 25 per cent increase on all such bills. This increase becomes effective at the beginning of the heating season and will continue during the war or until the conclusion of the heating season of 1920-1921.

The commission's order also urges a pooling of the plants for the economies and other advantages to be gained during the continuation of war conditions. In explaining its increase of the secondary rate for domestic consumers the order sets out that the commission believes this will encourage thrift and economies by the class of domestic consumers which uses relatively more electricity than the class of smallest consumers. The primary rate of 7 cents a kilowatt-hour for domestic consumption covers approximately the first 15 kw.-hr. consumed in any one month, and after that amount of energy has been consumed the secondary rate applies. It is this secondary rate which has been increased by the commission.

It is understood that the commission estimates that the relief granted the companies this year will be greater than that granted them during last year; but it likewise is estimated by the commission that the revenues under the new rates will not be great enough to admit of any dividends on the common stock except a possible very small return to the stockholders of the Indianapolis Light & Heat Company.

SYNDICATE BUYS $10,000,000 DUQUESNE COMPANY NOTES

Issue Is Secured by 5 Per Cent Mortgage Bonds on All Property Owned and by First Lien on All Leaseholds

Announcement was made on Tuesday that a syndicate headed by Harris, Forbes & Company, the First National Bank and Ladenburg, Thalman & Company has purchased an issue of $10,000,000 three-year secured notes of the Duquesne Light Company of Pittsburgh. The notes in addition to being a first obligation of the company are secured by the pledge of all of an outstanding issue of $15,000,000, 5 per cent mortgage bonds. These bonds are secured by a first mortgage of all of the property owned in fee by the company and by a first lien upon its leasehold interests, together with bonds and stocks of its subsidiaries. The company controls through long-term lease or stock ownership properties conducting the entire central station, electric light and power business in the city of Pittsburgh and throughout the major portion of Alleghany and Beaver Counties, Pa.

VALUATION OF WASHINGTON WATER POWER COMPANY

Engineers of Commission and of the Utility Present Figures Differing Only Slightly in Amount So no Order Is Issued

On Aug. 1 following the hearing on this apportionment of the Washington Water Power Company property Chairman E. F. Blaine of the Public Service Commission of Washington announced that no order would be issued in the matter as the engineers of the company and the commission were so close on data that no order would be necessary. He said copies of both engineers' data would be sent to all committees to be used as a basis for rate making.

Testimony was taken on July 31 in Spokane, Wash., by the State Public Service Commission on the apportionment of the valuation of the Washington Water Power Company light and power system among the several communities served by it in eastern Washington.

Engineer McCurrach appeared for the State, and J. S. Simpson, former accountant for the Public Service Commission, for the Washington Water Power Company.

Their division of value differed slightly in some of the details but agreed on the larger totals. Simpson's total for the city of Spokane was $100,000 less than that of Engineer McCurrach.

The figures of the two experts were practically accepted by the representatives of the municipalities present, including the city of Spokane.

The following figures are from the report of Engineer McCurrach as to the light and power valuation in Washington: Cost of reproduction Dec. 31, 1917, $14,854,674.

Valuation as fixed by Public Service Commission, $16,700,000.

VALUATION APPORTIONED BY DISTRICTS

District	Maximum Demands Kilowatts	
Spokane-Hillyard	24,135	$10,483,091
Medical Lake-Cheney	1,948	679,935
Spokane suburban	2,790	758,404
Palouse	1,632	1,114,709
Big Bend	3,260	1,471,459
Utilities	9,140	2,192,402
Totals	42,905	$16,700,000

CHANGES MADE IN THE NATIONAL ELECTRICAL CODE

Suspension of the Rule Calling for Marking of Wires to Facilitate Polarity Identification Made in Interest of Economy

The executive committee of the National Fire Protection Association, upon the recommendation of the electrical committee of that organization, has voted to suspend indefinitely the enforcement of Rule 26-a of the National Electrical Code, edition of 1918, in so far as this rule requires the marking of wires and cables by manufacturers to facilitate the identification of the polarity of conductors.

This rule, which is new in the 1918 code, was adopted last fall as a part of the report of the sub-committee on grounding and as printed in the code calls for enforcement after Jan. 1, 1919. It reads as follows:

> The neutral conductor on all three-wire circuits and one conductor on all two-wire circuits must have an identifying insulating covering, readily distinguishing it from other wires. This wire must be run without transposition throughout the entire installation and properly connected at all fittings to properly identified terminals in order to preserve its continuity.
>
> When one of the circuit wires is to be grounded, the ground connection must be made to this identified wire and as prescribed in Nos. 15 and 15A.

The purpose of the rule was to facilitate the identification of the neutral or grounded wire of a circuit in order that the proper grounding might be secured in all cases with less liability to mistakes, and as a part of the general tendency noticeable in the development of electric practice at the present time to extend the grounding of circuits and devote more attention to this and similar requirements, especially from the viewpoint of safety against accident to persons.

The recommendation for suspension of this rule came from Underwriters' Laboratories' Industry Conference on Rubber-Covered Wires after a careful investigation of the present situation had been made among wire manufacturers and others. This investigation developed the opinion that the present time under war conditions was unfavorable for the change involved, in view of the considerable increase in equipment at wire factories already pressed to the limit to provide the products necessary for government and other uses and the probable added expenses which would result in carrying stocks, in transportation and in distribution of wires and cables.

The idea has been suggested that inspection departments, contractors and others desiring to secure the result aimed at in the rule in question might arrange for a marking of conductors and terminals at outlets as they are installed by means of painting or other distinguishing marking. It would appear that if this were done carefully and systematically most if not all of the desirable results aimed at could be secured.

CENTRAL STATION—MUNICIPAL PLANT INTERCONNECTION

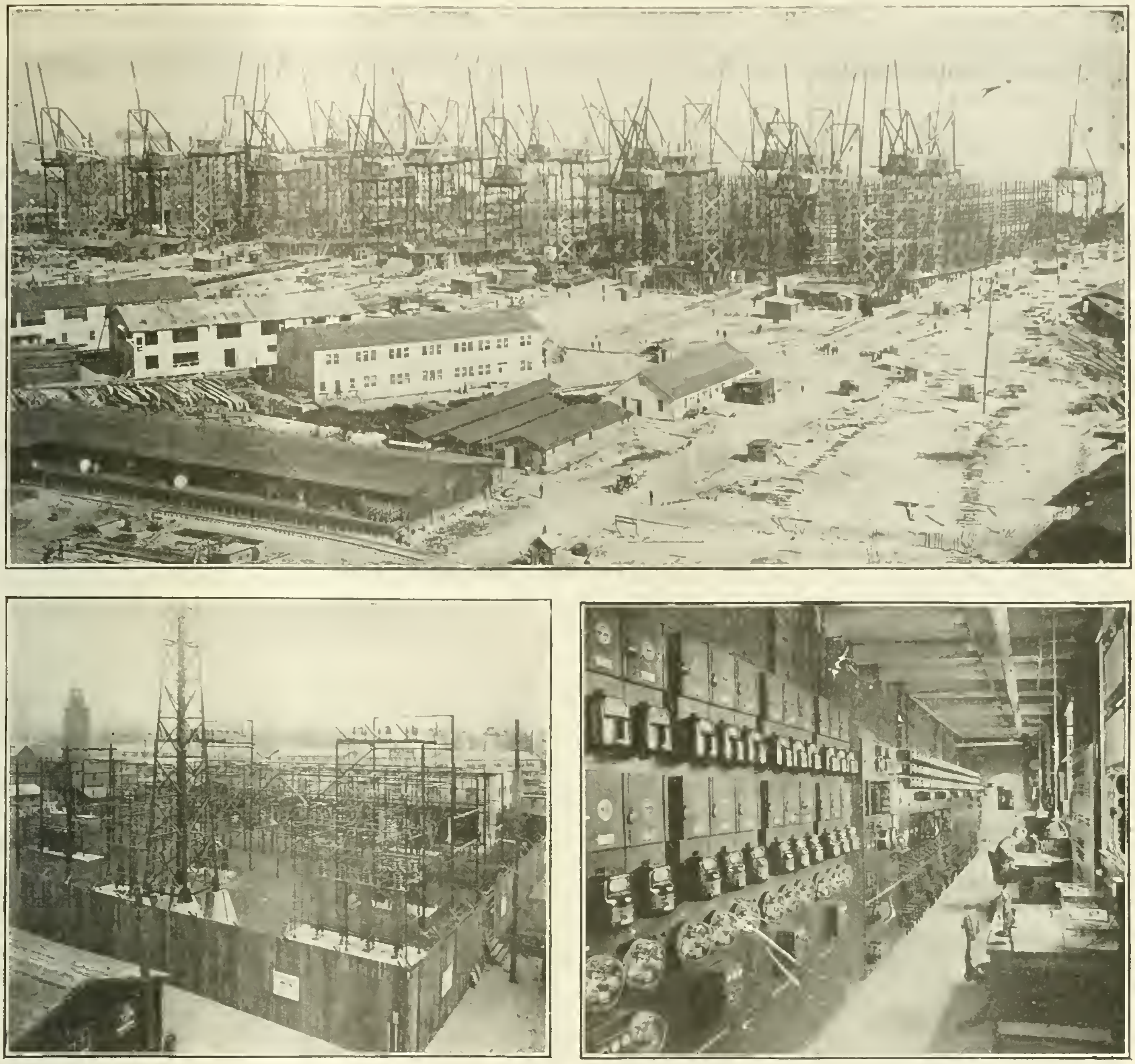
To Save Coal Commonwealth Edison Company Will Purchase Waste Power from Sanitary District —Provision for Present Is 6000 Kw.

For the purpose of saving coal the Commonwealth Edison Company of Chicago has entered into a contract with the Sanitary District to purchase energy which can be produced from water power which is now wasted. For all water power energy which the Sanitary District can provide, the Commonwealth Edison Company agrees to pay the equivalent of the net coal saved. The amount of coal that can be saved depends upon the units which the Commonwealth Edison Company must use to carry its load at the times when the Sanitary District has surplus power available. The new units are more efficient than older ones and hence require less coal to produce a kilowatt-hour. On Sundays the entire load can be carried on the more efficient units and on week days the less efficient units must also be operated. With these facts in mind and with a knowledge of the coal consumption of different combinations of units an estimate was prepared of the net coal that could be saved on Sundays and holidays and of the net coal that could be saved on week days. It was agreed between parties to the contract that this estimate was correct and figures which came out of the estimate were made a part of the contract. The payments are to be made on a straight kilowatt-hour basis. The price per kilowatt-hour is expressed as a constant (which came out of the estimate) times the price of coal. The coal price is taken as the average price over a period of four months. A different constant is used for Sundays than is used for week days. The constant used is 0.0009 for Sundays and holidays and is 0.00125 for week days.

The contract also stipulates that this constant shall be changed when the Commonwealth Edison Company puts another new unit into service and shall change again when the company builds its new Calumet generating station, if the war lasts that long. The period which the contract covers extends to the termination of the war.

Physical connection between the two systems is a simple matter as both operate in the city at 12,000 volts, 60 cycles. A connection capable of transmitting 6000 kw. will be effected at the Troy street substation of the Commonwealth Edison Company.

Largest Shipyard in the World Is Electrically Operated



PORTION OF HOG ISLAND TOGETHER WITH VIEWS OF OUTDOOR SUBSTATION AND SWITCHBOARD

This shipbuilding plant which is supplied with electricity by the Philadelphia Electric Company, has 475 electric hoists totaling 17,000 hp., 2400 hp. in shop motors, 42,000 kva. in transformers, 110,000 incandescent lamps and nineteen motor-driven compressors

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CENTRAL-STATION ENERGY ECONOMICAL FOR RAILWAYS

Investigation by Commission Shows That Purchased Power Is Least Expensive Method of Getting Energy Supply for Electric Railways

In the recently heard fare case of the Massachusetts Northeastern Street Railway an investigation of the cost of power on the road was made by the Massachusetts Public Service Commission. During the hearings some criticism was advanced against the company on account of the fact that in 1917 its cost of power was $223,593, or about $55,000 more than in the fiscal year 1916. Energy is purchased from the central station of the Rockingham County Light & Power Company, located on tidewater at Portsmouth, N. H. J. W. Lester, chief accountant of the commission, made a thorough study of the cost of electricity as produced at Portsmouth and delivered to the railway company, comparing the current rates with the estimated cost of generating energy in a new plant to be owned and operated by the railway, and also discussing electrical production costs in other Massachusetts stations.

The conclusion reached was that the purchase of central-station energy by the road was cheaper by about $45,466 per year than an attempt to generate in a plant of the railway.

The base price of energy to the railway company under the central-station contract is 1.4 cents per kilowatt-hour, electricity being delivered at the substations as three-phase, 13,200-volt energy. By the operation of a coal clause in the contract the average price paid for energy in 1917 was 1.77 cents, for alternating-current energy at the substations, comprising 11,687,908 kw.-hr. There were 10,239,232 kw.-hr. of direct-current energy delivered by the railway itself to its 600-volt feeder and trolley system. This brought the actual cost per kilowatt-hour of direct-current energy to 2.18 cents, and allowing 15 per cent for fixed charges, the total was 2.47 cents.

The Rockingham County company's station at Portsmouth generated energy in 1917 at 2.52 lb. of coal per kilowatt-hour, compared with 2.82 lb. on the Bay State Street Railway and 2.15 lb. on the Boston Elevated Railway. An interesting comparison of the cost of production at Portsmouth in 1913, the year before the war began, and in 1917, is printed herewith. It is significant that the efficiency of this plant has been increased as regards the amount of coal consumed per unit of output since the outbreak of the war, but that the cost of fuel has increased more than 100 per cent and that it has been impossible to generate energy at as low a cost as in 1913. This plant is now undergoing reconstruction and enlargement by the Harry M. Hope Engineering Company of Boston, and a carefully planned betterment program is yielding results, as evidenced by the striking reduction in coal consumption per kilowatt-hour as tabulated in Mr. Lester's report. In fact, in 1914 this fuel consumption attained a maximum of 3.40 lb. for the year, but the trend has since been downward.

PRE-WAR AND PRESENT PRODUCTION COSTS, PORTSMOUTH (N.H.) PLANT

	1913	1917
Wages	$25,035	$28,704
Fuel	77,005	191,095
Water	6,156	3,377
Miscellaneous supplies	5,117	4,636
Steam-plant maintenance	13,107	17,997
Electric-plant maintenance	1,973	978
Buildings and fixtures	1,115	3,873
Total	$129,512	$250,663
Kilowatt-hours generated	15,372,269	20,102,800
Net production cost per kw.-hr., mills	8.43	12.47
Pounds coal per kw.-hr.	3.19	2.52
Average cost coal in crusher per ton	$3.65	$7.51
Coal cost per kw.-hr. (mills)	5	9.5

In 1916 an estimate was made that a plant consisting of two 5000-kva. turbines, four 500-hp. water-tube boilers, a 12-ft. by 200-ft. (3.6-m. by 60-m.) self-supporting steel stack, a 200-ton coal bunker and accessories could be built on tidewater for the Massachusetts Northeastern company at a total cost of $552,000, or $55.20 per kva. This estimate was recently revised, and, covering the same items as in 1916, it was found that the installation could not be made for less than $1,106,000, or just about double the cost of two years ago, $110.60 per kva. being the figure for May, 1918. It is estimated by Mr. Lester that in case this new power plant were in operation at this time and the turbine equipment were producing energy on 2.15 lb. of coal per kilowatt-hour, the plant would consume 11,229 tons of coal. Thus, if purchased at the average price of $8.63 per ton, which is less than the price of coal delivered to-day at Portsmouth, the cost would be $96,906, to which would be added the cost of substation labor and expense, about $16,600, and also the labor and other expenses of generating energy at the main power plant.

In the case of the Boston Elevated Railway the labor and miscellaneous station costs of production are 1.95 mills per kilowatt-hour, which Mr. Lester states is lower than that of any of the steam generating plants of the state. Using this conservative figure, the cost to the Massachusetts Northeastern company would be increased by $22,815, and an allowance of 12 per cent for interest, taxes, insurance and depreciation would add $132,720, making the total cost of delivering energy to the railway lines at the substations $269,060, exclusive of the charges on the station site and the interest and maintenance of the requisite transmission line. Such a line would cost at least $175,000, and the right-of-way would have to be added. The commission's investigation therefore showed an annual net saving of at least $45,466 by continuing to purchase central-station energy.

TIDEWATER STATION OF ROCKINGHAM COUNTY LIGHT & POWER COMPANY AT PORTSMOUTH, N. H.

CENTRAL-STATION ENERGY CHEAPER FOR SPRINGFIELD RAILWAY

In April, 1917, a contract was made between the Springfield Street Railway and the Turners Falls Power & Electric Company whereby the railway company is to pay the power company at the rate of 11 mills per kilowatt-hour for energy taken at most points on the trolley system. There is no coal clause in this contract, and the energy sold is in the form of direct current at 600 volts. The contract did not become operative until late in the year, and in 1917 the railway company generated 71 per cent of the energy used. This was produced in a relatively inefficient steam plant on a coal consumption of 4.45 lb. per kilowatt-hour, and the average cost of power for the railway for the year 1917, including fixed charges, was 2.19 cents per kilowatt-hour. This year the economical service of the Turners Falls company will result in a large saving in coal for the Springfield transportation system, and such energy as is produced in the steam plants of the Turners Falls company will be generated in the new Hampden steam-turbine plant of that organization now approaching completion at Chicopee Junction, and at a far better economy than was possible in the old railway plant at Margaret Street, Springfield. The latter, in fact, has recently been placed on the second-hand machinery market.

The Worcester Consolidated Street Railway, which generates a portion of its power and purchases the rest, is fortunate in having a very favorable contract with the New England Power Company and is also fortunate in owning a generating station at Millbury, Mass., equipped with efficient turbines. These units develop energy on 2.11 lb. of coal per kilowatt-hour, and the average cost of power per kilowatt-hour for 1917 on this road, including both generated and purchased energy, was 8.8 mills. The cost, including interest, taxes and depreciation on plant and equipment, was 2.01 cents.

The Middlesex & Boston Street Railway, serving the suburban territory of the west of Boston, purchases its energy from the Edison Electric Illuminating Company of Boston upon terms which were criticised by the Public Service Commission in the 1914 fare case. At that time the average cost of power was about 1.75 cents per kilowatt-hour to the railway. The average cost of power to the Middlesex & Boston company is now about 2.17 cents. In a recent decision affecting fares on this road the commission acknowledges the economic advantage of central-station service, pointing out that the recent extraordinary advance in the price of coal, brought about by the war, has made the contract with the Edison company advantageous for the time being and has protected the railway against a heavy increase in operating cost on this account from which other trolley roads have suffered severely.

BANKERS PLAN TO AID PUBLIC UTILITY FINANCING

Amendment of Law Govering Loans by War Finance Corporation Suggested After Adverse Ruling of Attorney General

Right on top of the news from Washington that the plan for a $100,000,000 corporation to act as an intermediary between borrowing corporations and the War Finance Corporation had been knocked in the head by a ruling of the Attorney General, bankers interested in public utilities set to work to devise another plan.

The original plan instigated by the New York bankers and strongly supported by Chicago bankers was declared to be faulty. The Attorney General, deciding that Sec. 10 of the war finance act limiting loans to any one corporation to 10 per cent of the War Finance Corporation's capital applied to the proposed intermediary corporation. In consequence, the utmost amount that such a corporation could receive from the War Finance Corporation is $50,000,000.

The formation of a $60,000,000 or $70,000,000 intermediary corporation to aid the financing of public utilities was suggested at a conference of bankers in New York on Tuesday of this week. The opinion among the bankers generally was that the law as interpreted seems unworkable and that either the act will have to be amended or the interpretation of the Attorney General changed. If the War Finance Corporation were authorized to function more as an underwriting corporation than a money lender, many bankers believe its mission in aiding essential industries would be improved.

The bankers' efforts to devise instrumentalities for supplying public utilities with needed capital will continue to be co-ordinated through a special committee of which James W. Wallace, president of the Central Union Trust Company of New York is chairman.

INCREASE IN WAGES FOR ELECTRICAL WORKERS

Linemen and Splicers on the Pacific Coast and Electricians in Steel Mills Win Wage Decision

In a decision on the Bethlehem Steel Company's dispute involving workers on government contracts, the National War Board on Aug. 4 ordered the revision or complete elimination of the bonus system now in operation at the plant, a revision of piece-work rates and the establishment of a designated guaranteed minimum hourly wage rate. The workers are moreover granted the right to organize and bargain collectively.

The award applies the basic eight-hour day with payment of time and a half for all overtime, double time on Sundays and holidays, and orders the company to pay men and women alike when performing the same work. The case came before the War Labor Board following a series of strikes of machinists and electrical workers and after various government agencies bent on mediation had exhausted their efforts.

Specific wage increases are granted to 440 electrical workers who demanded increases to 67½ cents an hour for electricians and at least 40 cents an hour for helpers. The board awarded 67½ cents an hour for first-class electricians, 62½ cents an hour for second-class electricians and 40 cents an hour for helpers.

By referendum vote in about twenty locals of the Electrical Workers' Union, it was decided to accept the offer of 80 cents a day increase in the wages of electrical workers and cable splicers offered by the Pacific Gas & Electric Company of San Francisco. Electrical workers getting $5 a day are to get $5.80 and cable splicers getting $6 a day are to get $6.80. This increase, which will affect about 800 men, has also been granted employees by the Great Western Power Company, and the Western States Gas & Electric Company.

MEETING OF INDIANA ELECTRIC LIGHT ASSOCIATION

The Coal Situation Was the Chief Topic for Discussion and All Year Daylight Saving Is Advocated

Coal conservation in its many phases was almost the sole topic of discussion at the one-day meeting of Indiana Electric Light Association at Indianapolis on Wednesday. Mr. Vanblarcon, assistant to Charles E. Stuart, chief of power and light division, United States Fuel Administration, speaking on war conservation of light and power forecast changes which light and power men must soon expect. He intimated that lamp policies will have to be changed to encourage the use of smaller lamps, and to insure the elimination of carbon and "gem" lamps, discarding of free lamp renewals will be advocated. Further action looking to coal economy through the shutting down of inefficient isolated plants may be expected and further interconnection of utilities will be advocated. Even ice plant operations will be regulated to prevent running several plants inefficiently at light loads when one plant running at full load will supply the demand.

Alex Holliday of the Indiana Fuel Administration discussed the economic aspects of the present national policy of centralization and outlined the organization of the Indiana Fuel Administration.

T. A. Wynne, Jr., of Indianapolis, read a paper on "Proper Boiler-Room Management." President J. P. Ohmer of Elkhart complimented the association's coal committee on its efficient work in helping the smaller utilities. Saving coal by making the daylight-saving law apply throughout the year was a live topic of discussion.

On the suggestion of C. C. Perry of Indianapolis, E. J. Condon of Angola and Thomas Donohue of Lafayette, a resolution was passed placing the association on record as favoring a movement to set the clocks ahead during the whole year instead of only during the summer. A copy of the resolution is to be sent to the Fuel Administration.

Practically the only portion of the program not pertaining to coal conservation was an address by Governor James P. Goodrich, of Indiana. The Governor, who is a director in several utility companies, expressed sympathy with the central stations in their present difficult rate situation. The following officers were elected: President, T. A. Wynne, Indianapolis; vice-president, P. H. Palmer, Kokomo; secretary-treasurer, Thomas Donohue, Lafayette. Executive committee: J. P. Ohmer, Elkhart; S. W. Greenland, Fort Wayne; E. J. Condon, Angola; C. O. Murphy, Indianapolis, and F. J. Haas, Evansville. The advisory committee comprises:. J. M. Robb, Clinton; Thomas F. English, Muncie, and E. M. Walker, Terre Haute.

LABOR BOARD'S DECISION IN GENERAL ELECTRIC DISPUTE

Hours of Work Remain Unchanged but Increases in Wages Are Given and a Minimum Wage Scale Established

The National War Labor Board on Aug. 2 handed down its decision in the wage and time controversy between the Metal Trades Council and the General Electric Company of Schenectady. The decision is along the lines which Vice-President George E. Emmons conceded to the men. The award is as follows:

> The present bonus of 10 per cent shall become wages.
>
> For men there shall be a horizontal increase of 10 per cent in day and piece rates, except in the following trades: Steamfitters, carpenters, wide and narrow-gage men, painters, metal polishers and pattern makers, who shall receive an increase of 15 per cent.
>
> Men employed on night shifts shall receive compensation 5 per cent higher than those employed on day shifts.
>
> In no case shall any male employee, twenty-one years or over, receive less than 42 cents per hour.
>
> In all classes of employment there shall be an increase of 20 per cent in the wages of all adult women.
>
> No woman shall receive less than $15 per week.
>
> In all cases where women perform the same work as men, their pay shall be the same.
>
> In the case of the scrub woman, a minimum wage of $10.50 per week for the present hours of service is granted.
>
> In calculating the overtime rate for piece work, the piece price shall be used as a basis and not the day rate.
>
> The complaint submitted by the clerical workers was presented at such a late hour and the evidence is so unsatisfactory that an award will be postponed for further evidence, to be taken by the examiner assigned to supervise the execution of this award.
>
> The evidence in this case shows that prior to the submission of this controversy to the arbitrators, the employees demanded a forty-four-hour week, and that subsequently this demand was altered to a request for a forty-eight-hour week.
>
> Inasmuch, however, as the women in this plant are at this time working only forty-eight and one-half hours per week, and the men only fifty hours, the difference is so slight that we concluded, without passing on the merits of the length of the workday, not to change it at this time, because of the very great difficulty that would be involved in applying the present wage scale to these small changes of hours.
>
> For the purpose of securing the proper interpretation of the award, the secretary of the National War Labor Board shall appoint an examiner who shall hear any differences arising in respect to this award between the parties, and promptly render his decision, from which an appeal may be taken by either party to the arbiter making this award. Pending the appeal the decision of the examiner is to be binding.
>
> This award is to take effect as of May 3, 1918, for piece work and May 6 for day work, and shall continue for the duration of the war, except that either party may reopen the case before the arbitrators at periods of six months in intervals, beginning February, 1919, for such adjustments as changed conditions may render necessary.
>
> The company shall have until Sept. 15, 1918, to make back payments of wages herein awarded.

The Situation at Lynn, Mass.

Striking employees of the General Electric Company's Lynn (Mass.) factories returned generally to their work on Friday morning, Aug. 2, following the War Labor Board's assumption of jurisdiction in the case. On July 27 the State Board of Arbitration issued a finding recommending that the employees return to work on the 29th, and that questions of wages and hours be adjusted between the company and its employees after the latter had returned to work, subject to the arbitration of the board in case of dispute. The board also recommended that no discrimination against members of labor unions be practiced by the company and that the principle of the open shop be recognized by the parties. General Manager W. C. Fish at once agreed to the recommendations of the board, but the striking employees refused to return until the War Labor Board assumed jurisdiction. Secretary Wilson of the Department of Labor requested the War Labor Board last week to take over the adjustment of the strike, and after wiring the State Board of Arbitration for information and receiving a reply from that body to the effect that it would be agreeable to intervention by the national board, the latter took over the case as mediator, influenced in no small degree by urgent appeals by representatives of the War and Navy Departments. The strikers promptly voted to resume work, and the company announced that it would welcome the resumption of production and accept the mediation of the War Labor Board subject to the withdrawal of the State Board from the case.

About 9000 employees returned to work, many hundreds having previously withdrawn from participation in the strike and resumed their old places. It is noteworthy that only a few cases of violence occurred during the strike. The company's property was carefully guarded, but little or no attempt was made to molest it. Twelve turbines were shipped from the factory on Wednesday of last week, despite the strike. Hearings were begun by the representatives of the War Labor Board, Alpheus Winter, chairman, on Monday morning at Lynn.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Rates Should Stimulate Business.—Criticising rates submitted by the Athens electric light plant, the Illinois Public Utilities Commission comments: "It would certainly not operate to develop the business in a community of this character. Obviously, the aim of the utility should be to secure as large and liberal a use of its service as is possible."

Percentage Increases in Operating Cost.—In authorizing a war surcharge of 41 mills per kilowatt-hour on power rates for the Marion Light & Heating Company the Indiana Public Service Commission says in part: "The present power rates of the petitioner are low. They were made on a competitive basis. The competition is potential. That is, the rates cannot be made much higher than it would cost the individual power user to produce his own electrical energy with an individual plant. The existence of this point of potential competition is the chief justification for power rates so low in proportion to domestic and commercial rates. Last year the Public Service Commission made investigations which revealed that Indiana industries generating their own power showed operating costs greatly increased over those of 1915, the increases ranging from 15 to as high as 80.9 per cent. Since that investigation these percentages have increased and now range from at least 25 per cent to 80.9 per cent. This has the effect of raising the point of potential competition, and there is no longer any reason why power rates should be so disproportionately low. Except for the municipality of Fairmount, no power patron raises objection to this."

War-Time Service.—Where it appeared that, on account of abnormal conditions, the utility was unable to render the type of service desired by he consumer, but had contracted to supply a service more expensive and less adapted to the consumer's needs, the Illinois Public Utilities Commission required the utility to bill such substitute service on the basis of the service desired by the consumer. The case affects the East St. Louis Light & Power Company. The commission says in part: "The East St. Louis Light & Power Company obtains its power from the circuits of the Mississippi River Power Company and from several steam generating plants in East St. Louis and vicinity, and also by means of an emergency connection with the system of the Union Light & Power Company in St. Louis. The energy received from the Mississippi River Power Company is at 25 cycles, and the respondent distributes this energy by means of its distribution system and also distributes energy at 60 cycles.

The supply of 60-cycle energy is furnished from the stations of the company either by means of conversion apparatus, by which it is converted from the 25-cycle energy received from the Mississippi River Power Company, or by means of steam generating apparatus, by which the 60-cycle energy is primarily generated. Prior to the war the East St. Louis Light & Power Company had available what it regarded as a normal reserve for the supply of both 25-cycle and 60-cycle energy. When the demands of industries whose business was increased on account of the war made themselves felt, the East St. Louis Light & Power Company was called upon for additional service to such an extent that its available capacity in 60-cycle energy was utilized to as great an extent as the company felt could safely be done without jeopardizing the character of the service. Its supply of 25-cycle energy, however, was not entirely utilized. It appears that the complainant was willing to utilize 25-cycle energy, making the necessary investment in motors which were more expensive than would otherwise have been the case, and undergoing the inconvenience of the necessary complications in its operations, but did not wish to be penalized through its bills for service because of the inability of the East St. Louis Light & Power Company to supply energy of the same character which previously was furnished.

It does not appear reasonable that under these conditions the complainant should be required to pay an additional amount for service of a character which is less adapted to its requirements, provided that the service is of a permanent character which would assist in the normal development of the utility's normal business. Whether or not the service desired is of this character is best evidenced by the willingness of the consumer to contract for a period of time which under normal conditions would warrant permanent investment in needed facilties.

In the opinion of the commission, for service of this character such a period of time would be approximately five years. The condition which is illustrated by the complainant herein must be regarded as an emergency condition and one which warrants emergency treatment. For this reason the commission believes that a proper solution would be reached by billing the service of this complainant at the rates applicable to 60-cycle service and by combining, in so far as is physically possible, the meter readings for the two services. This method of billing should not be applied to consumers who, on account of a peculiarity of their manufacturing processes or for any other reason, desire service at both 60 cycles and 25 cycles. Neither should this billing method be applied to consumers who previous to the existing emergency were receiving service at both 60 cycles and 25 cycles."

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 239 of this number.

Electrical League of Cleveland.—On Aug. 3 the Electrical League of Cleveland held its annual picnic at Nela Park. The event was attended by a large crowd and various entertainments were held.

Synchronous Club of Los Angeles.—On Aug. 1 an election of officers was held by the Synchronous Club of Los Angeles. Present officers are C. A. Blair, secretary, and N. B. Hinson, chairman entertainment committee.

New York & Queens Electric Light & Power Company.—L. J. Montgomery has been elected president and J. A. McKeon has been elected secretary of the Employees' Association of the New York & Queens Electric Light & Power Company for the period ending 1920.

British Columbia Association of Contractors and Dealers.—The secretary, Captain W. J. Conway, 406 Yorkshire Building, Vancouver, B. C., announces that the annual meeting of this association will be held Sept. 13, 14 and 15, 1918, at the Empress Hotel, Victoria.

N. E. L. A. Michigan Section.—The Michigan Section of the National Electric Light Association will hold its annual convention on Sept. 17 and 18 at the Pantlind Hotel, Grand Rapids, Mich. The program will be given over entirely to subjects of war-time interest. All technical discussion that does not point directly to "Winning the War" will be avoided. Capt. Thomas Chandler, president of the Michigan Section, is now in France, so the meetings will be conducted by Vice-President W. M. Lewis of Muskegon.

American Society for Testing Materials.—"Engineering Societies: Their Utilities and Justification" was the subject of the address made by President William H. Bixby before the recent annual meeting of the American Society for Testing Materials in Atlantic City, N. J. He referred to the hundreds of technical societies which are in existence in this country and outlined a basis for determining which should be called societies, clubs, institutes, etc. The original purposes of technical societies are fast being replaced by new ones, he pointed out. Among their present benefits are the opportunity they offer men of one profession to get acquainted and exchange ideas and the chance afforded to overcome engineering problems, improve processes, standardize materials and finished products, etc. The engineering society which is the most important and useful to-day is the one which gives the most beneficial results to the general public rather than to the individual member.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Swedish Production of Electrical Goods.—Figures on the output of electrical machinery, apparatus and transmission lines by Swedish concerns as contained in recent recapitulation by Swedish Exports follow: 1912, $6,500,000; 1913, $8,000,000; 1914, $9,000,000, and 1915, $12,000,000.

Wisconsin Company Is Financing.—The Wisconsin Power, Light & Heat Company, of which Marshall E. Sampsell of Chicago is president, is marketing $200,000 worth of three-year 7 per cent collateral gold notes, in denominations of $100, $500 and $1,000, through the Fort Dearborn Trust and Savings Bank, Chicago. The company operates in twenty-two communities in Wisconsin.

Boiler-Room Conservation in Ohio.—M. S. Hopkins, formerly connected with the Columbus Railway, Power & Light Company, has been appointed administrative engineer of the Ohio Fuel Administration by Administrator J. H. Frantz. Under his direction a campaign of education will be carried on to bring about improved firing conditions in boiler plants with the idea of conserving fuel. Mr. Hopkins has been authorized to employ assistants to aid him in this work.

Field Artillery Central Officers' Training School.—A field artillery central officers' training school for civilians between twenty years and eight months and forty years of age and enlisted men of the army has been established at Camp Zachary Taylor, about 6 miles southeast of Louisville, Ky. The course will be about twelve weeks. Civilians entering this school must agree to serve in the army for the period of the war if they fail to receive commissions—those within the draft age by voluntary induction and those above the draft age by voluntary enlistment.

Capital Issues Committees.—Charles S. Hamlin, chairman of the Capital Issues Committee of the Federal Reserve Board, has announced the permanent organization of district committees on capital issues in each of the twelve Federal Reserve Districts. Among those who are members of the committees in their respective districts are: Charles A. Morss and Henry G. Bradley, Boston District; Charles A. Stone, S. Reading Bertron, Newcomb Carlton, George B. Cortelyou, Allen B. Forbes, George E. Hardy, New York District; Clarence M. Clark, Lewis Lillie, John Brooks, Ferdinand W. Roebling, Jr., Philadelphia District; Rufus C. Dawes, Louis A. Ferguson, B. E. Sunny, Chicago District.

Norwegian Power Plant Leased.—United States Vice-Consul H. E. Carlson reports from Christiania that $4,020,000 was appropriated by the Norwegian government on May 6, 1918, for the acquisition by purchase of the Glomfjord hydroelectric plant. Glomfjord is in the province of Norland, Norway. The government is to purchase the stock of the company at 18 per cent. There is to be leased to Herr Tilberg of Stockholm, Sweden, 45,000 hp. at $9.65 per horsepower for the first five years and for the following twenty-five years at $9.11 per horsepower. At the expiration of this time the contract may be renewed for an additional period of twenty years at the rate of $12.06 per horsepower. When the power plant has been completed it is estimated that it will have a capacity of from 80,000 hp. to 90,000 hp.

Government Residence Halls.—The Bureau of Industrial Housing and Transportation announces that contractors have been invited to send in bids for government residence halls planned for war workers in the District of Columbia. Groups containing unit buildings, each consisting of 150 rooms, will be erected at the Union Station Plaza and on the site bounded by Fourteenth, Fifteenth and B Streets and Ohio Avenue, Northwest. Each room will measure 9 ft. by 11 ft., and each will be provided with a clothes closet and running water, hot and cold. Shower baths and tubs and toilets will be provided for each group of about twenty-five rooms. The rooms are all designed for occupancy by one person. In the basements will be small supplementary laundries for the use of residents. Kitchenettes are planned also in the basements.

Fuel Economy Circular of University of Illinois.—The engineering experiment station of the University of Illinois has just issued a ninety-page booklet printed in four colors which shows that the average small power plant can save 15 per cent of its fuel by the exercise of greater care in equipment and operation. This means a saving of 12,000,000 or 13,000,000 tons per annum if applied throughout the country. The purpose of the publication, the title of which is "Fuel Economy in the Operation of Hand-Fired Power Plants," is to present to owners, managers, superintendents, engineers and firemen certain suggestions which will help them in effecting greater fuel economy and in determining the properties and characteristics of the coal purchased. Features of installation essential to the proper combustion of fuel are discussed, the practice to be observed in the operation of the plant is outlined, and the employment of simple devices for indicating conditions of operation is prescribed. Only a limited supply of copies of this publication is available for free distribution. Requests for copies should be directed to the Engineering Experiment Station, Urbana, Ill., and should specify "Circular No. 7."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Power of Commission.—Though the power of the Public Service Commission is extensive and the act creating it should be construed in the same spirit in which it was enacted, still when a particular power is exercised by or claimed for the commission, it should have its basis in the language of the statute, or be necessarily implied therefrom, according to a decision of the Court of Appeals of New York (119 N. E. 848).

Cause of Death.—Where a servant touched a wire carrying 114 volts of electricity and he was burned and died almost immediately, although he was a strong, able-bodied man, the presumption was that the accident was the cause of his death, until overcome by contrary evidence, notwithstanding that electricity of such power would not ordinarily cause death, the Court of Appeals of Kentucky has decided (204 S. W. 152).

Injury to Climbing Boy.—No liability was incurred by an electric company, or by a city, because of injury to a boy who climbed a pole bearing wires set just inside a school yard where the boy had to get on the fence to reach the handspikes, he being ten or eleven years old, not mentally deficient, and knowing that climbing the pole was not permitted, the Court of Appeals of Maryland held (103 A 948).

Delay in Fixing Wires.—In an action for the death of plaintiff's minor child by coming in contact with a broken electrically charged wire, the admission of evidence of defendant's delay in repairing the wire for an hour after the accident was prejudicial error, in view of the concession of defendant that the wire belonged to it, the Supreme Court of New York, Appellate Division, held—Costello versus Buffalo General Electric Company (170 N. Y. S. 1006).

Water Rights.—Laws providing that the beneficial use of water is a public one and that any person may exercise the right of eminent domain to acquire any property or rights when necessary for the storage of water for, or application of water to, any beneficial use do not expressly grant power to condemn state property, the Supreme Court of Washington holds in Mason County Power Company versus Superior Court of Washington for Mason County (173 P. 19). Where no right to condemn state property exists, when proceedings therefor are instituted, subsequent legislation cannot retroactively affect the matter and grant the right of such condemnation the court further held.

Judge Harold M. McClure of Lewisburg, Pa., has recently been appointed a member of the Public Service Commission of Pennsylvania.

John J. O'Brien, vice-president and treasurer of H. M. Byllesby & Company, has been appointed a member of the Capital Issues Committee for the seventh Federal Reserve District.

H. P. Pitts, industrial engineer with the Pacific Gas & Electric Company, San Francisco, has resigned to become purchasing agent for the Liberty plant of the Bethlehem Shipbuilding Corporation at Oakland, Cal.

Edward C. Niles, president of the National Association of Railway Commissioners and of the Public Service Commission of New Hampshire, has been appointed manager of the short-line division of the Railroad Administration, Washington, D. C.

E. R. Holt, assistant superintendent of the electric lighting, power and gas departments of the Lynchburg (Va.) Traction & Light Company, has been appointed acting superintendent of these departments during the absence of W. G. Claytor, who has been commissioned a captain in the army.

H. R. Woodrow, who some months ago was appointed assistant chief electrical engineer of the New York Edison Company, had been assistant to the chief electrical engineer of the company since 1911. Prior to that he was associated for two years with Dr. E. J. Berg in post-graduate work at the University of Illinois.

G. M. Turner, who has had charge of the local electric station operated by the Independent Electric Company, Portland, Ore., for several months past, has been promoted to be district superintendent of the company, with headquarters at Winlock. Mr. Mason of Winlock will succeed Mr. Turner in Castle Rock.

C. C. Hogshead, who for a number of years has been chief engineer of the power stations of the Roanoke (Va.) Railway & Electric Company, has been appointed acting superintendent of the electric light, power and gas departments of the company during the absence of W. G. Clayton, who has been commissioned a captain in the army.

R. H. Tapscott, who some months ago was appointed assistant chief electrical engineer of the New York Edison Company, was for the eight years previous assistant to the engineer of the lighting department of the General Electric Company at Schenectady. Mr. Tapscott entered the employ of the General Electric Company on graduation from Union College.

W. G. Williams, results engineer of the Empire District Electric Company, Joplin, Mo., has been appointed engineer in charge of fuel conservation in the mid-continent field by the petroleum division of the United States Fuel Administration. The appointment is for the duration of the war, and Mr. Williams will have his office in Oklahoma City.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

James B. Olson, who for the past thirty years has been prominently identified with the wire industry, on Aug. 1 joined the sales organization of the Okonite Wire Company, New York City. February last Mr. Olson resigned from the Habirshaw Electric Cable Company, of which he was assistant secretary and general sales manager. He had been connected with this company and its predecessor, the India Rubber & Gutta Percha Insulator Company, since 1894. His first connection with the wire industry was with the New York Insulated Wire Company in 1888. Four years later he went to Chicago, where for two years he was Western sales manager for the company.

C. A. Graves, president of the Graves Engineering Company, has been appointed assistant administrative engineer of the Fuel Administration for the State of New York. He will have charge of the work of the conservation division in the metropolitan district of the state, which includes Greater New York City, Westchester, Rockland, Nassau and Suffolk Counties. Mr. Graves before engaging in consulting engineering work was manager of the power bureau of the sales department of the Edison Electric Illuminating Company of Brooklyn. He was connected with this company in power sales work for nine years. He has also served on the gas engine committee and the power committee of the National Electric Light Association.

Morton G. Lloyd, electrical engineer in charge of safety work in the Bureau of Standards, Washington, D. C., has been appointed a member of the electrical committee of the National Fire Protection Association, to represent the Bureau. Dr. Lloyd was for many years a member of the scientific staff of the bureau, during the period of its early development. From 1910 to 1917 he was technical editor of the *Electrical Review and Western Electrician*. In 1917 he returned to the bureau and upon the resignation of W. J. Canada was put in charge of electrical safety engineering. Dr. Lloyd is a fellow of the American Institute of Electrical Engineers and has served upon its standards committee and various other committees. He is vice-president of the Illuminating Engineering Society and a member of its committee on lighting legislation. He is a member of the divisional committee on lighting of the advisory commission of the Council of National Defense, a member of the American Association for Labor Legislation and of numerous scientific and technical societies.

J. G. Fisher, distribution superintendent of the Drumright, Okla., division of the Oklahoma Gas & Electric Company, has been called into military service.

Patrick Fitzgerald, assistant superintendent of the Northern States Power Company, and Joe Colombo, also of the Northern States Power Company, Stillwater, Minn., division, have joined the army.

W. Graham Claytor, general superintendent of the lighting and power departments of the Lynchburg (Va.) Traction & Light Company, and the Roanoke (Va.) Railway & Electric Company, has been commissioned a captain in the National Army and granted a leave of absence from the two companies. Captain Claytor will engage in electrical engineering work with the construction division of the army. Captain Claytor was born at Bedford City, Va., and obtained his technical education at Virginia Polytechnic Institute, after which he took a year's course of practical instruction at the works of the General Electric Company. For the last twelve years he has been connected with companies engaged in the electric lighting, power and gas business.

F. H. Rickeman, for several years connected with the Interstate Light & Power Company (Northern States Power Company), Galena, Ill., has been appointed general manager of the company, succeeding W. R. Miller, resigned. This property is controlled by H. M. Byllesby & Company, Chicago, Ill.

W. R. Miller has resigned as general manager of the Inter State Light & Power Company (Northern State Power Company) Galena, Ill.

Obituary

First Lieutenant Edward T. Hathaway, son of F. B. Hathaway, Southwestern General Electric Company, Houston, Tex., died in France as the result of an aeroplane accident.

Abbot S. Cooke, president of the Cooke-Wilson Electrical Supply Company, Pittsburgh, Pa., died at his home on July 25 at the age of fifty-nine years. He was in the electrical supply business for twenty-two years.

George G. Caldwell, for a number of years construction engineer for H. M. Byllesby & Company, died of heart trouble on July 27 at Ottumwa, Iowa, where he was engaged on special construction work for the Ottumwa Railway & Light Company.

Captain Howard C. McCall, son of Joseph B. McCall, president of the Philadelphia Electric Company, was killed in action in France on July 20. Captain McCall, who at the time of his death was twenty-seven years old, was graduated from the University of Pennsylvania in 1909 and from the Law School in 1913. He won his captaincy at the second officers training camp at Fort Oglethorpe, Ga.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

CENTRALIZED GOVERNMENT PURCHASING SCHEME PROGRESSING

Electrical Goods Have Been Assigned So Far to Construction, Ordnance, Engineers and Signal Branches

Organization of the centralized purchasing scheme whereby the General Staff controls the buying of all commodities and supervises all contracts for the Army as outlined in the ELECTRICAL WORLD of last week, page 228, is rapidly progressing. Already assignment of purchases of a number of commodities has been made to the several branches of the War Department, and boards of review are passing on all contracts so as to insure a uniformity of contract control and provisions. The general administration of the scheme is under the direction of Brig.-Gen. Hugh S. Johnson, head of the purchase and supply branch of the division of purchase, storage and traffic of the General Staff of the Army.

So far the purchase of electrical commodities has been assigned to the following branches: *Construction.*—Electrical equipment and supplies, electric wire for heavy power. *Ordnance.*—Dry batteries and flashlights and batteries. *Engineers.*—Arc searchlights and electric-gas generator sets. *Signal.*—Electric wire, radio equipment, telephone and telegraph equipment. *Aircraft Production.*—Brass and copper tubing, electric wire and cable.

DOME-REFLECTOR STANDARDS ADOPTED BY MANUFACTURERS

As Conditions Warrant Various Other Types Will Be Discussed and Standards for Them Fixed Upon

The Associated Manufacturers of Electrical Supplies, through their reflector committee, have been working for some months over the problem of setting and adopting standard dimensions and other specifications for porcelain-enameled steel reflectors.

The difficulties attending this work were many, and, inasmuch as the physical properties of reflectors are directly dependent upon lamp dimensions, the development of standardized reflector designs was carried on by joint meetings of the committees of both the reflector manufacturers and the engineering departments of the various lamp companies. These joint meetings were the result of appreciation by the reflector manufacturers not only of the great advantages to be derived by the purchaser of standardized reflectors but by the lamp manufacturers.

As a result of these meetings certain standard dimensions and specifications for dome reflectors were adopted by the reflector manufacturers. These manufacturers will within a short time place upon the market dome reflectors under the trade name or designation of "R-L-M standard," meaning "reflector and lamp manufacturers' standard."

The outcome of the discussion of the character of the porcelain enamel surface was the adoption of a quality of enamel which is regarded as the most efficient for light purposes, considered from a standpoint of efficiency on one hand and elascticity and durability on the other.

The R-L-M standard reflectors for the present will be confined to the dome types for direct lighting and will be furnished in various sizes to receive lamps varying from 75 watts to 1000 watts, inclusive.

The adoption of these R-L-M standard reflectors marks only the first step in the development of reflectors by the committees. As conditions warrant, various other types of reflectors will be discussed and certain standards adopted. As soon as the conclusions of the committees have reached a point where their findings are sufficiently exact to be adopted by the reflector manufacturers and approved by the lamp manufacturers, such conclusions will be made public. More detailed information concerning the R-L-M standards will be published by the various reflector manufacturers individually.

HOIST MANUFACTURERS DISCUSS WAR SERVICE

Plants Are Now Heavily Booked Up for Government Orders, and the Problem of Securing Raw Material Becomes Critical

The Electric Hoist Manufacturers' Association held its June meeting at Montour Falls, N. Y., where the members of the association were the guests of the Shepard Electric Crane & Hoist Company. The general topic of the meeting was war service, and the general discussion was directed along lines for co-ordinating the experience and facilities of the electric hoist manufacturers to be of the most direct and efficient service to the government for war requirements. The electric hoist manufacturers are heavily booked up on government orders for war purposes, and the problem of securing raw material sufficiently in advance to meet government requirements promptly has become a critical one. The consensus of opinion of the electric hoist manufacturers is that government orders for war purposes should take precedence over all other orders, and if war requirements call for the complete output of all of the manufacturers of electric hoists, it will be desirable to refuse all other business.

ELECTRICAL EXPORTS STILL TO FALL OFF

April Figures Are $4,572,953 and Bring Total for Ten Months Ended April 30, Up to $44,494,572

Exports of electrical merchandise manufactured in the United States continue to fall below those for the corresponding months of 1917. The latest reports are for April last, which give electrical exports for that month as $4,572,953 as compared with $4,740,902 in April, 1917.

For the first four months of 1918 the exports of electrical goods amounted to $17,824,286, as compared with $18,428,062 in the first four months of 1917. In each of the four months the value of the exports was less than in the same month of 1917. Furthermore, prices in 1918 have been higher than in 1917, so that the volume of export business has fallen off much more than the mere values would show. It is interesting to note in this connection that the loss is by no means so great as the decrease in wire and cable exports.

April exports bring the figures for the ten months ended April 30 up to $44,494,572, as compared with $41,733,106 and $23,666,267 for the corresponding period one and two years prior respectively.

These figures are taken from the regular monthly compilation of the Bureau of Foreign and Domestic Commerce. The tabulated report follows:

	Month of April 1917	Month of April 1918	Ten Months Ended April 1917	Ten Months Ended April 1918
Batteries	$212,154	$268,294	$2,362,304	$2,770,627
Carbons		130,577		1,294,230
Dynamos or generators	164,337	307,911	2,041,161	2,111,289
Fans	63,700	104,503	336,468	532,922
Heating and cooking apparatus		38,959		436,311
Insulated wire and cables	653,379	457,354	5,930,585	5,031,951
Interior wiring supplies, including fixtures	122,230	136,471	899,005	1,253,454
Arc lamps	1,240	2,430	13,048	12,133
Carbon-filament lamps	11,653	7,365	121,108	130,317
Metal-filament lamps	215,739	278,150	1,440,490	2,397,840
Meters and measuring instruments	89,297	157,730	870,783	1,222,470
Magnetos, spark plugs, etc		230,719		2,839,220
Motors	643,719	560,071	4,818,684	5,502,785
Rheostats and controllers		14,805		159,373
Switches and accessories		163,076		1,892,256
Telegraph apparatus, including wireless	90,047	36,167	417,534	250,299
Telephones	206,588	172,912	1,513,435	2,040,335
Transformers	94,720	156,901	951,513	1,556,694
All other	2,172,099	1,348,558	20,016,988	13,060,066
Total	$4,740,902	$4,572,953	$41,733,106	$44,494,572

METAL MARKET SITUATION

Copper in a Very Unsatisfactory Condition as to Price and Delivery—Tin May Go Under Official Control

Speculation is rife concerning the exact status of the copper market. There is practically no change in the situation as reflected in this column last week. The conferences to be held this week and next between the different copper producers and the War Industries Board are subjects of importance to the entire electrical trade, and their outcome is being awaited with more than passing interest. What orders producers of copper are booking are at the price ruling at the time of delivery; and as buyers do not know what that price will be they find it difficult to figure cost price on material and goods of various kinds they are asked to sell or bid on. Copper consumers, including brass manufacturers and wire drawers, have been requested to file briefs with the board, giving in detail the quantities of metal recently ordered, from whom, and the ultimate disposition of the finished material.

Next to copper the supply of tin is a matter of concern to the manufacturers of electrical staples. The price of pig tin has not as yet been fixed by the government, but present indications make such action likely. The ruling price is ridiculous, and at that the metal is difficult to obtain. It is figured that orders for August-September shipment, would cost 85.65 cents a pound in 25-ton lots, the smallest quantity accepted for importation of Straits tin. Lead remains at 8.05 cents a pound, with few transactions. Antimony is active with price fluctuations. There is a scramble for copper and brass scrap.

NEW YORK METAL MARKET PRICES

	July 29	Aug. 6
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26.00
Casting	Govt. price 26.00	Govt. price 26.00
Wire base	29.25	29.25
Lead, trust price	8.05	8.05
Antimony	13.00 to 13.25	13.00 to 13.25
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	Govt. price 15.00	Govt. price 15.00
Spelter, spot	8.35 to 8.50	8.45 to 8.55
Tin, Chinese *	94	92.00
Aluminum, 98 to 99 per cent	Govt. price †33.00	Govt. price †33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	23.50 to 24.50	23.50 to 24.50
Brass, heavy	14.50 to 15.00	14.50 to 15.00
Brass, light	11.50 to 12.25	11.50 to 12.25
Lead, heavy	7.12½ to 7.50	7.12½ to 7.50
Zinc, old scrap	5.50 to 5.75	5.50 to 5.75

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* No Straits offering. † In 50-ton lots or more; carload, 33.10 cents per lb.; 1-ton to 14-ton lots, 33.20 cents per lb.

THE WEEK
IN TRADE

CONTRARY to former years when the hot weather of July and August saw a general let-up in business, the electrical trade this summer is going right along, paying no attention to the heat. Commercial building is now at a lower stage than ever before, but the demands of the government have taken up all the available stocks thus set free. Priorities classification on raw materials is now making it difficult to serve ordinary commercial customers.

Fan stocks up to the present week except for 12-in. and 16-in. oscillators were still fairly large and many folks expected to carry fans over. It is doubtful, now, if such will be the case, particularly Chicago east. Appliance demand continues unabated. Large lamps are still short on the Pacific Coast.

Prices are still advancing. Should copper go higher, as some seem to think, more advances will follow. A number of concerns have withdrawn prices until the government announces its August copper price and policy.

NEW YORK

Jobbers express themselves as being well satisfied with the way business is going. Sales are keeping up in volume, with more than 75 per cent being government orders or for enterprises indirectly doing work or making material or furnishing goods for some branch of the military and naval service. As stated last week, jobbing houses are showing more anxiety and anticipate trouble in getting enough merchandise to supply their regular trade. If a jobber can render service, having the stock to make deliveries, he is in a position to do an excellent business. While government orders may exhaust a jobber's stock, the opinion prevails that he should be allowed replenishment under a preferential order. This is not the case all together, however, although efforts to bring this about have been tried. Nearly every order of any size before shipment by the manufacturer as well as the jobber must be identified as to destination and purpose.

Prices are changing frequently, with some new and higher quotations being noted in certain staples. Prices continue to be withdrawn with no new lists issued, quotations being made only on application with specific orders.

GENERATORS.—About 90 per cent of the capacity of some manufacturers is taken up with government orders. Deliveries to the trade are fair on commercial or trade requirements; that is to say, a lag of three or four weeks. It is hard to get material for certain requirements, and it is almost necessary to have a prority certificate.

HOUSEHOLD APPLIANCES.—The Home Devices Corporation has increased its prices on electric washing machines from $10 to $15 each, effective Sept. 1. Household appliances—sewing and washing machines, ironers, etc.—are being bought freely; and high prices do not influence the buying detrimentally.

LAMPS.—It is believed when the new contract scale is delivered there will be a sharp advance in prices. Labor is more than double its former cost. Girls who in normal times made $18 a week now earn $35. There is a scarcity of these operators and they are difficult to retain even at these prices. Other items are in the same proportion. Standard stocks are growing larger.

ELECTRIC MILKERS.—Machines of this description are strong sellers. Farming communities are enjoying affluence and are buying every labor-saving device irrespective of price. The producers are making a big drive this summer and fall in all agricultural sections.

COLLECTIONS AND CREDITS.—Jobbers are holding down their settlements wherever possible to a thirty-day basis. Admittedly it is difficult to enforce the rule, excepting when drastic measures are taken. The Moral Risk Club at its weekly conferences are exchanging some interesting information on the subject. Credits are held close.

MOTORS.—Deliveries vary, but on two to three phase, 3 to 8 hp. rating, one leading Eastern manufacturer says the company is sixteen weeks behind. A great deal of repair work is on hand, customers rehabilitating their old machines for two reasons, namely: It is almost impossible to get new motors, excepting on long delivery; and the quality of the old motor is claimed to be much better and therefore worth overhauling. A new price list or discount sheet on a shorter basis is looked for in the near future. On government orders the use of motors are many and surprising. One manufacturer recently received specifications on motors for 5000 ice cream freezers for cantonments.

LAMP POSTS.—Lighting poles of iron were advanced 25 to 30 per cent in the last two months. No further increase is anticipated. The supply appears to be satisfactory and shipments and deliveries made in thirty days.

CHICAGO

Volume of business continues satisfactory and prices are still advancing. Direct government business and business which is indirectly traceable to government activities comprise a large part of the business being done. How large a part this really is may soon develop if the extension of the so-called "pledge" system continues. Jobbers are being asked by many of the manufacturers from whom they buy to sign pledges that they will sell materials or products only for work which is either directly or indirectly connected with government activities. It is expected that this will work no hardship on the jobber, as most of his business is already of government origin. It will affect the jobber's customers, however, because upon them lies the burden of the proof that their purchases are for the government's needs. This means that contractors and central stations when they want to buy goods will have to supply the seller with proof (in the shape of priority order or otherwise) that the material and equipment is needed for government work. This presents a problem when it is desired to purchase for stock. Another limitation on buying has been announced by the administrative engineer of the Illinois Fuel Administration. All orders for power house apparatus are subject to his approval. The manufacturers and jobbers are anxious that the trade should realize this situation and should patriotically comply with the government wishes.

Bates & Rodgers, a Chicago firm, has contracts to build a $10,000,000 nitrate plant at Toledo and a $5,000,000 shipyard at St. Andrews Bay, Fla.

SCHEDULE "I."—Edison plug cutouts (Schedule I material has increased in price 12.5 per cent.

WIRE.—All copper wire is on a 34-cent base in Chicago and it is expected that within two weeks it will be on a 36-cent base. This new increase will follow the granting of an increase to 27½ cents to the copper producers on Aug. 7, if the increase is made. Confidence that this increase will be granted is unshakable in Chicago trade circles.

CONDUIT.—Pipe is moving in large quantities, but all sales are being made on priority orders.

RAILROAD BUYING.—Maintenance material is about all that is being brought by railroads.

FANS.—Fans have not moved owing to cold weather.

ELECTRIC RANGES.—Manufacturers of electric ranges report that their business this year so far is slightly ahead of that for the season of 1917. This is considered remarkable because the 1917 business was extraordinarily good. The business this year is coming from entirely different sources, however, than those from which it was received before. Almost no business is being received from the large cities. One manufacturer reports that 172 small central stations have bought ranges this year which never before purchased an electric range. These stations, of course, are buying ranges in small quantities but in the aggregate it creates a considerable demand.

BOSTON

Trade has been very active during the past week, with the government a heavy buyer of equipment and supplies. It begins to look as if there would be little or no midsummer falling off in either the number or the value of industrial and war orders. In spite of the continued demand for electrical products, jobbers' stocks are still well maintained except in a few lines where the government has virtually closed down on shipments without some sort of priority classification. The extent to which money is being expended in war plant work is indicated by the fact that in one large government plant in the eastern Massachusetts district an average of $100,000 a day is going into construction supplies and apparatus, and this average must be maintained for months to come in order to equip the installation in scheduled time. The electrical machinery and supply market is one of many drawn upon in cases like these to contribute its quota to the carrying on of the war. Collections are fairly good. The small contractor is working largely on a hand-to-mouth basis, and such remodeling and old house wiring as he secures is handicapped by the difficulty in securing wiring material for other than industrial or direct war applications. After more than a fortnight of idleness the striking employees of the General Electric Company's Lynn (Mass.) factories returned to their tasks on Aug. 2, upon the agreement of the War Labor Board to determine the issues in the case. Prices show little change this week.

FANS.—Stocks are being lowered rapidly by the hot weather demand, the jobbers in many cases having disposed of a large percentage of the equipment on hand. It would not be surprising if a real shortage developed during the next fortnight.

ELECTRIC ROAD TRUCKS.—Steady growth in purchases is reported, with very little blowing of trumpets. It is intimated in dealer circles that increased garaging facilties are under consideration for Boston, and that if these are put into effect, there will be a good deal of new business to handle. The demands of the war in grain shipment and the high cost of feed are favorable to a wider use of electric trucks.

LAMPS.—The supply of ordinary sizes is steadily increasing. Large quantities of lamps are moving into war service all the time, but manufacturing facilities are greatly expanded, and reserve stocks will be in excellent shape to meet the winter business, according to present indications. It is unnecessary for central stations and jobbers to attempt to carry large reserve stocks in this district in view of the effects of fuel saving activities upon the volume of lamps consumed.

STORAGE BATTERIES.—Trade is brisk, with deliveries somewhat better, probably owing to enlarged and improved manufacturing facilities. Good stocks of batteries for automobile use are now to be found in Boston. Prices hold firm.

CONDUIT.—Stocks are spotty and the supply of new pipe is limited mainly to war service orders and to delayed arrivals of orders placed months ago. "Priority" is the password for conduit shipments now. Even if certain sizes for stock become exhausted, little can be done about it at present. In more senses than one, the government is exercising an ironclad control of the supply.

APPLIANCES.—Sales are less active, partly because of the vacation season and also on account of the present conservative central-station policy regarding new business. Retail stocks are still in good shape, but the outlook is not attractive for any very extended commercial development at this time, with the exception of labor-saving devices.

TRANSFORMERS.—Deliveries are improving, two to five months being quoted against seven to twelve months in the early spring. Probably 90 per cent of the orders are for the government. Prices are steady.

GENERATORS.—Deliveries are still relatively poor, even on smaller sizes. Recent demands for water-wheel driven machines have pulled heavily upon the manufacturers. Large steam turbines are now to be obtained only through governmental sanction, and this of course limits the sale of big units to war service or allied work.

ATLANTA

Normal activities in the electrical field have gradually gravitated to government account without any material economic disturbance, as evidenced by the fact that a great volume of business is now being transacted, mostly for war essential requirements. The volume of sales in all lines is well sustained, and, while shipment of steel products has materially lengthened, delivery on other classes of goods has shown some improvement.

This section will be greatly helped by the organization of the War Industries Regional Committee, covering Georgia, North and South Carolina, and Florida, for the proper distribution of war orders.

The recent apportionment by the government of the labor quota for the various states will help this section, and, although the quota at this time is very small, compared with that of the larger industrial centers, it will be increased from time to time.

Manufacturers report an advance in prices on a number of articles, beginning Aug. 1, and at the same time all new orders after this date will be closely scrutinized to determine whether goods so ordered are to be used for essential industries. It is not expected that requirements of this nature will cause any material loss in orders.

The petition of the National Association of Railways and Utilities Commissioners to the President suggesting an organization of a federal commission for the purpose of co-operating with the various state commissions for the purpose of determining the necessary rate increases of utilities indicates brighter prospects for relief.

Government authorities are fully cognizant of the shortage of power and realize that a general increase in rates will permit some utilities to continue their contemplated water-power plants. While a few of the Southeastern water powers have secured some relief this week, in the form of a light rainfall, the drought is not broken, and the water-power companies of this section are about holding their own.

The Georgia Railway & Power Company has not cut off its primary customers, and it is hoped that this will not be necessary, as sufficient rain is expected daily, especially as the precipitation on this company's drainage area is 25 per cent off up to Aug. 1.

FANS.—There is practically no movement in this line, as the temperature recorded during the past two weeks is considerably below normal.

TRANSFORMERS.—The demand for distributing types remains comparatively active. Southeastern stocks on this type show signs of accumulating. The call for larger power type is spasmodic, requirements having fallen off owing to lack of power for new business, and hesitancy on the part of central stations to make extensions.

SEATTLE-PORTLAND

Well-sustained volume of sales marked the last week in July throughout the entire Northwest. If anything the volume was a little larger than the previous week. Increases prevail generally throughout trade. As usual, war industrial plants predominate in the buying, although commercial orders and central-station buying show a slight increase. Sales to the government show but little fluctuation. Last week the sales of power apparatus showed a slight increase. Jobbers in the Puget Sound district particularly report a good demand. Stocks are in fair condition. The conduit situation is unimproved and stocks are still hard to obtain while the demand is insistent. Shipments are cleaned out as fast as obtained. Everything is difficult to obtain. All of the larger equipment must come through government orders and it is believed that shortly everything will have to be obtained through the same channels. The government at present is commandeering some items from jobbers' stocks. Jobbers are trying to stock up for fall business on all lines of material and equipment in expectation of an increased shortage and increasing disordered freight conditions. The freight situation is even worse, if possible, with absolutely no prospect of improvement. Emergency Fleet Corporation awarded contracts for fourteen 8800-ton steel ships to the Ames Shipbuilding Company, Seattle. Contracts for all wooden ships that the Foundation Company can build at Portland, Tacoma and Victoria plants during the remainder of the year and probably all of next are assured by the French government. Labor shortage in every industrial line is growing worse and the recent announcement of the Emergency Fleet Corporation that only employees whose loss would retard ship production will be given deferred classification in the draft threatens further to aggravate conditions in the shipbuilding districts.

SMALL MOTORS.—During the past week sales to industrial plants increased. However, no large special orders have come through for the past month. Stocks are low.

DOMESTIC APPLIANCES.—Sales are very satisfactory, particularly with washing machines. Ranges are moving well although not above normal.

LAMPS.—The situation regarding large sizes shows no improvement. The demand for larger lamps is active. Smaller sizes are coming through promptly and demand gradually increasing due to residence construction.

SAN FRANCISCO

Business continues excellent, railroad deliveries are good and the only rift to be discerned is the coming shadow of government priority regulations on certain commodities, which will limit their sale to war work.

New government building reported includes additional barracks at Tucson, Ariz., and a new hospital and other service building for the Oakland shipyards. A new packing plant for Elmonte, Cal., is under way and the Union Oil Company is adding to its tank equipment at Oleum. The Newberry Electric Company has been awarded the contract for the electrical installation in the new factory of the American Can Company at Fruitvale, Oakland, one item of which covered the installation of sixty-six motors.

The United States Food Administration has recommended that a huge tract of nearly 20,000 acres of farm land of the Middle Sacramento Valley be irrigated from the Lake Almanor supply, to prevent the crops and orchards on that tract from dying.

STREET LIGHTING.—The municipalities at San Mateo, Oceanside, San Diego and Los Angeles have instigated plans for improved lighting of certain districts. On the other hand, all bids for Fresno's proposed electrolier system have been rejected, since the city trustees acknowledge the wisdom of the Federal Reserve Bank communication requesting that cities economize as far as possible.

WIRELESS.—The great cost wireless demand caused by the many important stations and the government radio schools, such as that at Goat Island, have made it necessary for the building of California factories for the local construction of wireless material. The federal plant at Palo Alto will be doubled immediately.

BATTERIES.—Dry batteries have advanced slightly to meet new freight-rate conditions, the advance being on the basis of $1, $1.70 and $2.80 per hundred respectively for the 6, 7 and 8-in. standard sizes. The demand is enormous, ordinary maintenance calls being enhanced by the increased number of vehicles and by auxiliary construction to supplant natural irrigation. Samson and Edison batteries have increased 10 to 15 per cent.

WASHING MACHINES.—The dealers conservatively estimate that their sales would be doubled providing Eastern factories could cope with the orders placed with them. Recent sharp advances in prices have become effective, so that in general the dolly wooden machines now call for $60 on the Pacific Coast, standard machines for small families $100 and machines for families of four or five people for $135, which are increases from 15 to 20 per cent.

VIBRATORS.—The enormously increased cost of production has caused an advance of from 5 to 10 per cent in the selling prices of cheaper vibrators. Sales are steady, also slackened somewhat from the demands of last spring. On the other hand the allied line of drink mixers is in high favor and local stock is in poor shape. The growing prevalence of dry laws and the increasing number of dry sections have caused the conversion of saloons.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B & S. Sise	List Per 1000 ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95 00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315 00

Twin-Conductor

No. 14 solid	104 00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575 00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	57.25

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	66.75

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	97.75

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	126.80

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20% to List
Coil to 1000 ft	5% to 15%

	No. 12 Solid
Less than coil	+20% to List
Coil to 1000 ft	5% to 15%

Twin-Conductor

	No. 14 Solid
Less than coil	$115 00 to $80 00
Coil to 1000 ft	5% to 75 00

	No. 12 Solid
Less than coil	+20% to + 5%
Coil to 1000 ft	5%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	12%
1/5 to std. pkg	20%
Std. pkg	44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to 12%
1/5 to std. pkg	List to 20%
Std. pkg	25% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28	.29

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 40	$0 40
12 to 50	35	35
50 to barrel	.319 to 322	.329 to .332
Barrel lots	.289 to 292	299 to .302

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5.00
⅜	250	7.50
½	100	10.00
¾	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$69.75
⅜-in. double strip	75.00	72.00
½-in. single strip	100.00	93.00
½-in. double strip	100.00	96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75 00 to $78 75	$63.75 to $71 25
⅜-in. double strip	78 75	71.25
½-in. single strip	100 00 to 105.00	75.00 to 95.00
½-in double strip	105 00	93.00 to 95 00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
3/16	$0.05½	1	$0 25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
3/16-in.—	$55.00	$24 45	$21.50
¼-in.—	60.00	27.00	23.50

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
3/16-in.—	$60.00	$30.00	$26.50
¼- in.—	$65.00	$32.50	$29.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	12%	14%
2500 to 5000 lb	15%	17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb	+5% to 1½%	+3% to 3½%
2500 to 5000 lb.	+2% to 4½%	List to 6½%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5.00
Discount	30%

CHICAGO

List price	$5.00 to $7.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp	100	$0.25
35-amp. to 60-amp	100	.35
65-amp. to 100-amp	50	.90
110-amp. to 200-amp	25	2.00
225-amp. to 400-amp	25	3.60
450-amp. to 600-amp	10	5.50
600-Volt		
3-amp. to 30-amp	100	$0.40
35-amp. to 60-amp	100	.60
65-amp. to 100-amp	50	1.50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5.50
450-amp. to 600-amp	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	50%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$5.00
1/5 to std. pkg	4.50

Standard packages, 500. List, each $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$7.00
1/5 to std. pkg	$5.15 to 5.75

Standard packages, 500. List, each, $0.07

LAMPS, MAZDA

105 *to* 125 *Volts*

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.30
60-watt—B	100	.35
100-watt—B	24	.70
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2 20
300-watt—C	24	3 25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30	24	.77
Round Bulbs, 4⅜-in., Frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$35.90
Coil to 1000 ft	26.95

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30 00 to $35 00
Coil to 1000 ft	25.00 to 26.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24.00

CHICAGO

Net per 100	$21.75 to $30.00

OUTLET BOXES

Nos.	List, Per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25%	20%
$10.00 to $50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$38 00
1/5 to std. pkg	19 00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$15.80 to $24.15
1/5 to std. pkg	14 80 to 21.00

Standard package, 2200. List per 1000, $20.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500 5½ N.C.	Std. Pkg. 4000 Solid Nail-it—N.C.
Less than 1/5 std. pkg	$20.00	$30 75
1/5 to std. pkg	15 60	24 00

CHICAGO

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.	Std. Pkg. 4000 Solid Nail-it—N.C.
Less than 1/5 std. pkg	$9 48 to $18 40	$30 75 to $36 80
1/5 to std. pkg.	$8.88 to $16.00	24 20 to 32 00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
¼-in. cap key and push sockets	500	$0.33
¼-in. cap keyless socket	500	.30
¼-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	8%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List to 10%
1/5 std. pkg	16⅔%

SWITCHES, KNIFE

250-*Volt, Front Connections, No Fuse*

High Grade:	
30-amp. S. P. S. T	$0.80
60-amp. S. P. S. T	1.20
100-amp. S. P. S. T	2.25
200-amp. S. P. S. T	3.48
300-amp. S. P. S. T	5.34
30-amp. D. P. S. T	1.20
60-amp. D. P. S. T	1.78
100-amp. D. P. S. T	3.38
200-amp. D. P. S. T	5.20
300-amp. D. P. S. T	8.00
30-amp. 3 P. S. T	1.80
60-amp. 3 P. S. T	2.68
100 amp. 3 P. S. T	5.08
200-amp. 3 P. S. T	7.80
300-amp. 3 P. S. T	12.00
Low Grade:	
30-amp. S. P. S. T	0.42
60-amp. S. P. S. T	.74
100-amp. S. P. S. T	1.50
200-amp. S. P. S. T	2.70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T	1.22
100-amp. D. P. S. T	2.50
200-amp. D. P. S. T	4.50
30-amp. 3 P. S. T	1.02
60-amp. 3 P. S. T	1.84
100-amp. 3 P. S. T	3.76
200-amp. 3 P. S. T	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+5%
$10 to $25 list	11%
$25 to $50 list	14%
	Low Grade
Less than $10 list	5%
$10 to $25 list	16%
$15 to $50 list	24%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+15% to +5%
$10 to $25 list	+10% to 11%
$25 to $50 list	+14% to 14%
	Low Grade
Less than $10 list	+5% to 5%
$10 to $25 list	8% to 16%
$25 to $50 list	16% tn 24%

SWITCHES, SNAP AND FLUSH

5-*Amp. and* 10-*Amp.,* 125-*Volt Snap Switches*

	Std. Pkg.	List
5-amp. single pole	250	$0.28
5-amp. single-pole, ind	250	.32
10-amp. single-pole	100	.48
10-amp. single pole, ind	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P	100	.66

10-*Amp.,* 250-*Volt Push-Button Switches*

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+ 10%
1/5 to std. pkg	8%
Std. pkg	25%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List to 16⅔%
Std. pkg	25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	40%	30%
$2.00 to $10.00 list	50%	40%
$10.00 to $50.00 list	60%	52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25% to 40%	15% to 30%
$2.00 to $10.00 list	25% to 50%	15% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6 00
Discount	30%

CHICAGO

List price	$5.50 to $6 50
Discount	25% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$ 434
No. 18, full spools	.384

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.65 to $0.69
No. 18, full spools	.55 to .575

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$20.00	$15.00	$11.25
12	27 10	23.20	17.05
10	37.80	32.40	23.75
8	53.35	45.70	33.35
6	84.40	72.35	53.05

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$19 00–$21.00	$14.00–$16.00	$12.50–$13 25
12	27.53– 28.70	25.86– 28.70	24 50– 32 02
10	33.02– 40.10	30.48– 40.10	27.44– 34 23
8	46.09– 56 50	42.54– 48 23	38.99– 41.34
6	61.30– 91.18	61.76– 77.84	52.18– 66 72

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 *to* 3 *Inc.*

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$38 40
25 to 50 lb	36 40
50 to 100 lb	32 40

CHICAGO

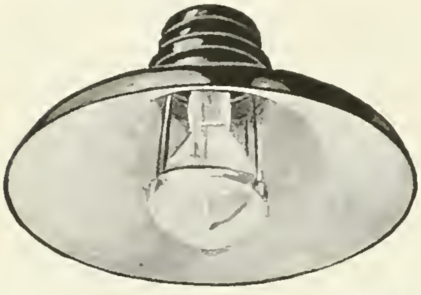
	Per 100 Lb. Net
Less than 25 lb	$37.00 to $39 72
25 to 50 lb	36.00 to 38 72
50 to 100 lb	35.00 to 37.72

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Lamp Shield for Eliminating Glare

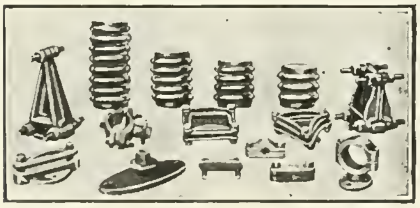
In order to soften the glare from a reflector unit in using gas-filled lamps of high intrinsic brilliancy, the Benjamin Electric Manufacturing Company, 128 South Sangamon Street, Chicago, is manufacturing a device shown in the accompanying illustration which consists of a glass or metal bowl inserted under the lamp. This device may be adapted to reflectors of any shape and is very easily removed for cleaning.



GLASS BOWL BENEATH LAMP FOR SEMI-INDIRECT DISTRIBUTION

Interchangeable Insulating Supports

To meet the needs of central stations and industrial companies erecting busbar and control apparatus under diverse voltage conditions, the Electrical Engineers' Equipment Company, 710 West Madison Street, Chicago, has designed a line of post-insulating supports with interchangeable parts. The porcelain unit consists of a corrugated post made by the wet process. Each porcelain unit is guaranteed to stand a side thrust of 900 lb. (408 kg.) and a tensile pull of 1800 lb. (816 kg.) The number of corrugations depends on the working voltage for which the post is intended, different styles being provided for 3500 volts, 7500 volts, 15,000 volts and 25,000 volts respectively.



STANDARDIZATION LIMITS USE OF SPARE PARTS

Into the end of each of these posts metal thimbles are cemented. To the thimbles the various bus holding and mounting fittings are attached, thus forming the complete support. The fact that any fitting may be attached to any post gives great flexibility. A further feature is that all supports are adjustable in both horizontal and vertical planes. The clamp for supporting vertical bars is also provided with adjustment which permits it to accommodate a vertical bus of any thickness from 0.25 in. to 2.25 in. (0.63 cm. to 5.72 cm.)

Motor-Operated Surfacing Machine

The Cavicchi Polishing Machine Company of Quincy, Mass., has developed two sizes of one-man motor-operated surfacing machines for tile, marble, granolitic and composition floors. A finish flush with the side walls is obtainable by means of a wheel composed of concentric sections operating independently of each other. Irregular surfaces can be made uniform and smooth. The machine is actuated by a General Electric 2-hp. motor, the speed of which is controlled by the switch and rheostat on the handle of the machine.

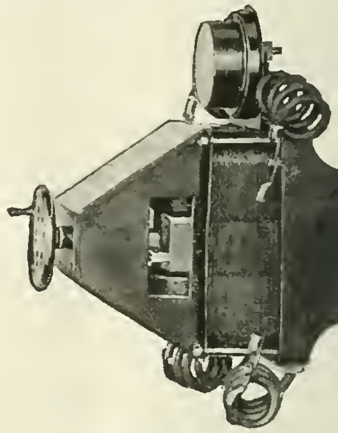
SUITABLE FOR FLOOR MAINTENANCE OF BUILDINGS

Compensator for Motion-Picture Projection

To give the close regulation of current essential for tungsten motion-picture projection lamps, the General Electric Company, Schenectady, N. Y., has developed a "compensarc," the type I, form B, shown herewith.

Protection against over-current and regulation to within 0.1 amp. is obtained, according to makers. The device operates on the reactance principle and is furnished for standard voltages and frequencies in ratings of 20 amp. and 30 amp., corresponding to the "mazda" lamps now on the market for this purpose.

The "compensarc" may be installed within convenient reach of the operator, who can watch the ammeter and control the current by the hand wheel shown in the illustration. It is made of a two coil auto-transformer stacked with standard transformer punchings within a rawhide housing, the complete wiring of which forms the line side with the lamp terminals tapped across one coil. The coils are stacked so that room is left between them for an iron leakage plug in each side of the magnetic circuit. Turning a hand wheel on the shaft of the iron plug moves it in and out between the two coils giving a very close adjustment for the lamp. Maximum reactance is obtained when the plug is completely in place. The only noise is a slight humming when the plugs are being withdrawn and this ceases when they come to rest.



REACTANCE-TYPE REGULATOR FOR TUNGSTEN LAMPS

Alternating-Current Magnetic Switches

For many special motor or electric control applications the Allen-Bradley Company, 495 Clinton Street, Milwaukee, Wis., has developed its type KB magnetic switches. The magnetic frames of these switches are made up of laminations of thin electrical steel, and the rest of the switches are made up of punched steel and copper parts, wherever possible, to secure the greatest electrical and mechanical properties with the least weight in order to make the switches quick-acting.

To overcome the low humming sound characteristic of alternating-current apparatus, which is sometimes an objection when it is installed in churches or theaters, these switches can be furnished so that they are held in the running position mechanically. The operating coil on the noiseless switches closes the switch and latches it in and opens its circuit. Then to open the switch a smaller coil is energized which trips the latch. With this arrangement the coils are not connected to the line except during the very short time consumed in opening or closing, so that the noise is entirely eliminated.

Flexible Steel-Armored Conductors

For interior wiring of light and power the Sprague Electric Works of the General Electric Company, New York, have developed an improvement on their single-flexible cable. The armor of this cable, instead of being formed of double strips of steel, is made with a single strip of galvanized steel interlocked and gasketed, the whole armor complying with the new code standard. It is light in weight and very flexible. At present this flexible cable, known as type S.S., is manufactured only in No. 14 B. & S. gage wire. Later it is expected that three-wire and other sizes will be supplied.

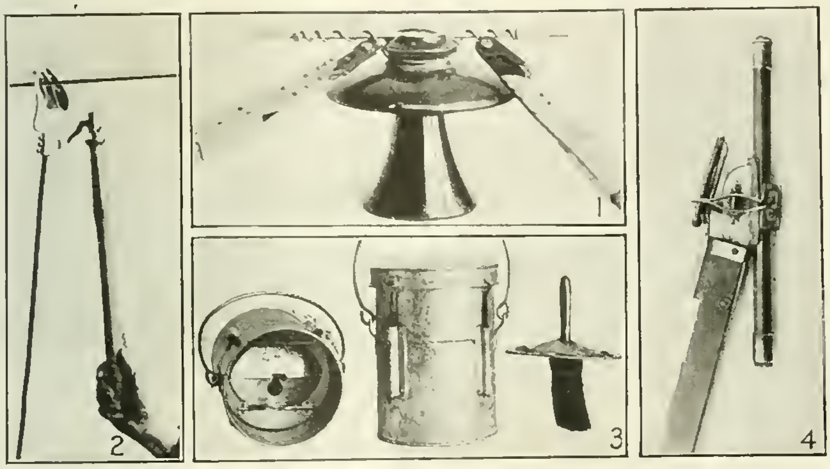
Easily Reparable Inter-Office Telephone

All of the internal parts except the magneto and the batteries of the "Victory" telephone are mounted on the swinging door. This door may be easily removed from the cabinet by pulling the hinge pins which are provided with extensions for use as handles. This method of arranging the interior parts was developed to facilitate repairs. Other features of the instrument, which is suitable for private industrial or central-station telephone systems, are that it has a single bell with double clapper and that has a writing slate above the mouthpiece on a level with the user's eyes. It was designed by J. Skinderviken and is manufactured by the Skinderviken Telephone Equipment Company, 2136 North Clark Street, Chicago.

Convenient High-Tension Line Tools

Some very practical devices for use in high-tension line work are made by the Bush Electric Tool & Manufacturing Works, Redlands, Cal. Fig. 1 shows how a defective insulator may be removed from circuit without interrupting the service. Two "hot-wire cutters" are shown in the process of cutting the tie wire to free the line conductor while the old insulator is taken out and replaced. The handles are impregnated to permit working on live conductors subjected to pressures up to 30,000 volts without additional insulating means.

For "shorting" or grounding lines to protect workmen against accidental closing of the circuit during repair the grounding clamp shown in Fig. 2 is useful. The wooden handles make the clamp safe and convenient to use.



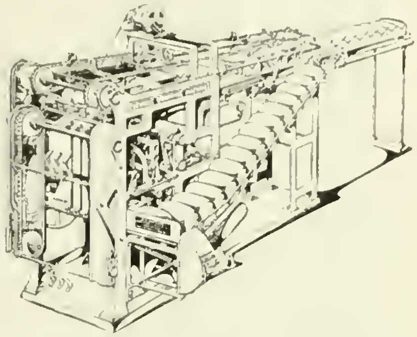
FIGS. 1 TO 4—HIGH-TENSION LINE TOOLS AND ECONOMICAL BUCKET

In Fig. 4 is shown a "fuse grabber" in employment to remove a fuse from a live circuit. The jaws are faced with rubber for gripping the fuse. It is said that the device may be readily and safely slipped over the fuse, automatically tightening its grip. It may be used for removing glass as well as fiber fuses.

A considerable saving in paint may be effected by the use of the special bucket shown in Fig. 3, according to the makers. The cover is made air-tight, thus keeping the paint and brush in good condition. About a third of the way down the bucket is shown a special brush-holding and wiping plate. When the brush is pulled through the rectangular opening in this plate the surplus paint drips back into the can instead of over the sides. It is pointed out that workmen will accomplish more and do better work with this paint bucket because the brushes will be in good condition. The bucket may be filled with water and used also to keep idle brushes away from the evaporating influence of the outer air.

Sanitary Bread-Wrapping Machine

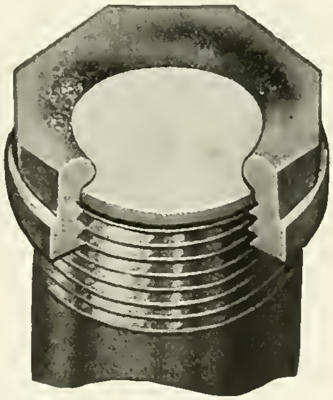
Bread wrapping has become a regular part of bread production as a result of public demands that it be delivered to the customer clean, sanitary and unhandled. Obviously, wrapping must be done by machinery to insure these results and to perform the operation at lowest possible cost. As a result of this requirement the National Wrapping Paper Company of Nashua, N. H., has developed a motor-operated wrapping and sealing machine, under the "Sevigne" patents. This machine performs the entire operation of receiving the loaves from the ovens and delivering them ready to hand to the customer. Power for the entire operation is furnished by a fractional-horsepower motor made by the General Electric Company for the prevailing supply circuit.



BREAD IS UNTOUCHED BY BAKERY HANDS

Conduit Seal

Barnes & Irving, Inc., Syracuse, N. Y., are distributing a simple conduit seal that is used for closing the ends of exposed conduit at distributing boards or outlets. It is claimed that this seal makes an air-proof, waterproof and dirt-proof covering and that it is especially desirable when used with conduit being laid in reinforced-concrete buildings because it eliminates concrete plugged pipes. This seal consists merely of a circular disk of cardboard, paraffine waxed and made in the various sizes for conduit.



INEXPENSIVE METHOD OF SEALING CONDUIT

Trade Notes

GOVERNMENT CONTRACTS—The following purchases have been made from and contracts have been awarded to the following firms: *Ordnance Department*—Wagner Electric Company, motors and transformers. *General Engineer Depot*—National Carbon Company, dry cells; National Electrical Supply Company, exhaust fans; General Electric Company, rheostats. *Navy Department*—Westinghouse Electric & Manufacturing Company, motors.

WIRE AND CABLE FOR AUSTRALIA.—An indication of the extent to which English manufacturers are taking steps to foster and protect after-the-war overseas trade in electrical goods is the recent decision of the Department of Trade and Customs of Australia to regard the use of the letters "C.M.A." on the labels attached to imported wires and cables as an indication that the manufacturers of the goods are associated with the British Cable Makers' Association and that the goods have been manufactured in accordance with the specifications of the association. The Department has also decided that statements such as the following, "Guaranteed equal in all respects to 'C.M.A.' product of similar grade," may be used on wires and cables manufactured by non-members of the British Cable Makers' Association, provided that the goods are thereby correctly described. It is interesting to note that prior to the war between 6 and 7 per cent of the exports of American insulated wire and cable went to Australia. The figures for the four years ended June 30, 1917, are as follows: 1914, $121,181; 1915, $64,304; 1916, $66,360, and 1917, $72,860. In the meantime the total exports of this line rose from $1,992,304 to $7,192,204. The increased demand, however, came largely from Europe and South America and it must be remembered represented a price that had more than doubled.

ELECTRIC MOTORS FOR SPAIN.—A report in a London paper states that "Spain is endeavoring to be independent of German electrical motor appliances by establishing an Institute of Electrical Industries at Barcelona with a department specially equipped for research work in this direction."

APPLICATIONS FOR LICENSE TO EXPORT.—The War Trade Board advises that all applications for license to export must be filed on the application form X, dated April, 1918. Later editions of this form will be supplied as they are printed. Previous editions are hereby discontinued. On and after Aug. 10, 1918, the War Trade Board, Washington, D. C., and branch offices, will accept for consideration only those applications which are filed in accordance with this notice. To secure forms, exporters should apply to the nearest office of the War Trade Board.

FARM-LIGHTING PLANTS AT NORTHWEST FAIR. — Manufacturers of farm-lighting plants are to be well represented at the Northwest Interstate Fair, Sept. 2 to 7, according to the applications for space that have reached the Spokane office. Compared to three or four entries in former years, seven firms will have space near the automobile entrance this year, as follows: Domestic Engineering Company, Fairbanks-Morse & Company, Nixon-Kimmel Company, Western Electric Company, Washington Electrical Supply Company, Lally Electro-Lighting Corporation and Warner Lamp Company. All the concerns will demonstrate their systems and equipment on the grounds.

TRADE COMMISSION STOPS MORE PRICE MAINTENANCE.—After a full hearing the Federal Trade Commission has ordered the Cudahy Packing Company of Chicago to discontinue as being unfair its practice of compelling dealers to maintain its fixed resale price in the sale of "old Dutch cleanser," one of its products. The corporation, in a formal order by the commission, was prohibited from making agreements with dealers for the maintenance of the price and from discriminating in price or refusing to sell to dealers who resell at any price they choose. The case is important as it is typical of a class of cases before the commission where the manufacturer requires the maintenance of resale prices by the jobber but not by the retailer. It is provided that the company is not prohibited from issuing price lists, or from printing prices in its advertising or upon containers and cases containing its product.

THE WAR TRADE BOARD, Washington, D. C., has issued a revised trading with the enemy list in supplement No. 6. It contains additions, removals and connections from March 15 to June 28. The board has also announced, under date of July 20, regulations governing the exportation of postage, revenue and other stamps of similar character, either canceled or uncanceled. They amplify the order announced on May 14.

JOHN P. TOPPING has just rounded out his twentieth anniversary of service with the Bryant Electric Company of Bridgeport, Conn., and he is one of the pioneer Western representatives of the Eastern manufacturers. He was recently appointed assistant Western manager of the Bryant Company with headquarters at 323 West Jackson Boulevard, Chicago, Ill., Mr. Topping was born on Feb. 1, 1875, in Alton, Ill., and was first engaged in the wholesale hardware and iron business. In 1891 he went to Chicago, and prior to and during the World's Fair was employed by the Ansonia Electric Company. He next became engaged in the contracting business, and was employed in the construction department of the Northwestern Electric Light & Power Company of Chicago, until 1898 at which time he entered the service of the Bryant Electric Company. Since that time he has been continuously in the employ of the company.

THE UNIVERSAL MOTOR CIMPANY of Oshkosh, Wis., which was organized and began manufacturing in 1914, has since then increased the output of its product to such an extent that, judging from present indications, the sales this year will not fall far below $1,000,000. The accompanying picture shows a portion of the factory with a number of the employees assembled outside.

UNIVERSAL MOTOR COMPANY.

LABOR SUPPLY.—Distinctly favorable results from the war-time employment of women in the metal trades are shown in a report just completed by the National Industrial Conference Board. The report summarizes information obtained from 131 establishments employing 335,015 men and 49,823 women, and treats of the comparative wages and output of men and women, the hours of work, and numerous other matters of general interest and of practical value to employers contemplating the introduction of female labor. The investigation showed that no extensive substitution of women workers for men has as yet taken place in these trades. In ninety-five establishments only 10,657 women were employed on work formerly performed exclusively by men. In the main, the work of women has been confined to the lighter process in which rapidity and dexterity are more important than technical skill acquired by long training. The report emphasizes that work of a "repetitive" character is exceptionally well adapted to the utilization of female labor. Comparing the output of men and women, the report shows that in sixty-four establishments of the ninety-seven furnishing specific information on this point and where men and women were employed on the same processes, the output of women was equal to and frequently greater than that of men. In only fifteen establishments was the output of women less than that of men on all operations on which both were employed. In the remaining eighteen their productions, although less in some operations, equaled or exceeded that of men in others.

THE PYROLECTRIC INSTRUMENT COMPANY, 148 East State Street, Trenton, N. J., manufacturer of special type of electric furnaces, pyrometers, and other electric precision instruments, has removed its works to larger quarters at 636 East State Street, to provide for increased capacity and facilities.

C. H. PICNIC—The eleventh annual picnic of the employees of the Cutler-Hammer Manufacturing Company was held at Waukesha Beach, Pewaukee Lake, Wis., on July 27. The main office and works were closed for the day. A program of athletic events was provided for boys and girls of all ages. The prizes consisted of thrift stamps in various amounts.

EMPLOYMENT OF DISABLED SOLDIERS.—The Novelty Incandescent Lamp Company, Emporium, Pa., has been engaged recently in the distribution of Red Cross circulars encouraging the employment of disabled soldiers in industrial work. The company has not itself employed disabled soldiers as yet, because it has lost few employees—most of its employees being girls. In this connection the company states: "However, without doubt we would arrange to do at least as much in this line as any other concern, and it might be that the lamp-manufacturing industry would prove a mighty attractive opportunity for the boys meeting with misfortune."

TURBINE WORKMEN INDORSE SHIPBUILDING PROGRAM. — The Delaval Steam Turbine Company of Trenton, N. J., recently forwarded to Charles M. Schwab, Director-General of the Emergency Fleet Corporation, the following testimonial from its workmen, 492 in number: "We, members of the force of the Delaval Steam Turbine Company of Trenton, N. J., hereby express to Messrs. Hurley, Schwab and Piez and to the members of the Shipping Board, Emergency Fleet Corporation and their assistants our appreciation of their energetic and courageous work in the building of ships, and we assure them of our readiness to back them up and to help them in every way we can in their program to build the ships our country needs." To this spontaneous and patriotic pledge, Mr. Schwab made a suitable reply, stating that "Just such united action and willingness to put everything else aside for the good of the common cause is going to help us carry 'over the top' the greatest construction program ever known."

MORE LEAD FOR STORAGE BATTERIES IN ENGLAND.—The Electric Vehicle Committee of the British Electrical and Allied Manufacturers' Association, acting in conjunction with the storage battery makers' section, having represented to the controller of the priority department of the Ministry of Munitions the desirability of increasing the amount of new lead allowed to be used in the repair and maintenance of batteries under the special battery permit issued to storage battery manufacturers, where batteries for electric vehicles are concerned, the controller has now consented to an addition to Clause 15 of the special battery permit held by members of the section, to come after the words "Not exceeding 100 lb.," the words, "Or in the case of electric storage batteries used as the motive power for propelling electric vehicles, 300 lb. and provided always, etc." This addition has been designed to enable manufacturers of storage batteries for use on electric vehicles to repair and maintain same without the necessity of individual application for permits being made to the priority department.

THE MINISTER OF MUNITIONS of Great Britain has issued an order amending the glass control (consolidated) order of 1917, according to the London "Electrical Review." It has been found necessary to extend the provisions relating to electric lamp glass contained in the order to vitrite and other glass used or intended for use in electric lamp caps for insulating purposes which were by that order expressly excepted from the operation of such provisions. It is now ordered that as from May 7 the order shall read and take effect as if in clause 8 the words "and the expresion 'electric lamp glass' shall include all lass used or intended for use in the manuacture of electric lamps, not excepting itrite or other glass used or intended for se in electric lamp caps for insulating puroses, but shall not include glass shades nd similar accessories," were substituted or the words "and the expression 'electric lamp glass' shall include all glass used r intended for use in the manufacture of lectric lamps, except glass used or inended for use in lamp caps for insulating urposes, but shall not include glass shades nd similar accessories."

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY of Chicago, manuacturer of staples and specialties, has renoved its executive offices to 806 Washington Boulevard.

THE STANDARD UNDERGROUND CABLE COMPANY, Pittsburgh, Pa., states hat the item in these columns in the July 27 issue saying that the company had completed arrangements for the erection of a new plant at Fords, N. J., was incorrect. The company has not yet, the letter states, even started arrangements for the erection of a plant.

THE ELECTRIC SUPPLY & EQUIPMENT COMPANY, of Hartford, Conn., with a branch in Scranton, Pa., on July 19 bought a building to accommodate its business in Albany, N. Y., for $50,000. The company had for two years maintained an office only in Albany. A new building is planned to take the place of the one purchased, and later a large warehouse will be erected.

STERRETT & FLEMING, INC., of Washington, D. C., succeed Sterrett & Fleming, distributors of the Diamond Grid batteries for the District of Columbia, Maryland and Virginia. John A. Sterrett and Robert F. Fleming, composing the former partnership, retain their interests in the new company.

THE DAVIS SEWING COMPANY of Dayton, Ohio, has announced to the trade a new unit-type motor-driven sewing machine.

THE HART MANUFACTURING COMPANY of Hartford, Conn., manufacturer of the "Diamond H" switches and appliances, on July 15 appointed the W. A. McCombs Company, Union Arcade Building, Pittsburgh, Pa., its representative and distributer for Ohio, Pennsylvania east to Harrisburg, West Virginia and Kentucky.

THE NEW ENGLAND ELECTRIC LAMP COMPANY, INC., of Danvers, Mass., has begun the manufacture of renewed nitrogen lamps. The company was recently incorporated under the State law and is officered as follows: President, Oscar Bodwell; treasurer, W. A. Webb; secretary G. F. Cochran.

THE WESTERN ELECTRIC COMPANY has established a new branch house at Syracuse, N. Y., with H. C. Goldrick as manager. F. X. Baldwin, formerly in the distributing department of the New York City branch, to which a large territory in the East is tributary, is on the sales force at Syracuse.

THE BURKE ELECTRIC COMPANY of Erie, Pa., announces C. D. Miller as manager of its Buffalo (N. Y.) branch sales office at 509 Morgan Building, Pearl and Niagara Streets.

LYMAN G. MORGAN, formerly connected with the sales force of the National X-ray Reflector Company at Milwaukee, Wis., has resigned to go with the Western Electric Company in its Seattle office.

THOMAS N. MEHAN, who was formerly a salesman for the Electric Appliance Company of Chicago in the Central States, has joined the sales force of the Utilities Indemnity Exchange, Railway Exchange Building, St. Louis.

J. M. WEIMER, who has been sales engineer for the National X-Ray Reflector Company in its Chicago office, has been appointed representative for that company in its Wisconsin and northern Michigan territories. Mr. Weimer is planning to make his headquarters at Milwaukee.

THE WESTERN ELECTRIC COMPANY will increase its Hawthorne (Ill.) factory by the addition of four factory and warehouse buildings, five and six stories high, on a piece of ground measuring 675 ft. by 211 ft. The buildings, on which work is to be commenced immediately, will cost in the neighborhood of $1,000,000. The The company completed a seven-hundred-thousand-dollar plant extension in July, 1917, which, together with the four buildings just mentioned, will give it a total of seventy-three buildings of the most modern type.

THE SOTHMAN CORPORATION of New York City, engineers, with offices at 5 Beekman Street, have opened a branch at Pittsburgh, Pa.

THE FLASHLIGHT BATTERY COMPANY of New York City has filed schedules in bankruptcy, with liabilities of $46,823 and assets of $30,586, consisting of stock and machinery, $46,00; patents' copyright, etc., $10,000; accounts due, $6050, and unliquidated claims, $9936. Among the largest creditors are: A. W. Rosen & Co., $6625; Peerless Light Company, $6520; Stackpole Carbon Company, $2933.

HARRY ROTHSTEIN, purchasing agent and general manager of the electrical supply department of the Eclipse Light Company left on July 29 for Paris Island, S. C., to become a member of the Marine Corps. Miss F. Levy will succeed Mr. Rothstein during his absence.

R. H. CORSON, representative of the National Carbon Company of San Francisco, will establish offices at 314 Empire State Building, Spokane, which will become the distributing center for the Inland Empire, Northern Idaho & Western Montana.

E. B. LATHAM & COMPANY, New York City, manufacturers of electrical supplies, have filed notice of an increase in their capital from $100,000 to $200,000, to provide for business extensions.

THE AMERICAN GENERAL ELECTRIC EDISON Corporation of China, Schenectady, N. Y., has filed notice of an increase in its capital from $500,000 to $1,000,000, to provide for business extension.

F. A. MANSFIELD, formerly connected with the sales department of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., has resigned to take the position of Pittsburgh district sales manager of the Mechanical Appliance Company at Milwaukee, Wis. This company manufactures a complete line of alternating-current and direct-current motors, small generators, motor-generator sets and inverted rotaries.

L. D. CALHOUN has been appointed as assistant sales manager of the Square D Company, manufacturer of electrical safety switches at Detroit, Mich. Mr. Calhoun has been advertising manager of the company for the past year, and in addition to his new duties will continue to handle the company's advertising etc.

THE EDISON STORAGE BATTERY SUPPLY COMPANY of New Orleans, has moved from 201 Baronne Street to larger and more commodious quarters in the Maison Blanche Building, room 911. This move is indicative of the increasing demand for Edison storage batteries throughout the South. D. B. Mugan is district sales manager.

THE "IRON TRADE REVIEW" of Cleveland, Ohio, has published in pamphlet form a "Complete List of Base Prices, Differentials and Extras on Iron, Steel and Non-Ferrous Products," which have been fixed under Government supervision. It is claimed that this is the only up-to-date price manual on iron and steel, as the minimum changes during the past six months have rendered practically obsolete those previously issued

THE ORENSTEIN-ARTHUR KOPPEL COMPANY of Koppel, Pa., an enemy-owned property, will be disposed of at public sale at Koppel, on Aug. 15, at 3 p. m., by A. Mitchell Palmer, alien property custodian. The company, among its other activities, manufactures electric industrial trucks.

THE MASSILLON ENGINEERING & ELECTRIC COMPANY, 416 West Main Street, Massillon, Ohio, has been recently organized and chartered and has taken over the J. C. Lewis Electric Company of that city. Mr. Lewis will be connected with the new firm as president and general manager, while the inside business management will be under Roy M. Bayless, secretary and treasurer of the company and recently superintendent of the Reliance Manufacturing Company. The present directors are Floyd C. Snyder, of the Reynolds Machine Company, Edison W. Hart of the Reliance Manufacturing Co., C. C. Miller, Joseph C. Lewis and Roy M. Bayless. While the Lewis Electric Company has enjoyed a steady growth, the new organization will provide adequately for this growing concern, which has been somewhat handicapped for lack of working capital, while the excellent directorship assures the new company's successful development. In addition to general contracting and repair work, the company will have a completely equipped storage-battery plant and magneto and ignition testing equipment and will operate a wholesale, as well as a retail department. It will also act as jobber for manufacturers' lines.

Trade Publications

ELECTRICAL CONNECTORS. — "Safest Solderless Electrical Connectors" is the title of a circular that is being distributed by the Cruban Machine & Steel Corporation, 2 Rector Street, New York. This circular describes and illustrates the several kinds of connectors that are manufactured by this company.

ELECTRICAL APPLIANCES.—The Hotpoint Division of the Edison Electric Appliance Company, Inc. of Ontario, Cal., is distributing a one-page leaflet, describing and illustrating the Hotpoint Electrical Appliances.

BALL BEARINGS.—Carwen ball bearing are described in a circular that is being distributed by the Carlston-Wenstrom Company, Richmond Street and Erie Avenue, Philadelphia, Pa. The specifications and list price of these ball-bearings for the 200 series is given.

SIGNAL SYSTEMS.—To illustrate the use of its signal system in hospitals the Holtzer-Cabot Electric Company, 125 Amory Street, Boston, Mass., has issued a card which visualizes the operation when a patient presses the signal push button.

LIGHTING UNITS.—The Beardslee Chandelier Manufacturing Company, 216 South Jefferson Street, Chicago, Ill., has issued a circular entitled "Better Lighting for Better Results" that describes the Denzar lighting unit for lighting factories, stores, shops, halls, hotel lobbies, hospitals, churches, public buildings, office buildings, apartment houses and schools.

LIGHTING FIXTURES.—The Peerless Light Company, 483 Broadway, New York, is sending out Bulletins 578 and 583. The former describes a desk or table unit called "U-ti-lite" and the latter a pull-switch chandelier.

New Incorporations

THE CARVER & NATE COMPANY of New York, N. Y., has been incorporated by F. H. Carver, C. D. Landry and E. F. Whittier, 533 Macon Street, Brooklyn, N. Y. The company is capitalized at $10,000 and proposes to manufacture hydraulic equipment.

THE ELECTRIC PRODUCTS CORPORATION of Richmond, Va., has been chartered with a capital stock of $150,000 to manufacture electrical equipment. The incorporators are O. S. Lindeman and Harold S. Blomberg.

THE H. W. EVANS COMPANY, of New York, N. Y., has been chartered with a capital stock of $20,000 by L. S. Muller, K. R. Miner and H. W. Evans, 88 Park Place, New York City.

THE ROCHESTER HOME ELECTRIC COMPANY of Rochester, N. Y., has been incorporated with a capital stock of $25,000 by P. E. Illman, J. M. Illman of Rochester, and H. Adsit Bulk of Buffalo, N. Y. The company proposes to deal in electric lighting and power plants and accessories.

THE ELECTRIC PROCESS COMPANY of Wilmington, Del., has been incorporated by M. L. Rogers, L. A. Irwin and W. G. Singer of Wilmington, Del. The company proposes to deal in steel, iron, etc.

THE DOMESTIC ENGINEERING & SPECIALTY COMPANY of Montreal, Que., Can., has been incorporated by Louis A. David, Louis P. Crepeau, S. H. R. Bush and others. The company is capitalized at $20,000 and proposes to construct, design and operate electric plants, water plants, etc., and to manufacture machinery and tools.

THE VIKING CORPORATION OF CANADA of Toronto, Ont., Can., has been incorporated with a capital stock of $50,000 to manufacture electrical appliances, automobile accessories, machinery, tools, etc. The incorporators are Thomas H. Wilson, 506 Temple Building; Jacob B. Broudy, William R. Bird and others.

THE OLDSMAR (FLA.) ELECTRIC & ICE COMPANY has been incorporated with a capital stock of $10,000 to generate and distribute electricity and also to manufacture and sell ice, etc. The officers are: Jacob Berstein, president and treasurer; Herman Bornstein, vice president, and A. Bornstein, secretary.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

STRATTON, ME.—The Stratton Light Company has petitioned the Public Utilities Commission for permission to issue $10,000 in capital stock, the proceeds to be used to purchase the property of the Stratton Electric Light Company and to erect an electric transmission line from Eustis to Stratton and to purchase a generator and other equipment necessary for the power plant.

FAIRHAVEN, VT.—The Hinchey Slate Company of Fairhaven has submitted a proposition to Captain Carroll H. Shaw of Washington, D. C., and Arthur H. Fast, government attorney, appointed to act for the United States in the power situation for New England, whereby the entire output of the water power from Lake Bomoseen will be given to the Western Light & Power Company a subsidiary of the Rutland Railway, Light & Power Company, dur- the period of the war. The power will be utilized to operate munition plants in the Connecticut Valley and in Massachusetts.

MONTPELIER, VT.—Preliminary papers, it is reported, have been signed by which the United States government is to take over the water-power privileges and rights of the Central Power Company on the Middlebury River at East Middlebury. The company owns 70 acres of land on the river with a head of 508 ft. It is estimated that 1400 hp. the year round can be developed. Charles H. Thompson of Montpelier is interested in the company.

BOSTON, MASS.—Contract has been awarded by the United States government to Edwin C. Lewis Inc., for the entire electrical installation at the Boston Quartermaster's Terminal at South Boston. The contract amounts to between $1,000,000 and $1,500,000.

FALL RIVER, MASS.—The Fall River Electric Light Company is now engaged in the work for the 16-mile extension of electric lighting facilities toward Providence, the extremity being at the boundary line between East Providence and Seekonk. R. F. Whitney, general manager of the company, has general supervision over the work. The cost of this line will be about $300,000 and its capacity will be 40,000 hp.

HOUSATONIC, MASS.—The new power plant of the Monument Mills at Housatonic is now in operation. The building is 221 ft. long by 96 ft. wide.

BRIDGEPORT, CONN.—The city is having plans prepared for the construction of a new pumping station to be located on Bostwick Avenue. It is planned to use the structure in connection with the proposed new sewerage treatment plant to cost $300,000. Contract for the structure has been awarded to the Eastern Engineering & Construction Company, Derby.

NORWICH, CONN.—The motive power of the plant of the Norwich Compressed Air Power Company is being changed to electricity.

NORWICH, CONN.—The Eastern Connecticut Power Company has purchased Kitemaug from William B. Walker, president of the American Thermos Bottle Company. The property consists of 75 acres and will be used in connection with the company's service line from the power plant in Montville.

WATERBURY, CONN.—Bids, it is reported, will soon be asked by the American Brass Company, Grand and Meadow Streets, for the erection of a two-story building, 90 ft. by 150 ft., and addition to power plant at Benedict and Buraw Street, to cost about $90,000.

Middle Atlantic States

BUFFALO, N. Y.—Plans have been prepared by the American Purchase Sales Corporation, 528 Ellicott Square, for the construction of a new boiler house and pumping plant, about 20 ft. by 30 ft. and 25 ft. by 25 ft., respectively. The structures will be one story. Martin C. Miller, Mutual Life Building, is architect.

ELMIRA, N. Y.—Plans have been filed by the Willys-Morrow Company for the construction of a new 1-story addition to its power plant, about 25 ft. by 110 ft. Contract for the structure, which is estimated to cost about $30,000, has been awarded to the Lowman Construction Company, Elmira.

NEWARK, N. Y.—In connection with the proposed alterations and improvements to be made in the heating plant at the State Custodial Asylum, the Board of Managers has awarded a contract to W. F. Devendorf & Company, 470 Court Street, Rochester. The work is estimated to cost $31,000.

NEW YORK, N. Y.—Plans have been prepared by the New York Mutual Gas Light Company, 142 East Fifteenth Street, for improvements and alterations in the purifier works on Avenue D, between Twelfth and Thirteenth Streets, to cost about $20,000.

OSSINING, N. Y.—Bids will be received by the Commission on New Prisons, Room 618, Hall of Records, New York City, until Aug. 29 for electrical work, including underground electric conduit and feeder system and pump house, for Detention Building No. 5 and Clinic Building No. 8, at Sing Sing Prison, Ossining. Drawings and specifications may be consulted at the above office, at the office of the warden of Sing Sing Prison, Ossining, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher, Albany, is state architect.

SCHENECTADY, N. Y.—Ground has been broken by the Mohawk Gas Company, 511 State Street, South, for the erection of a new one story addition, about 35 ft. by 65 ft., to its works on Villa Road. The structure is estimated to cost $10,000. W. F. Devendorf & Company, 470 Court Street, Rochester, are the contractors.

SOLVAY, N. Y.—Plans are under consideration by Pass & Seymour, manufacturer of electrical specialties, for the construction of a new addition to their local plant. The structure will be three stories, about 20 ft. by 30 ft. Russell & King, Snow Building, Syracuse, are the architects.

SYRACUSE, N. Y.—The Soment-Solvay Company of Syracuse is receiving bids for construction of one-story and two-story 40 ft. by 80 ft., and 60 ft. by 120 ft. T. N. T. plants at Split Rock. H. H. Cole, is engineer.

TAYLOR, N. Y.—The mill and water rights owned by George M. Law have been purchased by R. L. Brown. Improvements will be made by the new owner, including the installation of additional electric equipment. The plant will supply electricity in Taylor and Cincinnatus.

TOTTENVILLE, S. I., N. Y.—The Public Service Commission has granted approval to the application of the New York & Richmond Gas Company for permission to issue bonds totaling $2,000,000, the proceeds to be used, in part, for improvements and extensions in its plant and system.

WESTFIELD, N. Y.—The Borough Council is planning to commence work at an early date on the erection of a new brick and concrete pumping station, to cost about $35,000. Plans for the structure have been prepared.

BOONTON, N. J.—Fire completely destroyed the boiler plant and a portion of the works of the Montville Finishing Company. The total loss is estimated at about $70,000.

CALDWELL, N. J.—Rapid progress is being made on the construction of a new telephone line from Caldwell to the Big Piece Meadows government rifle range site. About 100 new poles will be installed and the necessary lines erected.

KEARNY, N. J.—The Federal Shipbuilding Company will utilize the property recently acquired on the Hackensack River, near its present works, for the construction of a new dry dock, erection of buildings and auxiliary works. The cost of the proposed extension is estimated at more than $8,000,000.

PATERSON, N. J.—Notice has been filed by the Samuel Smith & Son Company, 150 Railroad Avenue, of an increase in its capital from $100,000 to $200,000, to provide for business extensions. The company manufactures boilers and kindred products.

ROCKAWAY, N. J.—The Empire Steel & Iron Company is contemplating improvements to its power plant to provide for continuous service. Owing to a breakdown the electric turbine has been out of commission.

VENTNOR, N. J.—The City Council has appropriated $10,000 for lighting purposes during the coming year.

HAZLEWOOD, PA.—Plans have been filed by the Jones & Laughlin Steel Company of Pittsburgh for additions to its plant at Hazlewood, to cost about $389,000. The buildings will include a machine shop, to cost $29,999; a boiler plant, $163,000; benzol works, $42,000; pump and still building, $20,000; laboratory, $13,000; naphthaline works and other buildings.

HOLLIDAYBURG, PA.—The McLanahan-Stone Machine Company is contemplating the erection of a machine shop, 40 ft. by 100 ft., with 20 ft. leanto to cost about $20,000. The center span will be equipped with an electric traveling crane.

PHILADELPHIA, PA.—Contract has been awarded by the Bellevue Worsted Mills, Wister Street, to H. E. Baton, 1813 Sansom Street, for the construction of a new power plant, 30 ft. by 90 ft., at Sixteenth and Hunting Park Avenue, to cost about $18,000.

UPPER DARBY, PA.—The Philadelphia & Western Railway Company expects to place contracts in the near future for the construction of two substations and will purchase seven 750-kw. rotaries complete.

BALTIMORE, MD.—Plans are being prepared by the Armour Packing Company, 304 South Eutaw Street, for the erection of a packing plant on Pratt and Eutaw Streets, to cost about $250,000. C. A. Stoutenberg, care of Armour & Company, 120 Broadway, New York, N. Y., is engineer.

CHARLESTON, W. VA.—Work has begun on excavation for the foundation of a new power house for the Charleston-Dunbar Traction Company, to replace the one destroyed by fire last December.

WHEELING, W. VA.—The Wheeling Traction Company will soon ask for bids for the construction of a new carhouse at Wheeling island, to replace the one destroyed by fire last February. Bids will also be asked at the same time for the construction of a 1-story shop, about 125 ft. square, to be erected at the Wheeling Island station.

BRISTOL, VA.—The installation of a new electric power plant, mining machinery and equipment, to cost more than $100,000, is under consideration by the Floyd Elkhorn Consolidated Collieries of Bristol, recently organized to take over and operate the Floyd-Elkhorn Coal Corporation and other companies.

North Central States

GRAND RAPIDS, MICH.—The Semet-Solvay Company, Milton Avenue, is contemplating the construction of a picric acid plant, to cost about $2,000,000. Bids, it is understood will soon be asked for the work. H. N. Cole is owner and engineer.

ARCANUM, OHIO.—Improvements are contemplated to the municipal electric lighting system, to cost about $3,000.

OXFORD, OHIO.—Sealed proposals will be received by the board of trustees of Miami University, Oxford, Ohio, until 12 o'clock, Aug. 22, for the furnishing and delivering f.o.b. Oxford, Ohio, of an engine and generator for the central heating and lighting plant of Miami University, Oxford, Ohio, according to the plans, descriptions, bills and estimates and specifications prepared by Walter G. Franz, consulting engineer, Cincinnati, and which are on file at his office and at the office of the president of Miami University. Proposals are to be addressed to Dr. R. M. Hughes, president of Miami University, Oxford, Ohio.

LOUISA, KY.—The Louisa, Fort Gay & Torchlight Coal & Development Company, recently incorporated with a capital stock of $1,000,000, is planning to develop coal mines opening ten collieries and building a central power plant at the mouth of Lick Creek, and constructing 10 miles of railway. C. E. Stafford is president.

GARY, IND.—Twenty-four mills will be added to the local plant of the American Tinplate Company, at a cost of approximately $10,000,000.

LOGANSPORT, IND.—Plans are being prepared by the Pennsylvania Railroad Company for extensions to its local works, to cost about $150,000, which will include addition to power plant, remodeling engine house, etc.

MONTEREY, IND.—The Monterey Electric Light & Power Company is contemplating the construction of a new power plant, 50 ft. by 125 ft., 1-story, to cost about $25,000.

CHICAGO, ILL.—Permits have been issued to the United States government for the erection of buildings to be occupied by the Symington-Chicago Corporation, 122 South Michigan Avenue. The total cost of the proposed plant is estimated at about $5,000,000, and it will be located on a tract between Ashland, Robey, Seventy-fourth and Seventy-fifth Streets. The Thompson-Starrett Company, 49 Wall Street, New York, N. Y., has been awarded general contract. The L. K. Comstock Company, 30 North Michigan Avenue, and the Freeman Sweet Company, 608 Dearborn Street, Chicago, have been awarded contracts for electric wiring. The contract for heating was awarded to Mehring & Hauson Company, 118 North Franklin Street. The plant will be devoted to the manufacture of shells.

CHICAGO, ILL.—Bids will be received by the Board of Local Improvements, Chicago, Ill., until Aug. 6 for electric-lighting equipment for upper and lower levels of North Michigan Avenue, from Randolph Street to Chicago Avenue, a distance of about 1 mile, except lower deck of proposed bridge. The cost is estimated at about $70,000. C. D. Hill is city engineer. may be seen at the office of J. E. Stanton, Associated Forum Building, Sacramento.

OTTAWA, ILL.—The Illinois Coöperative Packing Company is planning to build a power plant in connection with its new packing works, now under construction. The cost of the entire works is estimated at about $125,000.

MILWAUKEE, WIS.—The Board of Supervisors is considering the proposal of lighting the Grand Avenue viaduct and the Blue Mound Road to the county infirmary by special lines built from the electric plant of the county at the almshouse.

MILWAUKEE, WIS.—The City Illumination Bureau has started work on the installation of 1000 lamp posts, to form part of the municipal street-lighting distribution system. The posts are to be erected in sections where the present lighting service is inadequate or considered too expensive. The cost of the work is estimated at about $90,000.

MILWAUKEE, WIS.—Swift & Company of Chicago, Ill., are planning to build an addition to the power plant, 35 ft. by 70 ft., of the Plankinton Packing Company, Muskego Avenue and Canal Street, Milwaukee (leased by the company). The proposed improvements include a 100-ft. stack. Machinery for the plant, including boilers, automatic stokers, etc., it is understood, has been purchased. Harry S. Culver is general manager.

MILWAUKEE, WIS.—The Universal Machinery Company, 754 Thirtieth Street, is reported to be asking for bids through Siebert & Gray, architects, 86 Michigan Street, for the construction and equipment of a power plant, 60 ft. by 75 ft., to furnish power for its new foundry and machine shop, now in course of construction at Sixty-fourth and Pullen Avenues. The equipment will include generators, transformers, switchboards, etc. E. C. Devlin is president.

VIRGINIA, MINN.—Bonds have been authorized for improvements to the municipal electric light plant and water-works system.

EARLY, IOWA.—The local electric light plant was recently damaged by fire.

LE MARS, IOWA.—Plans are under consideration by local business men to secure better electrical service and lower rates. It is proposed to erect an electric transmission line to connect with the power plant of the Iowa Light, Heat & Power Company, just outside of the city limits. Electricity is now supplied by the Le Mars Water & Electric Light Company, which has a franchise which will not expire for several years.

HARRISONVILLE, MO.—The Board of Aldermen is considering calling an election to submit the proposal to sell or lease the municipal electric light plant to L. K. Green & Sons of Pleasant Hill.

KANSAS CITY, MO.—Bids will be received by J. Ray Samuels, purchasing agent, Kansas City, until Aug. 21 for furnishing and erecting a steam turbine reduction gear, centrifugal pumping unit having a capacity to pump continuously 20,000,000, U. S. gal. of water per 24 hours against a total combined head of 370 ft. with steam pressure of 165 pounds per square inch at throttle; together with all machinery, tools, etc. W. G. Goodwin is chief engineer and superintendent.

RICH HILL, MO.—The contract for new machinery for the municipal electric light plant has been awarded to the Merkle Machinery Company, Interstate Building, Kansas City, at $11,600.

SAVANNAH, MO.—The Savannah Light & Milling Company is planning to equip a new plant and will require new machinery, costing about $3,500.

MADISON, S. D—The power plant at Madison was completely destroyed by fire on July 27. The power plant housed all the machinery used for the electric lighting, power and water pumps.

NORFOLK, NEB.—Alex Beck, Keeline Building, Omaha, has been awarded general contract for the construction of power house, to cost about $40,000, and ward building, to cost $70,000, at the State Insane Asylum, Norfolk. W. W. Berger of Whiting, Iowa, was awarded contract for electric wiring of both buildings.

PALMER, NEB.—Plans are being prepared by the Henningson Engineering Company, Twelfth and Farnam Streets, Omaha, for construction of electric light plant and water-works system, for which $40,000 in bonds have recently been voted. Bids, for the work, it is understood, will soon be asked for.

Southern States

WILMINGTON, N. C.—The Tidewater Power Company, it is reported, has made financial arrangements for the construction of an extension to the new shipbuilding plant.

JACKSONVILLE, FLA.—The Jacksonville Traction Company is contemplating an extension into the heart of Camp Joseph E. Johnston.

MIAMI, FLA.—Bonds to the amount of $30,000 have been voted for the purpose of building sidings on the municipal railway connecting with the Florida East Coast Railway. C. Murray is city engineer.

MOBILE, ALA.—The Mobile Shipbuilding Company contemplates the construction of a new shipyard for the construction of steel ships for which cranes and machinery will be required. The New York office of the company is at 30 Church Street.

GULFPORT, MISS.—Contract has been awarded to the Cooper & Greer Company, Gulfport, by the United States government, Navy Department, for the installation of a new fire protection system at the local station.

MERIDIAN, MISS.—The City Council is considering calling an election to submit to the voters the proposal to issue from $100,000 to $150,000 in bonds to establish an ice plant.

ASHDOWN, ARK.—The Commonwealth Public Service Company is contemplating the installation of an engine and generator in the electric light plant.

MARIANNA, ARK.—The City Council has instructed the light committee to obtain prices on boilers and other equipment necessary for a power plant to operate the city water pumping station. The service is now furnished by the Arkansas Light & Power Company.

LAKE CHARLES, LA.—The Louisiana Western Railroad Company is planning to construct a roundhouse and terminal facilities in Lake Charles, to cost about $132,000.

DUNCAN, OKLA.—An election will soon be held to submit to the voters the proposal to issue bonds for extensions to waterworks, addition to power plant and sewage disposal plant. The Benham Engineering Company, 1300 Colcord Building, Oklahoma City, is engineer.

PONCA CITY, OKLA.—At an election held recently the proposal to issue $40,000 in bonds for improvements to electric lighting system and $35,000 for extension to water-works was carried.

POTEAU, OKLA.—At an election held recently the citizens voted to grant the Citizens' Consolidated Power & Electric Company a franchise to supply electricity in Poteau for a period of 21 years.

JUAREZ, TEX.—According to a statement made by Mayor F. D. Gonzales of Juarez, tentative plans are being made by business men of that city for an electric light plant in Juarez. According to the plans it will be theintention to erect a large power plant and bring machinery from an abandoned plant near Parral.

MILES, TEX.—Plans are being considered by W. D. Allen to construct a dam across to Concho River and also a large pumping plant. The proposed dam will store water for irrigation purposes.

ORANGE, TEX.—Plans are under consideration by the Chamber of Commerce for extensions to the lighting system.

RANGER, TEX.—The Chamber of Commerce is promoting the organization of a local company to construct an electric light and power plant.

SOMERVILLE, TEX.—A new power house will be erected by the Gulf, Colorado & Santa Fe Railway Company at its local works. Plans for the structure have been prepared.

Pacific and Mountain States

SEATTLE, WASH.—The Capital Issues Committee has under consideration the application of the city of Seattle to sell $5,500,000 in bonds for the construction of hydroelectric plants on the Skagit River. The municipality is seeking to sell $1,500,000 in bonds this calendar year and $1,000,000 every six months thereafter until the entire amount is floated.

CASTELLA, CAL.—The California-Oregon Power Company of San Francisco has started work on the erection of a high-tension transmission line from Castella to Kennett, where connection will be made with the transmission system of the Northern California Power Company. The proposed line will be 35 miles long and will furnish electricity to the Mammoth mine and smelter at Kennett, relieving the Northern California Power Company of its load so that it can deliver more power at Chico and Hamilton City to the Pacific Gas & Electric Company. This line will interlock the three power systems.

REDLANDS, CAL.—The Coachella Valley Ice & Electric Company, Redlands, Cal., has been purchased by the Southern Sierras Power Company, Denver, Col. Through this purchase the Southern Sierras Power Company becomes the owner of the entire electric system of the Coachella company in Riverside and Imperial counties.

SAN DIEGO, CAL.—Plans are being considered by the San Diego Consolidated Gas & Electric Company for enlarging its plant and extensions to its power system. The company was recently given authority to issue $1,100,000 in bonds.

SAN DIEGO, CAL.—Contract has been awarded by the United States government to Lange & Bergstrom, Sharon Building, San Francisco, for the construction of new aircraft works on North Island, San Diego, to cost about $400,000. The proposed plant will consist of a machine shop, carpenter shop and other buildings.

SAN FRANCISCO, CAL.—The Northern California Power Company has begun work on a high-voltage transmission line from Hamilton City to Colton.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company, it is reported, will erect a substation at Knights Landing, Yolo County, to connect up a transmission line at Colusa, at which point connection will be made with the Northern California Power Company as part of the power-pooling plan. The plant will cost about $250,000 and will have a capacity of about 8000 kw.

OGDEN, UTAH.—The Globe Grain & Milling Company, Santa Fé Avenue, Los Angeles, Cal., is contemplating the construction of a mill and warehouse in Ogden, to cost about $500,000.

PUEBLO, COL.—Two new alfalfa mills are being erected in the Arkansas Valley district, between Ordway and Crowley. Both mills will be equipped for electrical operation. Electricity will be furnished by the Arkansas Valley Railway, Light & Power Company. The transmission line to serve these mills will also supply energy to several ranches on the line.

SANTA FE, N. M.—The Santa Fé Water & Light Company is contemplating extensions to its water-works system, to cost about $200,000.

Canada

VANCOUVER, B. C.—The Dominion Canners, Ltd., is contemplating the construction of a new boiler house at Vancouver, to cost about $60,000. A. E. Henderson is architect.

NEWCASTLE, N. B.—The Light and Water Commission is considering extensions and improvements to the municipal electric-light plant, to cost about $125,000. J. E. T. London is city clerk.

FORT WILLIAM, ONT.—The Department of Finance has been granted permission to issue $225,000 to be used for street-railway purposes.

BAGOTVILLE, QUE.—Preparations are being made by the Ponliot Company for the construction of a sawmill and rossing plant, to cost about $30,000. The company is in the market for equipment, including steam engine, boilers, etc.

COATICOOK, QUE.—The Council is considering extensions to the municipal electric-light plant, to cost about $7,500.

MONTREAL, QUE.—The construction of a power house, to cost about $10,000, is under consideration by Lamontagne, Ltd., 338 Notre Dame Street West.

MEOTA, SASK.—The installation of a municipal electric-light plant, to cost about $40,000, is under consideration by the town of Meota. A. E. Thompson is secretary and treasurer.

Record of Electrical Patents

Notes on United States Patents

1,271,246. Sterilizing Liquid; Max von Recklinghausen, André Helbronner and Victor Henri, Paris, France. App. filed Dec. 21, 1912. Relates to vapor-electric apparatus which is adapted for the production of ultra-violet rays for the sterilization of liquids.

1,271,255. Electromagnetic Circuit Controller; Alfred A. Zeigler, Boston Mass. App. filed May 26, 1916. Automatic operation by an electromagnet.

1,271,263. Electromagnet; Charles F. Baldwin, Montclair, N. J. App. filed Sept. 3, 1915. To provide an inexpensive and efficient slow-acting electromagnet.

1,271,267. Electrothermic Extraction of Zinc; Edward S. Berglund, Trollhättan, Sweden. App. filed July 25, 1917. Consists in conducting zinc-containing vapors simultaneously from two or more smelting furnaces to a common condenser.

1,271,316. Electric Switch; Charles H. Hill, Schenectady, N. Y. App. filed May 23, 1914. For use upon theatrical or other switchboards of similar character.

1,271,320. Electric Conductor; William G. Houskeeper, Philadelphia, Pa. App. filed Sept. 11, 1916. Relates to the formation of seals between the walls of vitreous vessels and to conductors efficacious in making such seals.

1,271,322. Telephone-Exchange System; Charles W. Keckler, Newark, N. J. App. filed April 24, 1917. A link circuit for automatically connecting an operator's telephone set upon connection of the link circuit with a calling line.

1,271,335. Telephone-Exchange System; Alben E. Lundell, New York, N. Y. App. filed Jan. 11, 1916. "Busy" indication will be effective only with the receiver of an operator's telephone set.

1,271,336. Telephone-Exchange System; Alben E. Lundell, New York, N. Y. App. filed Nov. 14, 1916. For the purpose of visually indicating the number of a telephone line to an operator.

1,271,337. Telephone System; Alben E. Lundell, New York, N. Y. App. filed Dec. 30, 1916. For preventing the connection of a line-finding switch with two lines simultaneously.

1,271,374. Electrodynamic Machinery; Amato N. Sammarone, Akron, Ohio. App. filed Jan. 25, 1916. Generators or motors constructed largely of rolled or die-pressed sheet metal.

1,271,378. Non-Interfering Key; Charles H. Smith, Chicago, Ill. App. filed June 19, 1913. Providing automatic means to prevent more than one switch-actuating member being effectively actuated at one time.

1,271,390. Buttonhole Electric Light; Edwin F. Thomas, Meriden, Conn. App. filed July 31, 1917. Quickly fastened to the garment so that the light rays radiating therefrom may penetrate in the pathway.

1,271,401. Magnetic Clutch; Jarl M. Weydell, Indianapolis, Ind. App. filed Feb. 15, 1917. For connecting two moving parts without any sliding contacts.

1,271,407. Protective Device; George Wolff, near Berlin, Germany. App. filed Jan. 11, 1915. Device is inclosed in tank to simplify and cheapen the application.

1,271,409. Coil-Retaining Device; Francis E. Wynne, Wilkinsburg, Pa. App. filed July 3, 1916. Applied to the magnetizable core member of a dynamo-electric machine to retain the coils securely in the slots of such member.

1,271,428. Process of Electrical Welding and Apparatus Used in Connection Therewith; John Burns, Kenosha, Wis. App. filed Oct. 30, 1916. Adapted to electrically welding the seam of a tube.

1,271,438. Dynamo-Electric Machine: Charles S. Cook, Pittsburgh, Pa. App. filed Nov. 25, 1914. Relates to ventilating structures for railway motors.

1,271,441. Magneto; William W. Dean, Stamford, Conn. App. filed Aug. 22, 1916. The rotor is in the form of a permanent magnet having a plurality of poles.

1,271,469. Fire-Alarm Box; Szczepan Horst and Waclaw Horst, Buffalo, N. Y. App. filed May 28, 1917. The person sending in the alarm is retained with his arm in the box until the proper officer reaches the box.

1,271,475. Regulator for Motor Arc Lamp; Johann Kiefer, Charlottenburg, Germany. App. filed July 20, 1915. A direct-current motor is geared to the electrodes whereby the latter are actuated to recede from or approach each other.

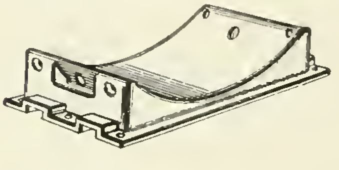
1,271,478. Floor Box; Hubert F. Krantz, Brooklyn, N. Y. App. filed Dec. 18, 1912. To provide against short-circuiting by water or any other foreign element.

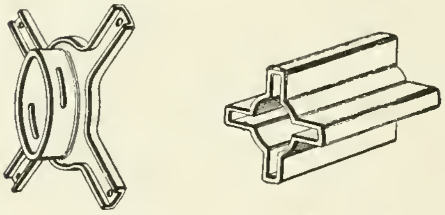
1,271,483. Incandescent Lamp; Irving Langmuir, Schnectady, N. Y., App. filed Sept. 4, 1913. The helical winding of the filament is interrupted at certain points to leave portions of the filament substantially uncoiled.

1,271,514. Sounder; Thomas J. Murphy, Rochester, N. Y. App. filed Oct. 2, 1916. May be telegraphically operated by an alternating current.

1,271,520. Quick-Break Switch; Alexander K. Sutherland, New Britain, Conn. App. filed Nov. 5, 1917. Can be easily assembled and will be quick and positive in its action.

1,271,524. Selective Motor; James Burke, Erie, Pa. App. filed June 28, 1911. The starting and operating of motors are selective as regards the frequency of the single-phase supply.





1,271,374—Electrodynamic Machinery

1,271,535. Electric Circuit Changing Apparatus; Joseph Bijur, New York, N. Y. App. filed Aug. 26, 1911. To provide a practical and reliable device for intermittently interrupting an electric curcuit.

1,271,555. Switch Mechanism; Elie F. G. H. Faure, Erie, Pa. App. filed March 17, 1914. Has reference to means for causing a reciprocatory bar to move quickly in one or both directions.

1,271,577. Electric Clothes Presser; Joseph Jeannetaud, Dubuque, Iowa. App. filed Aug. 6, 1915. For use by tailors and those engaged in repairing clothes.

1,271,592. Railway Signaling; Ronald A. McCann, New Brunswick, N. J.; App. filed Aug. 19, 1914. Applies to signaling for stretches of single track between passing sidings.

1,271,593. Railway Signaling; Ronald A. McCann, Swissvale, Pa. App. filed Aug. 19, 1914. Signaling for single track over which traffic moves in both directions.

1,271,596. Insulator Support; Walter S. Mayer, Philadelphia, Pa. App. filed April 21, 1917. Characterized by method for clamping it firmly to carrying means.

1,271,600. Electric Sign; Albert C. Meyer, San Diego, Cal. App. filed May 3, 1917. To facilitate the making of a large number of changes in the sign with comparatively small flashing apparatus.

1,271,624. Automobile Thief Alarm; Joseph I. Silbar, St. Paul, Minn. App. filed Apr. 7, 1917. Will automatically ring a bell when a thief attempts to start or even to enter an automobile.

1,271,633. Method of Electrolytic Production of Perchloric Acid; Edward C. Walker, Brookline, Mass. App. filed April 23, 1917. Produced with economy consistent with commercial requirements.

1,271,682. Electric Locomotive; George M. Eaton, Pittsburgh, Pa. App. filed Jan. 4, 1916. Trucks are disposed relative to one another to insure good tracking and running qualities in the locomotive.

1,271,690. Secondary or Storage Battery; Bruce Ford, Philadelphia, Pa. App. filed Jan. 29, 1915. Especially adapted for use on board boats or ships.

1,271,691. Secondary or Storage Battery; Bruce Ford, Philadelphia, Pa. App. filed Dec. 3, 1917. To provide means accessible from the outside of the cover for fastening a filling and ventilating standpipe to the cover.

1,271,692. Electric Storage Battery; Bruce Ford, Philadelphia, Pa. App. filed March 29, 1918. To provide for safely hoisting complete or assembled cells.

1,271,696. Automobile Signal; Manlous Garl, Akron, Ohio. App. filed March 27, 1917. Chauffeur gives a signal at the time he is about to turn or stop the automobile.

1,271,713. Method for the Production of Silicon Tetrachloride; Otis Hutchins, Niagara Falls, N. Y. App. filed Oct. 30, 1917. By passing dry chlorine over silicon carbide heated to a temperature of 1000 deg. C.

1,271,732. Current Modifier; Oscar M. Leich, Genoa, Ill. App. filed March 24, 1915. Application in connection with vibrators used for signaling purposes in telephone exchanges.

1,271,733. Current Modifier; Oscar M. Leich, Genoa, Ill. App. filed March 24, 1915. Can be operated directly from an alternating-current circuit and provide intermittent or pulsatory current of a frequency other than that of the source.

1,271,735. Illuminated Watch Holder; Benjamin F. Lockwood, Oakland, Cal. App. filed Sept. 5, 1916. To produce a simple and effective holder for the watch or other timepiece to be carried in the glove.

1,271,760. Electric Furnace; Carl A. Pfanstiehl, Highland Park, Ill. App. filed Oct. 30, 1916. Useful for the reduction of tungsten trioxide WO_3 to metallic tungsten powder.

1,271,788. Variable Power Regulation; John A. Snee, Jr., West Elizabeth, Pa. App. filed Feb. 16, 1915. Automatic regulation of prime movers in such manner as to maintain the wheel under the most efficient load.

1,271,793. Brush Holder; Robert W. Stanley, Cleveland, Ohio. App. filed Dec. 11, 1916. The equalization of the pressure exerted by the two brushes of a pair.

1,271,794. Protective Device; George H. Stevenson, Mount Vernon, N. Y. App. filed Nov. 20, 1916. Relates to devices for protecting electric circuits from lightning and more particularly to protective devices of the vacuum type.

1,271,806. Fire Alarm; Edith L. Tibbs, Greenville, S. C. App. filed June 12, 1916. Heat from fire will be a prime factor in closing an electrical circuit.

1,271,815. Heat Regulator; Everett H. White, St. Paul, Minn. App. filed Jan. 10, 1916. Employs an expansible chamber filled with ether gas as the thermostatic element.

1,271,822. Gas Range Lighting Appliance; Nicholas Zam, Cleveland, Ohio. App. filed July 31, 1917. An electrical system adapted to deliver a spark in ignitable proximity to a fuel burner.

1,271,824. Telephone and Telegraph Cable; Gustavus A. Anderegg and Wilbur E. Mougey, Oak Park, Ill. App. filed June 30, 1916. The production of duplex cable highly efficient in the transmission of electrical impulses over the conductors therein.

1,271,831. Railway Safety Signal; Wilhelm Swoboda, Alton, and Boleslaw Swoboda, East St. Louis, Ill. App. filed July 7, 1916. If switch ahead of train is in unsafe position, engineer on locomotive is given signal to prevent accident.

1,271,835. Lamp Socket; Reuben B. Benjamin, Chicago, Ill. App. filed July 8, 1915. Construction which is particularly advantageous in pull switch sockets.

1,271,842. Cable Splice; Newton K. Bowman, Canton, Ohio. App. filed Oct. 4, 1915. To prevent interference of the splice with the smooth and ready winding of the cable upon the spool.

1,271,855. Trunking System; Henry P. Clausen, Mount Vernon, N. Y. App. filed March 6, 1915. Particularly adapted to automatic telephone exchange.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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Congress Alone Needs Enlightenment

THINKING men have always recognized the necessity for the development of the water-power resources of the country for economic reasons. Nor is a proper understanding of the matter lacking in high places. The President and members of his Cabinet have openly espoused the cause and urged remedial legislation to make water-power development possible and practicable. The latest Cabinet convert is Secretary McAdoo, who looks to water power to relieve the country from the thraldom of coal and to furnish electricity for the operation of the railroads. But it is not the administrative branch of the government that needs conviction, it is the legislative branch that is still groping in outer darkness; and while it is very gratifying to have so influential a citizen as Secretary McAdoo express himself forcibly and convincingly on the necessity for hydroelectric development, it would be more so if certain senators and representatives became just as enthusiastic on the subject. The obstructionists are not in the vicinity of the White House; their abode is on Capitol Hill.

The Two Types of Research

RESEARCH is commonly understood to be the extending of the bounds of knowledge. All deliberate research bears a resemblance to the exploration and occupation of a new country. First the pioneer or explorer penetrates the wilderness and blazes a pathway; then his comrades follow and survey the land, make maps and decide what portions to select for their farms and their towns.

Likewise, in the domain of the mysteries of nature there is a necessity for the two types of men to occupy the field. First must usually come the pioneer, who, with a vision to see what is hidden from the most of us, discovers new laws and fundamental relationships of nature; then come the comparatively greater number of men who work in endowed laboratories of universities or national bureaus of standards, to amass a fund of detailed information, establish constants, melting points, etc. Both of the above are pure research and are not ordinarily the function of the commercial laboratory.

Primarily, industrial research has for its object the production of something for human need, comfort or pleasure that is better or cheaper than what was before available. Faraday was an exponent of pure research; Edison is an industrial researcher in the fullest sense.

When we consider the types of minds engaged in the scientific end of our industrial growth, we find the same division of the men into two classes—pioneers or inventtors, who reach out for the unknown or new paths, and routine research men, who map out the field disclosed and determine what are the limits of operative success and point out possible improvements. It is this latter function that really occupies a large part of the time and effort of industrial research organizations. It is there that research and engineering merge.

Resisting the Heat Wave

TO US the most striking fact about the unparalleled heat of last week was not the temperature records but the small casualty lists. Had such a hot wave struck the country twenty years ago, the list of prostrations and deaths would have been very great. In past years much lower temperatures have been known to swamp the hospitals with cases of heat prostration. No doubt a large part of the credit for the gradually lessening fatalities due to heat is rightly attributable to the work of health departments and to a better understanding of the laws of hygiene by the general public. However, we are vain enough to believe that a considerable part of the credit is due to the wider use and application of electricity. Certainly, with the denser populations now prevailing in the great cities and with the temperatures recorded in those cities, the use of electricity for the operation of fans, illumination, transportation and other purposes deserves greater recognition than is ordinarily accorded to it by an unthinking public, in making the heat bearable.

Efficient Distribution of Electricity

VERY few electrical distribution systems, big or little, are actually used at anything like maximum economy. The chief reason for this condition is that in the growth the load distribution, originally well designed, falls into a state where improvement is sadly needed. Extensions are required to meet the demands of new customers or even to supply new districts. The distribution of the load, in part or in whole, is continually shifting, and the more prosperous and active the company the greater this shifting is likely to be. The time comes therefore when the sum of the changes is sufficient quite to offset the initial good design, but by changes on the whole so gradual that they are not fully realized. When this time comes rearrangements are in order, and they may frequently be made, without prohibitive expense, to yield greatly improved economic results. W. B. Stelzner's discussion of this subject is a well-marshaled account of the exigencies of the situation commonly met and of remedies which can be applied.

The first matter for consideration, although not generally the most important, is the loss in the primary circuits, including lines and transformers. This is quite analogous to the feeder losses in a low-tension system of distribution. In the first place, the high-tension lines often cause a loss so considerable as to lower the economy of the primary distribution somewhat seriously as well as to impair its regulation. The remedy here is essentially that of readjusting the feeding system, bearing in mind that transformer losses at light load must not be forgotten, and that trouble may come not only from actual increase of kilowatts delivered but from lowered voltage and impaired power factor. In these days the latter is by no means unimportant, underloaded motors, sometimes of intrinsically bad power factor, being far from uncommon. In general the changes desirable in the primary system are rearrangement of the feeding points to provide a uniform distribution of load, corresponding changes in the size of transformers, and reinforcement of the primary lines.

The figures given by Mr. Stelzner, being based on pre-war prices, are now subject to some modification, and the balance of costs must be figured on things as they are. As the prices of the generating costs, however, have risen like those of construction, so these also must be taken into account. At the present time so much is available in the way of automatic switching apparatus that it is easily possible, if a plant is afflicted with considerable periods of light load, to cut out a portion of the transformers, leaving the remainder to feed the secondary network. Right here it should be remarked that the ordinary alternating-current station has a somewhat undeveloped secondary network, and engineers would often do well to consider this matter, bearing in mind the earlier practice of direct-current plants.

The losses in the secondary distribution are usually considerably greater than those in the primary, and they are not only the most important factor in economy but also in the equally important matter of regulation. Reinforcement of the copper frequently becomes necessary, although a great deal can be done by the addition of high-tension feeders and consequent redistribution of the secondary load. The characteristics of the secondary distribution require more careful attention than is commonly given them, especially in the numerous cases where long extensions have to be made. Particularly is this true in its effect on the energy sold. Poor regulation and low voltage mean not only increase in the general losses but decrease in the proportion of the load actually paid for, and it is no uncommon thing to find a shocking discrepancy between the load generated and that metered. Good regulators skillfully applied are well-paying investments, both in improved service rendered and in cash.

Finally, there is a good deal to be said for the four-wire, three-phase distribution, with its great capabilities for reducing losses. For some reason or other it has not been a system commonly applied, although it has been uniformly successful wherever employed, and, as recorded from time to time in our columns, the change has already been made by various plants. For a given investment in construction it probably yields more relief than any device yet tried. The long and short of the matter is that the facility of distribution with alternating currents has worked to its disadvantage. In the old low-tension direct-current days the details of the load had to be studied, for there was no convenient avenue of escape from present difficulties.

There is really no good reason why a modern alternating-current system, with its enormous flexibility, cannot be brought to the same degree of finish in the design and operation of the distributing system considered as a whole. It is not unlikely that the present high costs of labor, material and fuel may prove a blessing in disguise by forcing closer attention to details.

Electric Power on the Farm

IT WAS forty years ago last May that the electric motor found its first practical industrial occupation, and this was in the service of agriculture. The particular task accomplished was plowing, the plow being dragged back and forth across the field by a cable between a winding drum at the motor end and a movable anchorage opposite. Since that time motor applications have grown to their present millions of horsepower and have ramified in almost every conceivable department of industry. But agriculture as a field in electric working has remained in the background. The reason is rather obvious in the difficulty of getting distribution of a character to lend itself readily to anything except the mechanical auxiliary work about a farm.

The electric distribution networks stretching over a great expanse of territory often give the farmer light and perhaps a small motor for working some of the farm machinery, but nothing more except in a few places, chiefly in the Far West, where irrigating pumps form a welcome and useful part of the motor load. For what one may call the mobile operations of farming the horse has held undisputed sway until the recent arrival of the tractor; but if under stress of war the gasoline supply runs short, the tractor, the gasoline pumping engine and other farm machinery will have rather a hard time of it.

Therefore it is worth while looking toward some modern adaptations of the famous experiments of MM. Chrétien and Félix, not in the service of the sparsely sowed and scantily reaped farmlands of the Northeast, but in intensive farming which, in the scarceness of labor, takes on a new importance under the stress of war—an importance it has always deserved though seldom received. Wherever electric light is available electric motor power goes, and on ground intensively tilled the question of distribution, otherwise serious, becomes less important. Not only can a big market garden be piped for irrigation and served by an electric pump, but it would not be a difficult matter to wire several acres so that energy could be delivered after the manner of the trackless trolley to the ordinary machinery of cultivation, including equipment for the spraying which is a necessary part of modern agriculture. Besides this use of mobile machinery, there naturally falls into line the operation of all other farm machinery by electric power, putting it into the hands of a single man to work an area of cultivation otherwise utterly out of the question, thereby not only saving a large amount of labor but freeing it for purposes that now seem more imperative. The problem furnishes a good chance for the practical inventor to distinguish himself to the very considerable benefit of the community at large. Load of this kind would be strictly daylight load with a large diversity factor and would consequently add little to the burden of energy production compared with the good accomplished. At all events, the matter is one very well worth study as a development of applied economics.

The Electric Furnace and Its Applications

A BRIEF account in this issue by W. H. Easton of a Heroult furnace for the preparation of nickel alloys gives a capital idea of the special applications of electric heating which are coming rapidly into use A furnace of this sort requires comparatively small energy at the start, but a large and fluctuating quantity when the melt is well under way. At this point the changes in furnace resistance are great and rapid, including many momentary and some persistent short circuits. High momentary overloads are characteristic of this kind of electric furnace work and require exceptionally good regulation to keep the variations of load within bounds. In this case a very ingenious Thury regulator has been installed to maintain automatically as nearly as possible a constant current at the electrodes. Each electrode is regulated separately, being provided with a motor to raise and lower it. Whenever the current from the electrode passes the limit set a momentary contact starts its motor and withdraws the electrode slightly, repeating the operation step by step until the current is down to its proper limit. With a current too low the electrode is in a corresponding fashion pushed in to the required point. Series transformers in the main high-tension circuit furnish power to the solenoid control for the regulator.

It is interesting to note that the regulating motors for the electrodes are operated on direct current, by reason of the delicacy of the control thereby obtained, a small motor-generator set furnishing the necessary power. Each electrode motor is equipped with a controller for manual operation if necessary. Finally, when the work on the charge is quite completed and the product ready for use, the whole furnace is tipped for pouring by an alternating-current slip-ring motor geared to the mechanism and controlled manually. The whole installation exhibits a very finished case of the fine automatic control of an operation requiring careful and delicate work for successful results.

Motors in the Printing Trade

PROF. C. E. CLEWELL'S notes on this subject assemble in most convenient form the data regarding motor applications in the printing plant. Much of the work here done is quite comparable to that in other branches of manufacture and demands nothing unusual in the way of motor equipment save ordinary care in the adaptation of individual drives. The presses require the closest attention to obtain successful results, and the problem in this case is quite like that encountered in the paper-making machine, where there is likewise necessity for good speed regulation, for heavy starting torque to overcome the inertia, and for inching the machinery along very gradually during certain stages of the operations. It is not unusual in large presses, indeed, to apply the same two-motor device as in the calenders, a small machine being used for the very slow movement, a big one for the regular running.

Barring starting torque, the power required by printing presses is rather suprisingly small, as Professor Clewell shows. The press-driving problem is essentially one of varying speed, and the means adopted here are substantially those used elsewhere, of varying the field and resistance in the armature circuit enough in each case to give the required range of speed. The interpole motor lends itself particularly well to such control here as in other cases. Where alternating current has to be used one is generally driven to slip-ring motors with variable resistance. As the running load of a press is fairly uniform, this arrangement can be made to work successfully despite the fact that, as in series-wound continuous-current motors, the speed varies through a certain range with changes of load. The control adopted is generally of the push-button type and frequently from several points, the form and multiplicity of control being chosen for safety and convenience.

It is in the adaptation of this type of control to the requirements of the particular printing plant considered that the greatest ingenuity can be exercised by the engineer. Aside from this, the equipment of printing machinery is a very simple matter.

The Coming Issues

FOLLOWING our policy of calling attention to interconnections that may be beneficial to all concerned, we will publish an article soon on the electrical systems in southern California, pointing out what is being considered or has been done to utilize water powers, economize in oil fuel and make use of existing equipment more fully. The selection of motors and control apparatus for elevators such as are used in apartment houses and office buildings of ordinary height will also be discussed. An article by a writer talking for the Fuel Administration will call attention to the importance of the human element in trying to obtain the maximum plant economy. Experiences of several well-known companies will be cited. Numerous arrangements for operating induction machines will be referred to, and their characteristics under different operating conditions will be obtained.

Economy in Electrical Distribution

Investigation of Losses in Distribution Systems for the Purpose of Improving the Service at Minimum Expense—Rearrangement of Equipment and Improved Construction Considered

BY W. B. STELZNER

CENTRAL-STATION companies have difficulty in getting new apparatus for their systems because all manufacturing is now primarily devoted to the purpose of winning the war. These companies must therefore use every device to maintain their service by getting the maximum use from existing apparatus and must use the greatest care in purchasing new equipment. To this end greater effort must be made to study the losses in distribution and to reduce them by the best means. When automatic voltage regulators are used on lighting feeders, for instance, it may be possible to open the primary circuits during the light load period and thus save 75 per cent of the iron loss.

It is generally known that if the primary lines of a distribution system are too small an excessive copper loss results, but it is not so well understood that if the voltage at the load is low the power is correspondingly decreased and a definite loss of revenue occurs. Larger conductors are thus required. In the case of low-tension circuits, however, line losses may often be reduced and the service improved by changing the transformer locations. Another serious obstacle to economical distribution is low power factor at the load, which causes high line losses and seriously limits the capacity of the wires. This condition may usually be attributed to the operation of induction motors on the system at only partial load, and is obviously best corrected by rearrangement of the motors or if this is not feasible by the use of synchronous motors.

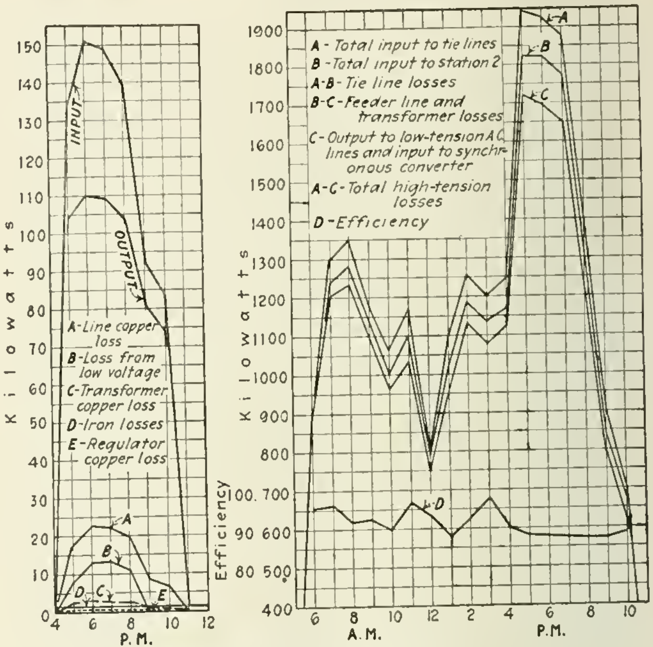
An analysis of the losses on the lines of a company of medium size was recently made and some of the results will be reviewed in order to show the economic importance of these losses in the distribution of electricity. The losses that will be discussed are: the high-tension-line copper loss, the low-tension-line copper loss, the induction regulator losses and the transformer losses. The copper losses will apply to the conditions obtaining for the average winter load.

The system studied includes a generating station connected by four lines to a substation from which emanate three lighting feeders and one power feeder. These feeders are equipped with single-phase regulators and supply current at approximately 2400 volts. A synchronous converter also supplies a railway load from the substation.

High-Tension-Line Copper Loss

The high-tension-line copper loss is given in Fig. 1, which shows the condition existing in one of the lighting feeders. The curves show this loss to be 98 kw.-hr. for a twenty-four-hour period, or 16.6 per cent of the energy sold in the same time. This large line loss is accompanied by an excessive pressure drop with the result that the pressure at the load is below normal and a direct loss in the sale of energy ensues. When the load current is 51 amp., the regulator reaches the position of maximum boost and any increase in load current produces a fall of voltage, entailing a loss of revenue.

In this case the obvious remedy is to increase the size of wire in order to reduce the line drop sufficiently to permit the induction regulator to hold the voltage up to normal. The loss of energy may be calculated at the rate of 7 cents per kilowatt-hour, assuming that the added cost of supplying this energy would be small. As will be noticed, the line copper loss is appreciable only between 5 and 10 o'clock in the evening. Although this loss occurs at the peak load, a possible minimum value for the loss, the cost of coal, might be 0.5 cent per kilowatt-hour. Using pre-war prices for material and labor and an annual charge of 10 per cent for interest, depreciation, insurance and taxes, the saving by replacing the No. 6 wire used with No. 2 is as follows:



FIGS. 1 AND 2 — LOSS CURVES FOR SINGLE-PHASE FEEDER AND EFFICIENCY OF HIGH-TENSION SYSTEM

Maximum copper loss occurs at peak load and may thus limit rating of line. Iron losses are ever present, however.

No. 6 B. & S. Wire		No. 2 B. & S. Wire	
Cost of wire as installed to point *a*, Fig. 5	$239.00	Cost of wire	$602.00
		Changing wires	80 00
			$682 00
		Credit for removed wire	75 00
		Cost of change	$607.00
24-hr. capital charge	06		17
24-hr. cost of line loss	49		19
24-hr. loss due to low voltage	3 36		.00
Total 24-hr. charge	$3 91		$0 36

The calculations indicating the economy resulting from the selection of a No. 2 wire for this circuit are summarized in the following tabulation:

Wire Size, B. & S. Gage	4	2	1/0	2/0	3/0	4/0
Additional capital required for change to above wire size	$385	$607	$985	$1,235	$1,545	$1,955
Total twenty-four-hour charge	$0 40	$0 36	$0 40	$0 43	$0 49	$0 60

The No. 2 wire carries the smallest charge and the capital expenditure required in its installation will be recovered within one year's time owing to the decrease in operating costs. The economy resulting from the substitution of the larger wire is very evident.

LOW-TENSION-LINE COPPER LOSS

The low-tension-line drop is probably the most important element in maintaining a high standard of service. This becomes apparent when we consider that by means of voltage and power-factor regulators the pressure of the high-tension lines can be controlled. With a well-designed system and under efficient operation these regulators give practically constant voltage at the distributing centers. Especially is this true when lighting feeders are maintained separate from the power feeders. Such apparatus is not used on the low-tension lines and the regulation at the loads is therefore determined almost altogether by the low-tension-line drop.

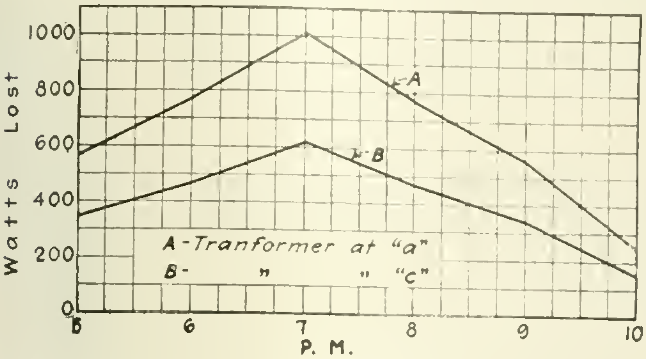


FIG. 3—LOW-TENSION-LINE LOSS

Curve A for the circuit shown in Fig. 5 with transformer at *a*; curve B with transformer at *c*.

The line losses in the low-tension circuit are indicated in Fig. 3. These data give the copper loss in the line wires and service leads and show the influence on the losses of the design of the circuit. The information may also be presented as follows:

	Curve A	Curve B
Transformer size (kva.)	20	20
Energy sold (kw.-hr.)	90.7	90.7
Line loss (kw.-hr.)	3.94	2.39
Per cent lost	4.2	2.6

A comparison of curves A and B indicates which is the most economical location for the transformer feed-in point. This is a most important consideration both with regard to the losses and to the regulation at the loads. The cost of moving this transformer to the position indicated would be $5.50, a sum fully warranted in view of the improvement in losses and regulation. A further change that might be warranted would be to change the size of wires *ab* and *bc*. In some cases other considerations may govern the selection of the transformer location, and position *a*, Fig. 5, may be chosen. In this event the change in wire sizes must be made or the circuit may be sectionalized and another transformer installed.

POWER FACTOR

The power factor of a circuit depends not only upon its characteristics but those of the apparatus connected to it. To transmit 100 kw. at 2400 volts single-phase would require a line current of 41.6 amp. if the power factor is unity, and a current of 52 amp. if the power factor is 0.80. Due to this increased current at reduced power factor, the copper loss in apparatus and lines is increased in proportion to the square of the decrease in the power factor. Low power factors, therefore, mean greater losses, lower capacity and decreased economy in distribution. The power factor of a circuit may be changed by a rearrangement of motors and loads, so that all induction motors will be operating under approximately normal load conditions, or synchronous machines may be used of sufficient rating to control the power factor of the circuit.

For the circuits involved in this study the power factor of the lighting feeders averaged 0.92 at peak load and 0.42 at no load. The power feeder, owing to lightly loaded induction motors and transformers, had an average power factor of 0.52. The power factor of the tie lines was usually kept above 0.90 by over-excitation of the synchronous machine supplying the railway load.

Fig. 4 gives the loss in the tie lines for two loads, a day load and a night load, and shows how this loss would vary with the power factor. Suppose an induction motor-generator set were used in the substation and that this should result in a tie-line power factor of 0.85 for the night load and 0.70 for the day load. Then results would be as follows:

Time	Actual Loss (Kw.)	Assumed Power Factor	Resulting Loss (Kw.)	Loss Due to Reduced Power Factor (Kw.)
7 p.m.	108	0.85	141	33
10 a.m.	66	0.70	117	51

The reduction in line loss by power-factor correction, with its accompanying effects on the pressure regulation at the substation and on the capacity of the tie lines, measures the economic value of power-factor control and its influence in the selection of power equipment.

VOLTAGE REGULATION

Pressure regulation is involved in all distribution problems and it is an important factor in electric service. Good regulation means minimum losses and maximum sale of energy.

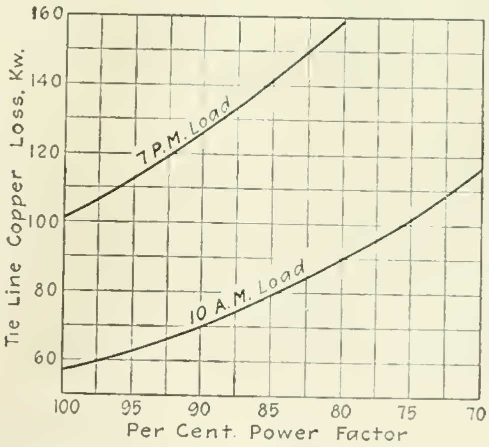


FIG. 4—VARIATION OF TIE-LINE LOSS WITH POWER FACTOR

By separating the lighting and the power loads and supplying them by different feeders, as is done in the system studied, individual control of each is possible and the best regulation may be secured. To accomplish this automatic voltage regulators are required for each circuit.

The fluctuating power loads produce power factor and current variations in the tie lines, and these two effects combined with variations in the generated voltage determine the fluctuations of the pressure at the substation bus. This pressure may be controlled by the use of an automatic voltage regulator in connection with the synchronous machine in the substation, as in this way the power factor may be held constant. A similar regulator, if required, installed at the power station would control the pressure generated there.

Induction Regulator Losses

The loss in energy sold due to low voltage at the load, as shown by Fig. 1, is caused by resistance of the line. The loss is kept as low as that given by means of the boosting action of the induction regulator, increasing the phase pressure from 2400 to 2600 volts. The influence of the regulator in controlling this loss is determined as follows:

Energy delivered to the circuit as installed (kw.-hr.)	757.8
Energy that would be delivered without regulator (kw.-hr.)	626
Difference during the period of twenty-four hours (kw.-hr.)	131.8

This indicates the decided usefulness of the regulator even without considering its chief function of improving regulation.

The regulator which was under consideration was rated at 11.5 kw., 2200 volts, 50-amp. secondary. It was an old design with a tested iron loss of 400 watts and a copper loss at rated load of 187 watts. The high iron loss is partly due to the fact that it is subjected to a pressure 9.1 per cent in excess of that for which it was designed. The exciting current was found to be 2 amp. For a regulator of modern design the iron loss would be about 160 watts and the exciting current 1.89 amp.

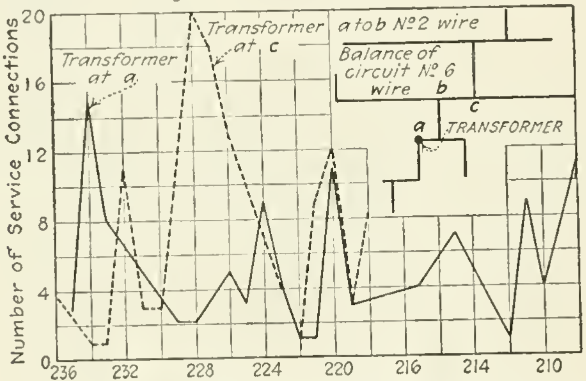


FIG. 5—VOLTAGE AT SERVICE CONNECTIONS

Full line shows number of services receiving a given voltage at peak load. Dotted line shows the improvement resulting from moving transformer from *a* to *c*.

A comparison of the losses for a year's time gives the following results:

	Old Regulator	New Regulator
Annual cost of iron loss	$17.51	$6.57
Annual cost of copper loss	2.61	4.53
Total annual loss	$20.12	$11.10

or an annual saving in losses of $9.02 in favor of the modern design. This saving alone, however, would not justify the increased capital expenditure required to make the change.

The greatest economy in this case would be realized by installing switches in the shunt coils of the regulators so they may be disconnected during the nineteen hours per day of light or no load. This would result in an annual saving in iron loss of $13.75 per phase or $41.25 per feeder. Assuming a three-pole switch, installed, to cost $75 and an annual charge of 13 per cent, we have an annual charge of $9.75 on the switch. The net saving, if the switch is used, amounts to $31.50 per feeder per year. The iron loss of all transformers on one circuit amounts to 1.2 kw. At a cost of 0.5 cent per kilowatt-hour the annual cost of this loss is $52.60. With rated voltage at each transformer and with transformers of modern design the annual cost of the iron loss would be $47.80, a saving of $4.80 per year. Obviously this saving alone would not justify the replacement of these transformers with others of the proper voltage rating.

Summary of Losses

In order to show the relative magnitude of the losses as studied, the following table applying to one circuit is given for the twenty-four-hour period considered.

Transformer iron loss (kw.-hr.)	28.8	
Regulator iron loss (kw.-hr.)	9.6	
Total iron loss (kw.-hr.)	38.4	
Per cent of total loss		20
Transformer copper loss (kw.-hr.)	12.5	
Regulator copper loss (kw.-hr.)	1.4	
Line copper loss (kw.-hr.)	98.0	
Total (kw.-hr.)	111.9	
Per cent of total losses		56
Loss due to low voltage (kw.-hr.)	48.0	
Per cent of total loss		24
Total loss (kw.-hr.)	198.3	
Total input (kw.-hr.)	788.4	
Total output to low-tension lines (kw.-hr.)	590.0	
All-day efficiency, per cent		75

The total losses in the high-tension system are as follows:

	Kw.-hr.
Energy to tie lines	21,440
Energy to bus at substation	20,360
Loss in tie lines	1,080
Loss in feeders, regulators and transformers	1,114
Total loss	2,194

Conclusions

Knowledge of the actual losses and their distribution over the system is essential to the most economical operation. Such data show just where more copper is needed, where copper may be removed, where to install regulators and power-factor-correcting devices, the most economical location of transformers, etc. In other words, a knowledge of the distribution losses is necessary for the most effective use of the system or the production of maximum service at a minimum cost.

The line copper loss, since it varies with the square of the load current, is likely to be serious. The gradual growth in load may result in large line losses or changes in the distribution of the load may result in idle copper. A survey of the losses reveals these conditions and leads to their correction.

The iron losses are kept low on this system by reason of the fact that the transformers are so spaced as to supply rather large areas. In this way larger as well as fewer transformers are used with a resulting reduction of iron losses and exciting current. This practice also results in a lower investment in transformers. Another advantage lies in the fact that by supplying the larger area a reduction in transformer rating is possible because of the diversity factor of the connected load. In some cases, however, these economies may be more than offset by the losses in the low-tension lines. Economies can be obtained by using larger transformers and increasing the distance between them when such a policy is consistent with the investment in the low-tension mains.

Power-factor correction on lines carrying loads of low inherent power factor results in a material saving in line loss and line capacity and a decided improvement in regulation.

The value of a study of the losses encountered in the distribution of electricity is made apparent by considering the fact that the ultimate cost of the product depends on the efficiency of the system. High efficiency, though a desirable attribute, cannot always be fully realized if the system is to have its greatest value. Low capital cost is essential to low production cost and low capital costs are influenced by losses as well as by diversity, load factor, available funds, etc. On the other hand, a mistaken economy in capital costs may act to seriously impede the development of the system. While no system can be laid down as commercially complete, the engineer must look, although it may be far into the future, to what would probably be the demand if the whole energy consumption of the district were supplied electrically.

The rapid growth in the load so often experienced illustrates the necessity for a rather generous attitude on the part of the public toward the utility in order that this increase may be properly taken care of and the best interest of both public and company conserved.

Electric Furnace for Melting Alloys

Control Apparatus Must Be Carefully Selected to Provide for Heavy Fluctuation of Load — Graphic Records of Power Demand When Melting Nichrome and Nickel Steel in Electric Furnace

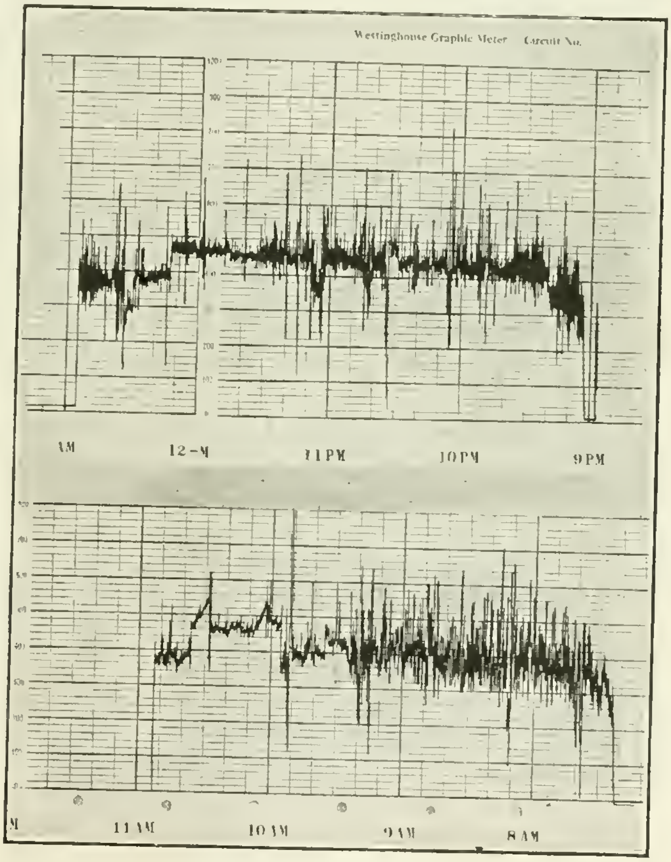
BY WILLIAM H. EASTON

AN ELECTRIC furnace which has recently been put in operation at the plant of the Driver-Harris Company, Harrison, N. J., is of interest because it is used for the preparation of special alloys and because its electrical equipment is an excellent example of modern practice. Its main product is nichrome, the well-known resistance alloy, but it is also used for making alloys of a different character. The furnace is of the Heroult arc type with automatic regulation, and has a capacity of 2 tons.

Fig. 1 is a graphic wattmeter record of the power consumed during a run on 3000 lb. (1361 kg.) of nichrome, and Fig. 2 is a similar record for high-nickel steel. In both cases the charge consisted of the various metallic constituents fed into the furnace in a solid state without preheating. The amount of power taken at the start of the heat is small in both cases, but as the resistance of the furnace circuit decreases, owing to the heating up of the electrodes and the consolidation of the charge, the power consumption rapidly increases until stable conditions are reached. The average amount of power consumed is then held practically constant by the automatic regulator, with the exception of a slight continuous increase due probably to a corresponding decrease in the resistance of the furnace circuit.

There is, however, no uniformity in the actual power consumption. As the charge melts down, pieces of metal fall in between the electrodes and establish short-circuits. For the most part these short-circuits are only momentary as the fragments causing them are promptly melted down; but occasionally they persist and then the automatic regulator draws up the electrodes until they are clear. This process sometimes breaks the arc and then there is a sudden decrease in the power consumption until the regulator brings the electrodes down again and re-establishes the arc. As would be expected, the nickel-steel alloy shows more of these irregularities than the softer nichrome.

Toward the end of the run there is a marked change in the power consumption, when the metal is given a special treatment before pouring. In the case of the nickel-steel a higher temperature was necessary, perhaps to lower the carbon content, while with nichrome the temperature was lowered. The temperature of the furnace averages about 2200 deg. Fahr. (1204 deg. C.).



FIGS. 1 AND 2—GRAPHIC WATTMETER RECORD FOR NICHROME AND NICKEL-STEEL MELTS

The power required for melting nichrome changes rapidly from practically open-circuit to short-circuit. Fluctuation of power is even more marked with nickel-steel than with nichrome on account of the character of the charge.

The high momentary overloads are characteristic of electric furnace work and make it very different from ordinary power service. They must be taken into account in designing the electrical equipment for the furnace, and some of the apparatus must be especially designed to withstand them, as shown in the following description of the Driver-Harris installation.

Energy for this furnace is supplied from a two-phase, 60-cycle, 2200-volt circuit on the lines of the Public Service Electric Company. In the high-tension lines are a disconnecting switch and an oil circuit breaker. This breaker, used to control the circuit, may be operated manually and is also provided with low-voltage and overload protection. In order to prevent its operation on momentary overloads, the overload trip is controlled by relays with definite inverse-time-limit action. The high-tension apparatus and the transformers are contained in a brick compartment constructed behind the furnace.

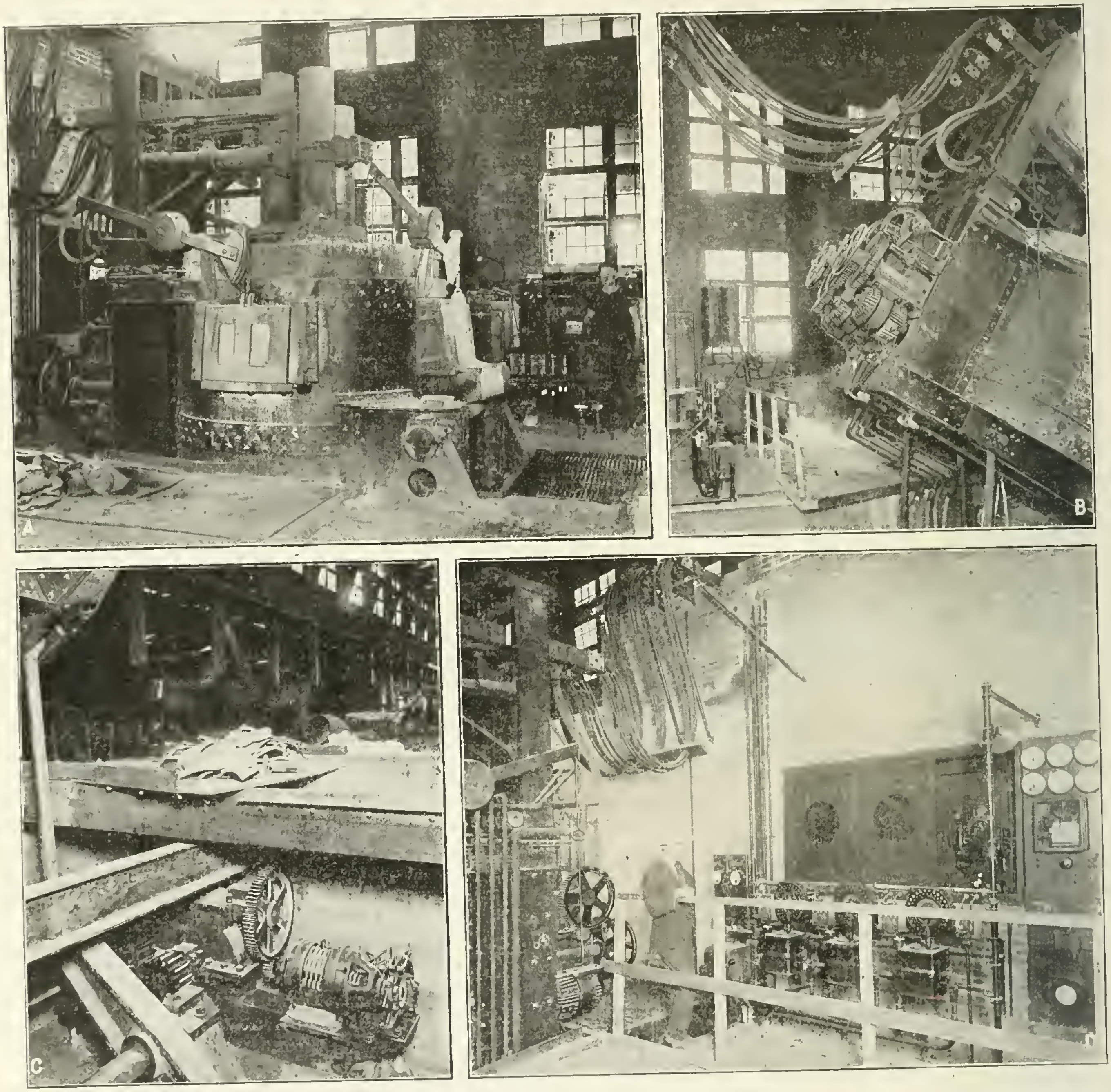


FIG. 3—VIEWS OF FURNACE AND CONTROL APPARATUS

A—Furnace during normal operation—heavy carbon electrodes shown above. B—Tilting position for discharging the melt—large flexible electrode leads above. C—11-hp. motor for tilting furnace—motor is alternating-current slip-ring type. D—Thury regulator at rear of furnace; on the right the control and meter panels are shown.

There are two 400-kva., 2200/110-volt transformers of the oil-insulated self-cooled type. They are T-connected so that they change the high-voltage two-phase current into low-voltage three-phase current, one phase for each of the three electrodes of the furnace. Special construction is necessary to withstand the overloads. These overloads are of such short duration that their heating effect is negligible, but they tend to force the coils apart. Hence the coils are very firmly braced and are capable of withstanding momentary overloads fifteen times greater than the normal load. The reactance of these transformers is about double that of ordinary power transformers of the same size. This reactance, together with that developed in the low-tension leads (which are made as short as possible in order to keep this factor low) prevents the current flowing through the furnace from exceeding five or six times normal values even on dead short-circuits. The voltage regulation is from 106 volts on no load to about 100 volts on full load, and the power factor is from 85 to 90 per cent.

One of the most interesting features of the equipment is the Thury regulator, which automatically maintains an approximately constant current at the furnace electrodes. Without this device the current consumption would vary erratically even if an operator were constantly endeavoring to correct the variations. It therefore saves labor and energy, reduces to a minimum the time required to prepare a charge, and, by providing uniform conditions, keeps the quality of the product uniform.

OTHER FEATURES OF EQUIPMENT

Each furnace electrode has a separate regulating mechanism and a raising and lowering motor. The regulator can be set for any desired current value, and when this value is exceeded each regulating mechanism closes a contact momentarily, which causes the motors to raise the electrodes slightly. The contacts continue to close at brief intervals until the electrodes are drawn up high enough to reduce the current to the predetermined value, the intermittent action being employed to prevent the electrodes from being raised too high and thus causing an unstable condition. When the current falls below the predetermined value the electrodes are lowered in a similar manner. The regulator itself is controlled by a solenoid energized by means of current from series transformers in the main high-tension circuit. Damping devices prevent the regulator from acting on overloads that immediately correct themselves. In addition to the automatic device, each electrode motor has a drum controller for manual operation.

The electrode motors are direct-current machines, because alternating-current motors cannot be controlled with sufficient delicacy. The operating current is obtained from a 4½-kw. motor-generator set located in the transformer compartment. The motors are of 2 hp. capacity and are totally inclosed; they are provided with grease-cup lubrication instead of the ordinary ring-oiling system, so that the lubrication is not interfered with when the furnace is tilted for pouring.

An instrument board is located beside the regulators and carries the following apparatus: An indicating wattmeter; a voltmeter; a power-factor meter; an ammeter for each phase; a graphic wattmeter; a plug switch for reading the voltage of each phase, both across the arc and across the low-tension leads outside the furnace; the operating handle of the high-tension circuit breaker; the inverse-time-element relays for the circuit breaker, and an integrating watt-hour meter. On the other side of the regulator is mounted a small panel carrying the switches and meters for the motor-generator set, below which is the motor auto-starter.

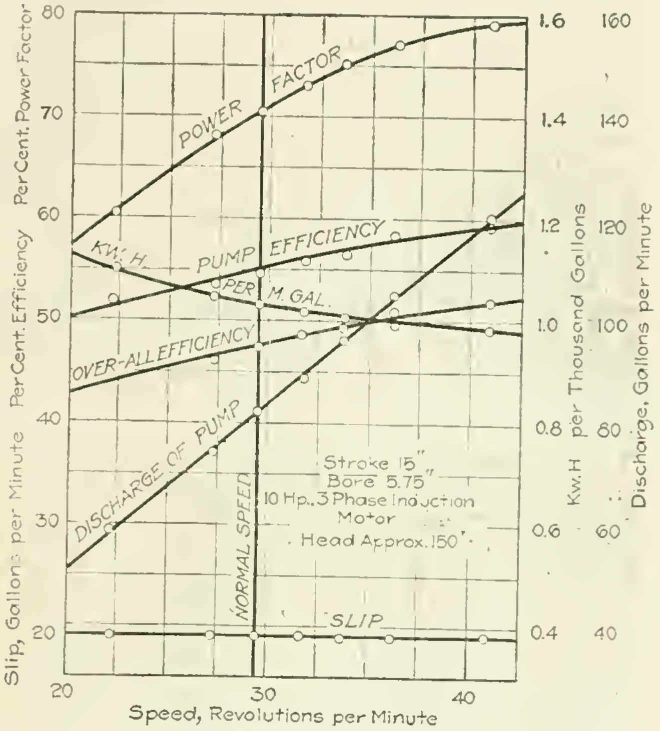
When the charge is finished, the whole furnace is tilted bodily for pouring. This tilting is effected by an 11-hp. alternating-current slip-ring motor located in a pit beneath the furnace and geared to the tilting mechanism. It is controlled by a drum controller at the side of the furnace. All of the equipment described is standard Westinghouse furnace apparatus.

THE WAR-TIME OPERATION OF MOTOR-DRIVEN DEEP-WELL PUMPS

Discussion of the Characteristics of Reciprocating Pumps Applicable to Other Systems of Pumping or to Pumping Oil

BY P. S. BIEGLER AND I. W. FISK
Department of Electrical Engineering, University of Illinois

IN MAKING an investigation of the performance of electrically operated reciprocating deep-well pumps serving communities of small or average size it is not uncommon to find the over-all efficiencies of the individual pumping units anywhere between 30 and 60 per cent. It is not hard to find reasons for this uncertainty of efficiency in water-pumping systems. They usually serve small towns and cities, and the business may not warrant paying high salaries to superintendents. Commonly these pumps are equipped with motors that are larger than necessary, which may be justified for the reason that the level of the ground water may vary from year to year and that the valves may not be operating properly, or there may be mechanical defects which prevent good performance.



CHARACTERISTICS OF PUMPING UNIT FOR VARYING SPEEDS OF PUMP

It is evident then that close and intelligent supervision and periodic testing of pumping systems should prove profitable, but it is still more important that every utility should meet war conditions by increased efficiency and economy. Pump tests cannot be made without apparatus especially adapted to the work. A system of testing developed by the writers*, together with some plotted results, is given here to show how this work can be accomplished.

Of the faults frequently found in pumping apparatus the use of a much larger motor than necessary is per-

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*For details of apparatus used see paper by I. W. Fisk and P. S. Biegler, "Some Tests of Electrically Operated Deep-Well Pumps," *Journal American Water Works Association*, November, 1917, Vol. 32, page 8.

haps the most common and the most serious in its consequences, because the motor may operate at extremely poor power factor and also at low efficiency. On account of the low power factor, the generating apparatus must be much larger than should be required if the power factor were reasonable, and the excess of lagging current imposed upon the distribution lines may cause poor voltage regulation. The power factor of the generating plant may, of course, be raised by the use of a synchronous motor, but this is costly and only a partial cure, since the motors continue to operate at low power factor and efficiency. The best remedy for such conditions is to rearrange the motors, where possible, so that each one is properly loaded and to dispose of the rest to the best advantage, buying new motors where necessary.

TESTING MOTOR FOR PROPER LOAD

In making tests to determine whether a motor is properly loaded, it is not sufficient to find out whether it is running at a reasonable temperature, since, at low power factor, the motor may run warm at only a fraction of full load. Furthermore, if the valves need attention, this fact may be readily determined by a decrease in the pumping rate which is indicated by the reduced load on the driving motor. While it may be possible to detect a sudden decrease in the water delivered from a well merely by observation of the discharge stream, it is evident that systematic measurement would be more certain and more useful. The most convenient method is to measure the electrical input to the motor. Then, from characteristic curves plotted against kilowatt input, the current, power factor, horsepower output, etc., may be determined. The measurement of the power or current input of a motor driving a reciprocating pump is best accomplished by means of a rotating standard watt-hour meter provided with a number of current and voltage ranges.

Where there is considerable uniformity in the equipment of the wells, it is not difficult to get at the complete performance of the motor, knowing the power input by reference to the characteristic curves. However, periodic tests should be made on each motor. If the motors are fairly well cared for, there is no reason why the characteristics should change appreciably from year to year, and the performance curves should be useful for this purpose as long as the motor runs satisfactorily.

While the measurement of power input at each motor is an excellent means of checking periodically the discharge of each well, it is desirable to make more complete tests from time to time, including the measurement of head and actual discharge. This may be done with nearly the same degree of accuracy as in the case of the electrical power measurement by the use of appropriate devices.

The curves reproduced herewith show the characteristics of a motor-operated deep-well reciprocating pump illustrating the effect upon operation of varying the speed of the pump. The actual slip of the pump does not increase with the speed, and it is rather a function of the head against which the pump is working. The pump efficiency rises on this account with higher speeds, and the over-all efficiency increases in about the same proportion when the motor is operating on the flat part of its efficiency curve.

The fact that the output of a well may be increased considerably by speeding up the pump, and that it will thereby operate at higher efficiency, should not be overlooked because every possible method of increasing efficiencies must be utilized in war time. Also, in some communities a considerably greater output of water has been required to supply an increasing population due to growing war industries. It may not be possible for pump manufacturers to supply this sudden demand, so that instead of drilling and equipping new wells it may be desirable to speed up pumps now in use, which should be utilized to their full rating even at the expense of some increased maintenance. The operator must proceed with discretion, of course, for the pumps should not be speeded up indefinitely. It has been pointed out that the possibility of increased output without added well equipment is sound engineering policy in normal times, but the suggestion assumes double importance as a possible war measure.

While the foregoing discussion is based primarily on water systems, the principles might be applied to the pumping of oil. It is quite certain that an increased demand for fuel oil will be developed by our war activities.

TEAM SYSTEM IS THOUGHT TO BE BEST LABOR SOLUTION

Heavy Industrial Demand for Labor at Youngstown, Ohio, Makes Conditions Severe—Many Trying Situations Confront Employers

Labor conditions affecting public utilities are as difficult at Youngstown, Ohio, as at any point in the country, according to H. W. Bromley, engineer of power production for the Mahoning & Shenango Railway & Light Company. As a result of this the company has come to the policy of paying wages as high as any of the neighboring industries, including the steel mills. Common labor, which two years ago was paid 17.5 cents an hour, is now getting 54 cents an hour. Watch engineers are being paid $173.50 per month for nine-hour-a-day shifts; switchboard men receive 52 cents an hour and work nine hours; oilers and water tenders are paid 45 cents and 51 cents an hour respectively, and foremen are paid from 45 cents to 48 cents an hour. Besides being expensive, this labor is difficult to handle, and constant friction arises.

Bonus systems have been tried, but without success. The latest plan, and the one which seems to Mr. Bromley to be destined to give the best results, is one which he calls the team system. With this plan a foreman paid 70 cents an hour is placed in charge of five or six men. This unit is called a team. The foremen are held responsible for the quantity and quality of work done by the team as well as for destruction of material by its members. The teams are usually chosen so that all of the men in each unit, including the foreman, are of the same nationality. The real bosses of the job then talk to the foremen, but never to the men. This plan gives the foreman a good opportunity to keep in close touch with all members of his team and to bring out their best efforts. Of all the groups employed under this system negroes are said to have accomplished the best results.

New England Interconnection Plan in Shape—II

Most Economical Plants Will Run Almost Continuously and Inefficient Plants During Peak Loads—Details of the Changes Which Have Been Found Necessary to Tie Plants Together

REFERENCE was made in the last issue of the ELECTRICAL WORLD to the study which is being made of the financial and engineering problems involved in the interconnection of New England plants. The present method of operation and the proposed plan of making the interconnections were outlined.

The theory upon which this program of interconnection has been developed does not involve the permanent discontinuance of any of the generating plants composing the complete system. On the contrary, each plant will be required to operate its generating equipment some portion of each year, the most economical plants running almost continuously and the inefficient stations for a portion of each day for periods of thirty to forty-five days each year during maximum load times, according to location. In this way the full capacity of the entire group can be rendered available as required. The sphere of action of each of the main sources of supply which would be utilized for the larger part of the year, excluding the maximum load period each winter, is indicated in Fig. 4.

The simplicity of the entire system will be appreciated by a study of Fig. 2, by which it will be noted that economical plants of large capacity are installed at each end, with another in the middle of the system, thus affording efficient means of supplying the various blocks of load locally around each generating station and avoiding transmission losses of any moment. It is obvious that the successful and economical operation of such a system will involve the control of the use of each plant under the direction of a competent central authority who will be qualified to determine the methods of operation by which the best results can be secured for all.

A study of the losses in transmission which would be experienced in the completed system, if arranged and operated in agreement with the general scheme suggested in Fig. 4, indicates that with the estimated output of 1918 they would not exceed those developed by the railway company in the same year.

The following step-by-step procedure has been worked out as desirable, taking into account deliveries of equipment and the time required for construction:

1. Install cable connections and transformers to connect the substations of the Fall River Electric Light Company and the Bay State Street Railway in Fall River.
2. Replace 25-cycle rotary converters in railway substation at Fall River with 60-cycle units and operate from Fall River Electric Light Company's system.
3. Install connection to New Bedford plant.
4. Replace 25-cycle rotary converters in railway substation at Taunton with 60-cycle units and operate from Fall River Electric Light Company and New Bedford company jointly.
5. Make similar change at Bridgewater railway substation to No. 4.
6. Install connection to Brockton Edison generating station at East Bridgewater.
7. Replace 25-cycle rotary converters in railway substation at Brockton and operate from Brockton Edison company.
8. Replace 25-cycle rotary converters in railway substation at Rockland and operate from Brockton Edison company.

9-10. Install frequency changers in Bay State generating plant at Quincy Point and install cable connections to Boston Edison company.

11. Connect plants of Quincy Electric Light Company, Weymouth Electric Light Company, Braintree and Taunton municipal plants as convenient.
12. Connect lines to Portsmouth and Newport, R. I., as installed.

Manufacturers of rotary converters, transformers and frequency changers guarantee delivery in four to five months; conduit and cable work and construction in the various stations can be completed within five months; all overhead-line construction with the exception of the New Bedford connection can be completed within three months, and it is estimated that if the right-of-way for the latter can be secured without delay, it should be completed within six months. In general, with careful attention to scheduling the work, it appears that the entire program of interconnection could be completed within six months from the date when authority was given to start construction.

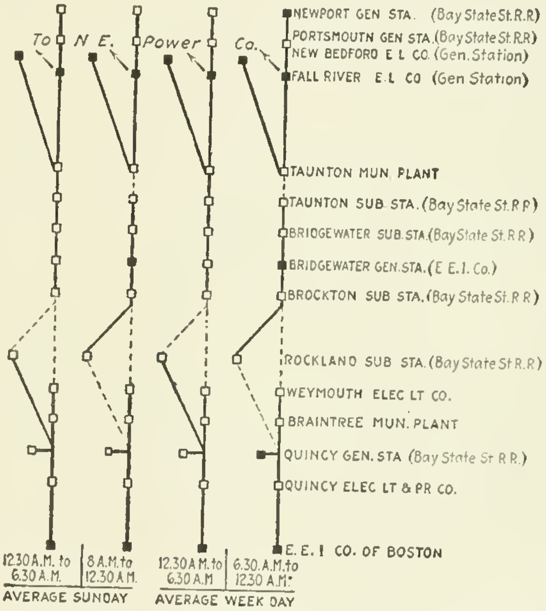
To N. E. Power Co.
NEWPORT GEN STA. (Bay State St.R.R)
PORTSMOUTH GEN STA.(Bay State St.R.R)
NEW BEDFORD E L CO. (Gen. Station)
FALL RIVER E.L CO (Gen Station)
TAUNTON MUN. PLANT
TAUNTON SUB STA. (Bay State St.R.R)
BRIDGEWATER SUB. STA. (Bay State St.R.R)
BRIDGEWATER GEN.STA. (E. E. I. Co.)
BROCKTON SUB STA. (Bay State St. R.R)
ROCKLAND SUB STA. (Bay State St R.R)
WEYMOUTH ELEC LT CO.
BRAINTREE MUN. PLANT
QUINCY GEN. STA (Bay State St R.R.)
QUINCY ELEC LT & PR CO.
E. E. I CO. OF BOSTON
12.30 A.M. to 6.30 A.M.
8 A.M. to 12.30 A.M.
AVERAGE SUNDAY
12.30 A.M. to 6.30 A.M
6.30 A.M. to 12.30 A.M.
AVERAGE WEEK DAY

FIG. 4 — SCHEMATIC DIAGRAM SHOWING MOST ECONOMICAL METHODS OF OPERATION

Filled-in squares indicate that a generating station is operating, while empty squares indicate that it is being held as a reserve. Stations joined by heavy lines are served by the generating station operating in that group. The dashed lines indicate connections that can be made if necessary.

It has been pointed out that the generating capacity of the system can be materially increased in the future, at a minimum cost, by installing additional boiler capacity only, in certain stations where the generator capacity now predominates.

	Boiler Capacity, Kw.	Generator Capacity Kw.
Bay State Street Railway, Quincy, Mass.	15,000	22,500
Brockton Edison Company	14,000	19,000
New Bedford Gas & Edison Light Company	28,00	37,000

The capacity of the Brockton Edison company's station can be increased by the installation of an additional 10,000-kw. turbo-generator in accordance with the original design of the station as now constructed.

No data have been included in this investigation on the capacity and output which can be derived from the connection with the New England Power system at Fall River. This connection will form a valuable adjunct to the interconnected system in many ways and eventually be a source of the sale of energy to the New England Power Company, which requires additional output to supplement its present capacity.

TABLE I—REPRESENTATIVE COST DATA IN ESTIMATE

Switching and two two-way metering equipments for two 4/0, 15,000-volt lines at one generating station	$16,000 00
Four-duet conduit, per foot, laid	3.00
4–0 three-conductor, 15,000-volt cables, installed, per foot	2 30
Two 2000-kw., 13,200/2300-volt transformers, installed, with switching and two two-way metering equipments, per kw	5.00
Two 3750-kw., 25-60-cycle frequency changers, with switching and metering equipment, per kw	15.00
Two 400-kw., 13,200/2300-volt transformers, installed with switching and two-way metering equipments, per kw	10.00
Two 1500-kw., 13,200/6600-volt transformers, installed with switching and two two-way metering equipments, per kw	5 50
Replacing three 300-kw., 25-cycle rotary converters with three 300-kw., 60-cycle rotaries, per kw	8 50
Two one-way metering equipments for above	1,000 00
Replacing one 1500-kw. and three 750-kw., 25-cycle rotaries with 60-cycle machines of the same capacity, per kw	7 00
Four one-way metering equipments for above	2,000 00
Replacing three 500-kw., 25-cycle rotaries with 60-cycle units, per kw.	8 00
Replacing four 750-kw., 25-cycle rotaries with 60-cycle units, per kw.	7.50
Two 3750-kw., 23,000/13,200-volt transformers, installed with switching and two two-way metering equipments, per kw	5.00
One mile six-duct conduit	16,300 00
Four miles three-conductor, 4/0 15,000-volt cable at $2.30 per foot, total	48,576.00
Eighteen miles 66,000-volt overhead line, three 1/0 wires, per mile line	6,000 00
Cable, 25,000-volts, laid, per foot	2.00
Cable, 25,000-volts, laid, submarine crossing, per foot	5.00
Three 500-kw., 60-cycle rotary converters, installed, new, per kw	18 00

The estimated cost of interconnection construction and changes in equipment for the plants in Group 1 is as follows: Switching and metering equipment, $48,500; step-down transformers, $152,000; rotary converters and frequency changers, $188,550; underground construction, $436,431; overhead construction, $176,500; total, $1,001,981.

TABLE II—LOAD DATA OF PLANTS

	Max. Generator Rating (Kw.) Two Hours, 1918	Max. Continuous Rating (Kw.) 1918	Economical Continuous Rating (Kw.), 1918	Max. Load (Kw.) 5 p.m. Dec. 13, 1917	Time of Yearly Max.* Load	Estimated Max. Load (Kw.) of Dec., 1918
Boston Edison	145,000	115,000	100,000	83,781	Dec. 13, 4:50 p.m.	100,000
Quincy Electric Light	2,600	2,600	..	1,500	Mar. 6	2,500
Bay State Street Railway, Quincy	15,000	15,000	12,000	12,000	....	15,000
Braintree	450	450	......	400	....	400
Weymouth	1,500	1,200	.....	1,200	Aug. 4, 8 p.m.	1,400
Brockton	15,000	12,000	10,000	6,400	Nov. -4:15 p.m.	11,000
Taunton	3,800	2,500		2,650	.. ..	3,000
Fall River	15,000	11,000	11,000	9,250	Dec. 17, 4:55 p.m.	13,000
New Bedford	28,000	26,000	25,000	17,150	Dec. 13, 5 p.m.	25,000
Plymouth	1,000	1,000	......	Included in New Bedford		
Buzzards Bay	1,000	1,000	....	Included in New Bedford		

These costs are based upon 1918 estimates and quotations, among which the data given in Table I are of general interest from the unit standpoint.

For the plants in Group 1 at Quincy (Electric Light & Power Company), Braintree, Weymouth, Taunton, Fall River and New Bedford, it is estimated that 29,300 kw. in transformers would be required, at an estimated cost of $94,100 and of $59,900 for installation and equipment, or a total of $154,000 for this apparatus in place. The frequency changers, it is estimated, would cost $90,000 for the apparatus and $22,500 for installation and metering and switching equipment. In the railway substations of Group 1 10,050 kw. in rotary converters would be required at an estimated cost of $59,325, $16,725 being added for installation.

The above tabulation yields a total maximum generating capacity on the two-hour basis of 228,350 kw. in 1918 and a sum of maximum loads estimated for the 1918 peak as 171,300 kw., leaving an excess capacity at the maximum load period of 57,050 kw. Holding back 30,000 kw. for reserve spare capacity, the interconnected plants of Group 1 would then have 27,050 kw. spare capacity available for sale on the 1918 estimated combined peak, and at $80 per kilowatt this means a release of generating capacity valued at $2,164,000 by the interconnection program for the plants of Group 1.

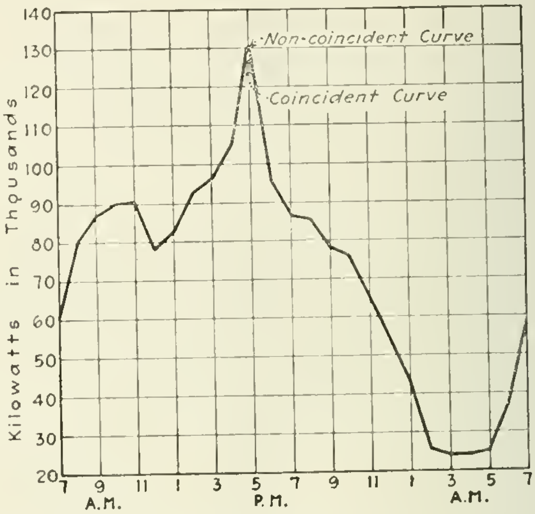

FIG. 5—COMBINED LOAD CURVES OF ELECTRIC SYSTEMS SOUTH OF BOSTON FOR 1917

At 15 per cent fixed charges on this excess capacity, there would be $324,600 to be carried. The estimated decrease in fuel consumption in the plants of Group 1 totals 37,583 tons, or $300,664 at $8 per ton. Deducting 15 per cent fixed charges on the new investment required for the Group 1 interconnection ($1,001,981), or $150,297, from the value of fuel saved, there appears a net saving on fuel alone of $150,367 on the estimated 1918 output. There also would be a very large but as yet undetermined saving in labor. Putting the results of the program in another way, it may be said that by an expenditure of $1,001,981 spare capacity in generating plants conservatively valued at $2,164,000 can be released for active service and future expenditures for new plant of an equivalent amount avoided, as well as the fixed charges for such an investment. As was pointed out in the previous article in the ELECTRICAL WORLD, the saving in fuel alone would be sufficient to retire the new investment in ten years.

The inclusion of the stations in Group 2 adds 500 kw. more to the available reserve capacity but with no material increase in the net results, either as regards increase in capacity or in fuel saved. It is doubtful if the expenditure required for this group is justified by the results in sight, and owing to their character it appears desirable to deal with these Group 2 plants individually and in connection with local conditions.

A further study of the distribution of energy between the plants in Group 1, if interconnected, indicates that at least 60,000,000 kw.-hr. would be handled the first year, this being an increase over the amount previously estimated, viz., 53,636,000 kw.-hr. This increase, it is estimated, would be derived from increased business in the Quincy and Taunton districts in excess of the original estimate and from the service supplied to certain generating plants which would not be operated so long as previously estimated. By 1919 it is probable that 80,000,000 kw.-hr. would be handled by the interconnected lines.

THE ADVANCING COST OF CENTRAL-STATION LABOR

Figures Showing the Percentages of Increase Over January, 1910, Classified According to Employment and Department

In a recent hearing held by a public service commission to consider the fairness of a proposed rate increase the estimated advances in operating expenses were substantiated by schedules showing the increasing cost of labor. This schedule, covering the more standardized positions on the central-station pay roll, is here presented as a table of percentages, indicating increases over the base rates existing in January, 1910. Although the rates paid in corresponding positions vary in different sections of the country and in cities of different classes, it is believed that the percentages are fairly representative of the advances which the average central station has been called upon to meet.

Obviously, as these statistics are drawn from the experience of a single company, certain discrepancies appear where wages are influenced by peculiar local conditions. In some cases the trend of the scale is affected by particular employees. However, it is believed that the result is fairly indicative of the rise in labor costs.

Certain points are noticeable. The standardized skilled laborers have experienced wage increases which have been fairly constant throughout the past eight years. On the other hand, common labor advanced slowly at first, experiencing but little gain during the years of building expansion (1911-1912), when skilled labor went ahead rapidly, but forged to the front with the general labor shortage following the war boom. Semi-skilled labor (helpers, such as fitters', blacksmiths', carpenters', masons' helpers, etc.) has naturally followed unskilled labor. However, whereas in 1910 such helpers usually received laborer's pay, at present they seem to have forged definitely ahead of those entirely unskilled and are rapidly becoming a class of their own.

This table of percentages is based entirely on weekly or monthly rates of pay, and does not take into consideration decreases in hours of work. There has been a decrease of one hour per day applying to many of the classifications listed.

TABLE OF PERCENTAGES SHOWING INCREASE OVER BASE RATES EXISTING IN JANUARY, 1910

Position	Jan., 1911	Jan., 1912	Jan., 1913	Jan., 1914	Jan., 1915	Jan., 1916	Jan., 1917	Jan., 1918	June, 1918
Steam plant:									
Shift engineers	0	0	10	10	15	15	15	25	30
Oilers	20	40	40	40	50	50	70	80	109
Firemen...	14	14	14	14	14	21	21	29	43
Coal passers	12	25	25	25	25	25	25	37	50
Boiler cleaners	7	7	14	14	21	43	43	50	57
Cleaners' helpers	12	25	25	25	25	25	37	62	62
Steamfitters	17	17	17	17	33	33	42	67	73
Fitters' helpers.	12	12	12	12	12	12	12	22	55
Station wiremen....	14	14	14	14	28	28	28	36	43
Distribution system:									
Inspectors ...	13	13	13	33	50	50	60	67	80
Crew foremen..	12	25	25	25	25	25	25	31	37
Linemen....	7	14	14	14	28	28	28	36	43
Apprentice linemen..	0	25	25	25	25	50	50	63	63
Groundmen.....	12	12	12	25	25	25	25	37	62
Inside wiremen ..	7	14	14	14	28	28	28	36	43
Cable splicers	6	11	11	11	22	22	22	27	34
Splicers' helpers	7	14	14	14	28	28	28	36	43
Patrolmen. ..	11	11	11	11	14	14	28	33	39
Substation operators	11	11	11	14	28	28	33	39	33
Trimmers...	8	15	23	23	38	38	38	54	69
Metermen....	9	18	36	36	45	45	45	54	63
Meter helpers.	10	10	10	20	20	20	20	30	40
Laborers....		12	12	12	12	12	25	37	50
Engineering department:									
Draftsmen.	8	17	25	30	40	40	40	50	67
Clerks.	0	8	17	17	17	30	40	54	58
Transitmen	0	8	8	33	42	42	58	67	67
Rodmen	0	11	11	44	44	55	55	55	67
Repair shops:									
Blacksmiths	9	9	18	27	45	45	45	45	55
Blacksmiths' helpers	11	11	11	11	11	22	34	44	56
Carpenters.	14	14	14	29	29	29	29	37	37
Carpenters' helpers	11	11	11	11	11	22	34	44	55
Masons...	18	54	54	69	69	69	69	85	108
Masons' helpers	12	25	25	37	37	37	37	50	63
Painters.	10	20	60	60	60	60	60	69	70
Painters' helpers	12	12	12	25	25	25	25	37	62
Machinists	10	30	30	40	40	60	60	92	92
Garage mechanics	8	8	20	33	58	58	58	75	75
Washers...	12	12	12	25	25	25	25	37	80
Chauffeurs	0	13	33	53	53	53	53	67	67
Truck drivers	0	13	33	33	33	33	55	55	78

In order to determine general averages of increased labor costs, eliminating variations due to changes in conditions or extension of plant, the average number of each listed classification employed at present was used as a basis and the total pay roll for a month was figured for January, 1910, January, 1914, and June, 1918, using the unit rates applying to each period. It was found that labor costs for January, 1914, indicated an increase of 21.6 per cent over January, 1910. June, 1918, shows an increase of 53.6 over January, 1910, and an increase of 26.2 per cent as compared with January, 1914.

Application of Printing-Press Motors

Major Features Needed in Motors and Control Apparatus to Meet Requirements of This Service—Typical Motor Data—Semi-Automatic Direct-Current and Alternating-Current Control and Full Automatic Control

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THE choice, installation and operation of motors for driving the presses and other machinery in printing plants and the equally important items of proper control for such motors form an interesting field for the attention of the motor application engineer. The marked development of electrical equipment for the printing industry is shown by the many installations, both of belted and direct-connected motor drives, and also by the adequate means for accomplishing the specific results in the control of such apparatus both by semi-automatic and by full-automatic control equipment.

Types of Machines Involved

In addition to the printing presses of the various types, the motor is also widely used for composing machines, folders, cutters, stitchers and binding machinery in the book and job printing establishments, and for such cases as matrix and plate-making machines, paper hoists, conveyors, exhaust fans and the like in the newspaper printing plants. In practically all of these cases the motor application problem is relatively simple, except perhaps for printing presses and folders, but in the former particularly the motor problem is of considerable importance and involves factors which require due care if the best results are to follow.[1]

Printing presses may be divided into three classes—job presses, cylinder presses with a flat bed, and rotary presses. The tendency in motor control is toward automatic or semi-automatic equipment which may take the form of push-button stations. In job presses the inertia is the element which determines the motor torque requirements, the steady running conditions corresponding to about one-half the power necessary for starting. Where reciprocating motion is involved, as in flat-bed cylinder presses, a belt connection between the motor and press is usually favored.

A common method used in the control of printing-press motors is to employ part armature resistance and part field control. Thus Carpenter[1] gives the following figures for job presses, namely, a speed reduction of about 40 per cent below normal by armature resistance and a speed increase about 25 per cent above normal by field control, accomplished by the so-called "predetermined speed-adjusting and self-starting" controller, which, in standard equipments, also has a self-contained service switch for purposes of starting and stopping.

Values given for other presses are 35 per cent speed variation by field control and 50 per cent by armature resistance for cylinder presses of the flat-bed type, and 50 per cent by field control and 40 per cent by armature resistance for rotary presses. For these larger presses push-button stations are particularly useful, and they are designed to include positions for stopping, running and for "inching," this last term applying to the operation of coaxing along the press when "making ready" for printing, for washing up, and for similar requirements.

Motor Data

Power requirements of printing machinery have been reduced to elaborate tabulations in complete form for ready reference by most of the manufacturers. Such tables for job presses are based on the inside dimensions of the press "chase" and the maximum number of impressions per hour. Thus a press having an 8-in. by 12-in. (20.3-cm. by 30.5-cm.) chase and making 2800 impressions (maximum) per hour calls for a ¼-hp. motor to take care of starting conditions. Similarly, a 17-in. by 22-in. (43.2-cm. by 55.9-cm.) chase and 1700 impressions per hour calls for a 1-hp. motor.

With the flat-bed cylinder press the size of the bed and number of impressions are made the basis for power requirements, while with a rotary lithographic press the size of the sheet and the number of impressions are used. However, figures of this kind give merely the horsepower requirements and to this extent are incomplete. Consideration must also be given to the mechanical characteristics of the press and the type of motor best suited to meet these conditions.

Other tabulations of a more complete nature are available from motor manufacturers. A few specially selected examples from a large mass of data collected by the Crocker-Wheeler Company[1] are shown in Tables I, II, III and IV, the last two cases referring to machinery other than presses. In a general way, it may be stated that the small size of the motors in these tables is no indication of the importance of electric drive in the operations involved. The symbol I. P. H. used in these tabulations refers to the number of printed impressions made per hour by the press, Table I giving both maximum and minimum values.

Types of Motors.

Standard direct-current motors for small job presses are usually compound-wound so as to meet the demands for heavy starting torque, common sizes ranging from ⅛ hp. upward. In the very small sizes for certain applications, like stitchers, such motors may be connected to the line directly without auxiliary starting resistance. One manufacturer who has specialized in printing-press motor equipment lists ⅛-hp. motors at 1700 r.p.m. for small job press work, proof presses, sewing machines and stitchers. For ¼ hp. the speed is rated at 1100 r.p.m.

For work involving medium or high speeds, that is, 1150 up to 1700 r.p.m., where constant-speed operation by armature control is desired, or where adjustable speed up to say 25 per cent with field control meets the conditions, this same manufacturer lists the commutating-pole direct-current motor from ½ hp. at 1700 r.p.m. upward.

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[1] Various sources of information have been drawn from in the preparation of these notes, including a paper on "Printing Presses," *Transactions A.I.E.E.*, Vol. 34, Part 1, p. 1314, by W. C. Yates; bulletins, data and illustrations from the Sprague Electric Works of the General Electric Company, Westinghouse Electric & Manufacturing Company, Crocker-Wheeler Company, Wagner Electric Manufacturing Company and Reliance Electric & Engineering Company. A number of references have also been made to an article on this general subject by C. E. Carpenter, "Standard Handbook for Electrical Engineers," fourth edition, page 1275.

A round-type direct-current motor is also commonly used for printing-press applications and has proved of considerable value. Among its characteristics are its heavy construction, high efficiency, inclosing frame, wide speed adjustment and a large overload capacity. This type is available in capacities which range from ⅛ hp. at 750 r.p.m. up to 5 hp. at 1150 r.p.m. It is particularly suited for binderies, where its inclosed construction is an advantage.

TABLE I—DATA ON TWO, THREE AND FOUR-ROLLER PRINTING PRESSES

Press No.	Bed	I. P. H. Max.	I. P. H. Min.	Press Ratio	R.p.m. Max.	Shaft Min.	Press Pulley	Hp Required
"Optimus" Two-Roller								
3	26 x 32	3000	1500	5.68:1	284	142	24	1½
4	27 x 39	2800	1400	6:1	284	140	24	1½
"Optimus" Three-Roller								
4	28 x 41	2500	1250	6:1	250	125	27	1½
"Optimus" Four-Roller								
5	30 x 43	2400	1200	7½:1	300	150	28	2
6	34 x 47	2100	1050	8:1	280	140	32	2
7	36 x 52	1900	950	9:1	284	142	32	2½
9	39 x 55	1800	900	9.6:1	288	144	32	3
10	41 x 55	1700	850	9.9:1	280	140	32	3
11	45 x 63	1600	800	10:1	266	133	32	3½
12	47 x 66	1500	750	10.57:1	264	132	32	3½

TABLE II—MOTOR DATA FOR JOB PRINTING PRESSES BASED ON THE USE OF 115-VOLT AND 230-VOLT MOTORS

Combined Armature and Field Control

Chase	Hp.	R.p.m. Motor Max.	R.p.m. Motor Nor	R.p.m. Motor Min.	Motor Pulley	Press Pulley	Controller
8 x 12	1/3	720	560	360	3 x 2	14 x 2	44
10 x 15	1/5	875	750	438	3½ x 2¼	12 x 2¼	44
12 x 18	2/5	900	780	450	3¼ x 2¼	14 x 2¼	44
13 x 19	2/5	900	780	450	3¼ x 2¼	14 x 2¼	44
14 x 20	1/2	660	550	330	4¼ x 2¼	14 x 2¼	44
14½ x 22	1/2	660	550	330	4¼ x 2¼	14 x 2¼	44

Combined Control and Friction Drive on Flywheel

Chase	Hp.	R.p.m. Motor Max.	R.p.m. Motor Nor.	R.p.m. Motor Min.	Motor Pinion	Flywheel	Controller
8 x 12	1/5	890	750	445	6 x 2½	32	44
10 x 15	1/4	2220	1800	1105	4 x 2½	40½	44
12 x 18	1/2	1950	1650	975	5 x 2½	40½	44
13 x 19	1/2	1950	1650	975	5 x 2½	40½	44
14 x 20	1/2	2020	1650	1010	4 x 2½	40½	44
14½ x 22	1/2	2020	1650	1010	4 x 2½	40½	44

Standard sizes of this type for printing presses are 1½ hp. at 850 r.p.m., 2 hp. at 700 and at 1150 r.p.m., 2½ hp. at 950, 3 hp. at 825 and at 1150, and 4 hp. at 1150, these values applying to flat-bed and the smaller rotary presses. The smaller motors mentioned in the preceding paragraph apply to job presses.

Commutating-pole direct-current motors for flat-bed and small rotary presses are available in standard sizes of 4½, 7½, 10, 12½ and 15 hp., and are also built up to 120 hp. Speed adjustment is accomplished by field control, a speed variation of 50 per cent being permitted with medium-speed motors and 100 per cent with low-speed units for flat-bed and small rotary presses.

For newspaper and magazine rotary presses one manufacturer recommends a commutating-pole motor with speed adjustment of 2 to 1 (that is, 100 per cent) by field control. Where it is desirable to have a wider speed range than 2 to 1, and especially with one-motor equipments, a speed range as high as 5 to 1, with field control, is available.

To give some indication of the alternating-current motors that are adapted to printing-press work the operation of flat-bed and small rotary presses will be considered. Wound-rotor two and three-phase induction motors are available in sizes from ¼ hp. up, for voltages of 110, 220, 440 and 550, and for frequencies of 25, 40, 50 and 60 cycles, but for the special case of flat-bed and small rotary presses the standard sizes of one company are 1½ to 15 hp. with usual speeds of 1800, 1200 and 900 r.p.m. for 60 cycles, and correspondingly lower values on the lower-frequency circuits.

Speed adjustment in motors of this type is accomplished by varying the auxiliary rotor resistance. By their use the special requirements of printing-press operation have been met successfully, considering large starting effort, low current at starting even under heavy load, and a low temperature rise even where operation is continuous throughout the day.

For newspaper and magazine presses the slip-ring type two or three-phase induction motor is also used, although its success is due in large measure to the perfection of a completely automatic alternating-current system of control.

Single-phase alternating-current repulsion-type motors are used to some extent and are especially applicable where speed adjustment must be accompanied by approximately constant torque. This motor is well suited to small presses in sizes ranging from ⅛ to 7½ hp. and for speeds from 1200 to 1800 r.p.m. They may also be employed for fans and blowers by belt or by silent-chain connection. Speed adjustment with the repulsion-type motor is accomplished by brush shifting.

CONTROL FOR BELTED EQUIPMENTS

Turning now to control features, the older form of belted motor equipment may be mentioned. Here the motor is started with its belt on a loose pulley and hence under no load. By means of a lever-operated clutch low speed is applied to the press, and by shifting the belt to a tight pulley high speed is applied.

The motors used for this form of drive may be of the adjustable or constant-speed direct-current or alternating-current types. The direct-current motors may be controlled by a hand-manipulated speed-regulating panel, and alternating-current motors either by a drum-type or a dial-type controller. Convenient mountings of these control devices for printing presses have been worked out.

TABLE III—MOTOR DATA FOR CUTTERS BASED ON THE USE OF 115-VOLT AND 230-VOLT MOTORS

Size	Cutter Flywheel Dia.	Cutter Pulley Dia.	Cutter Pulley Face	Cutter R.p.m.	Motor (Compound) Hp.	Motor (Compound) R.p.m.	Motor (Compound) Pulley Dia.	Motor (Compound) Pulley Face
30″	21½″	14″	2.75″	200	1½	900	3″	3½″
33″	23½″	14″	3¼″	200	1½	900	3″	3½″

TABLE IV—MOTOR DATA ON FOLDING MACHINES

Folder Data Pulley	Folder Data R.p.m.	Motor Recommended Hp.	Motor Recommended R.p.m.	Motor Recommended Pulley
10¼ x 3	135	½	550	
6¾ x 3	200	½	550	2½ x 3
8 x 3	300	1	780	3.2 x 3
6¾ x 3	300	1½	850	2.4 x 3
10 x 3	400	2	1175	3.4 x 3
6¾ x 3	294	1	780	2.6 x 3
8 x 3	360	1½	850	3.4 x 3
8 x 3	360	1½	850	3.4 x 3
8 x 3	300	1	780	3.1 x 3
8 x 3	420	1½	850	4 x 3
8 x 3	546	1½	1250	3.5 x 3
8 x 3	546	1½	1250	3.5 x 3
8 x 3	546	1½	1250	3.5 x 3
8 x 3	258	1½	850	2.4 x 3
6¾ x 2¼	120	1	550	....
6¾ x 2¼	210	1	550	2.6 x 2¼
10 x 3	420	2	1175	3.6 x 3

One manufacturer's equipment for semi-automatic direct-current control consists of a two-motor driving equipment, a master dial switch, a controller panel and resistance and push-button stations. By these means it is possible to start, to "inch," to run at a low speed and to stop the press at any one of the push-button stations. It is interesting to note certain aspects of this form of printing-press control.

To increase or decrease the press speed the handle of a master dial switch, mounted on the side of the press, is turned. The various steps of armature resistance are inserted or removed by contactor switches on the control panel. These, in turn, are operated by push buttons on the dial switch. The dial switch is also used to insert or reduce the auxiliary field control resistance. Current-limiting relays prevent too rapid acceleration of the press by wrong handling of the dial switch, so that this system possesses some of the

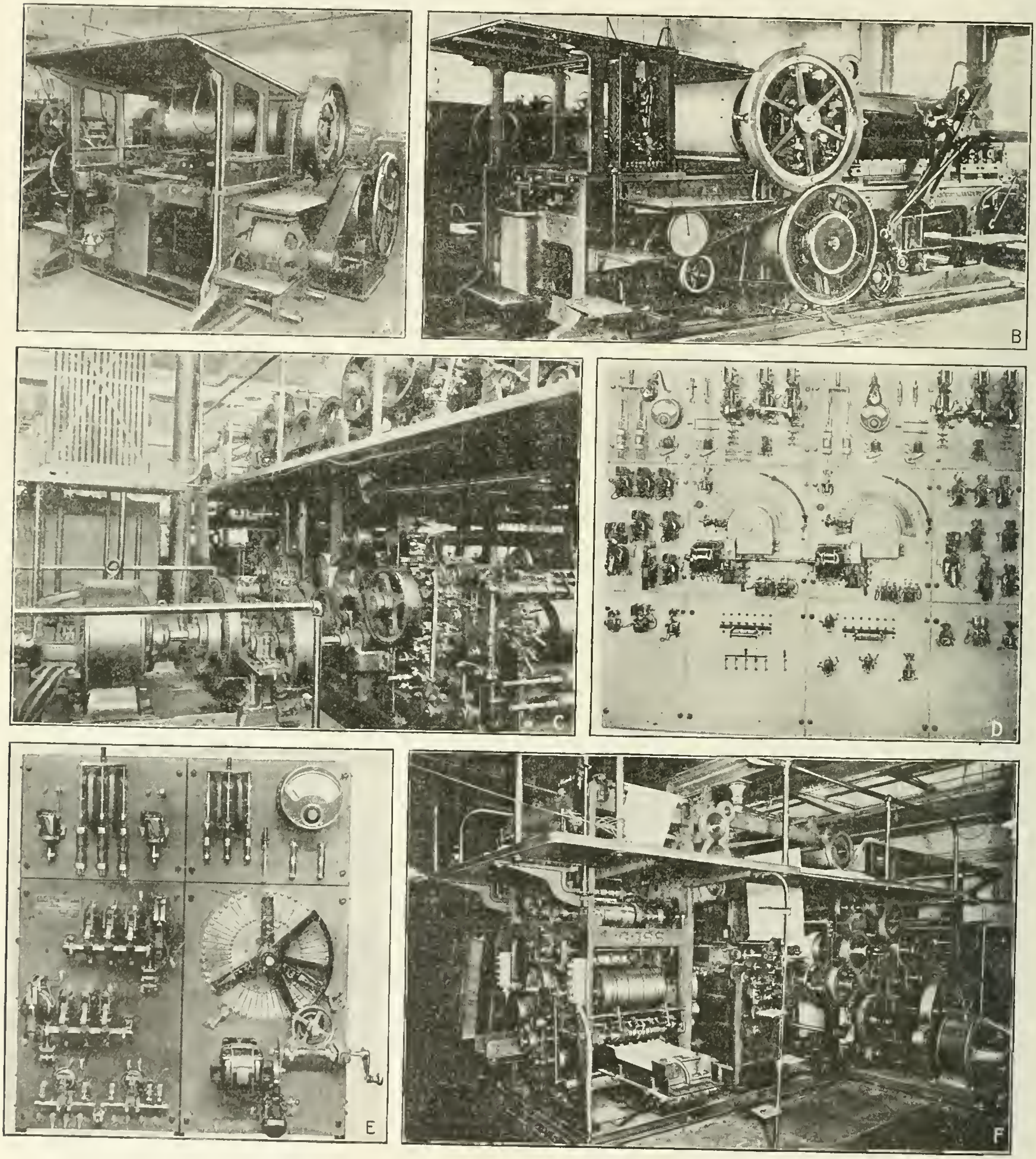
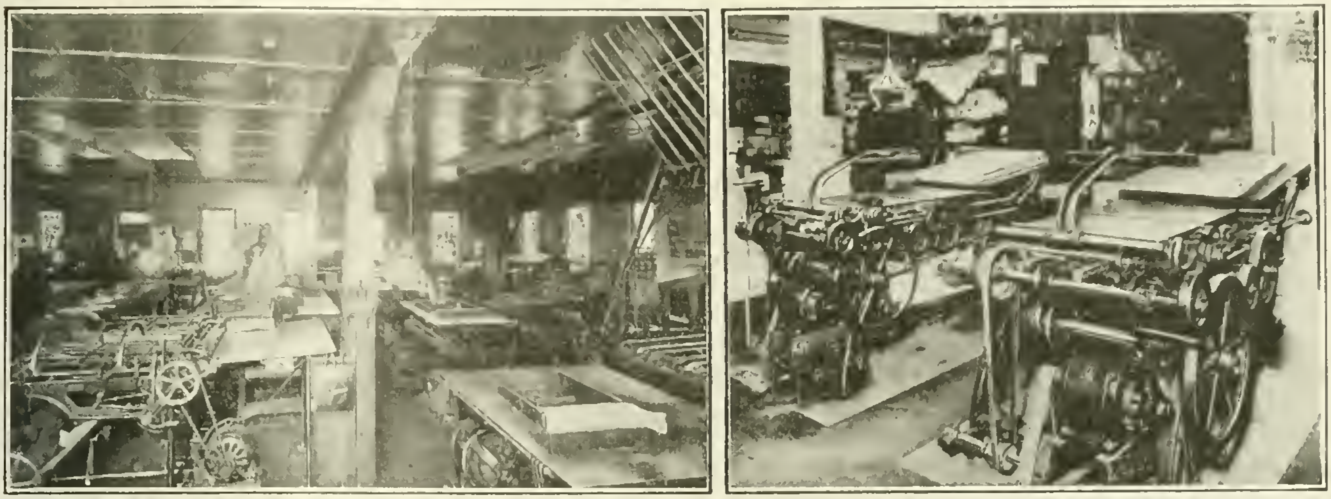


FIG. 1—MOTOR AND CONTROL APPLICATIONS FOR PRINTING PLANTS

A—Printing-press belt operated by direct-current motors. B—Adjustable-speed motor, 6 hp, 600 to 1500 r.p.m., equipped with automatic starting control and speed dial applied to a 43-in. by 56-in. printing press. C—Example of direct-current motor-drive for the operation of cylinder printing presses (note mechanical connections). D—Complete automatic controller for four-motor printing press. E—Panels for full automatic double-motor printing-press control. F—Cylinder press driven by direct-current motor and controlled by push-button stations.

features of the completely automatic control system described below.

The alternating-current two-motor semi-automatic control system is used in sizes ranging from 15 to 100 hp. and is applicable to newspaper and rotary magazine presses. Here also the controller is of the dial type. and push-button stations are employed in connection with it. By means of properly graduated controller steps it is possible to adjust the press cylinder speed from say 10 revolutions per minute up to 200 r.p.m. to 300 r.p.m.



FIGS. 2 AND 3—POLYPHASE MOTORS FOR PRINTING-PLANT OPERATION; PRINTING-PLANT FOLDERS BELT-CONNECTED WITH DIRECT-CURRENT MOTORS

The practical operation of one semi-automatic system extensively used for either direct-current or alternating-current motors may be best explained by the following details. The push buttons are in groups of four, the buttons marked "Jog," "Stop," "Safe" and "Run" respectively. Pushing the "safe" button prevents starting until the "run" button at that same station shall have been closed.

With the controller at the off position, the "jog" button may be pushed for inching along the press by fine movements. The same "jog" button, if closed with the controller at its "slow" position, starts the press and operates it at low speed. The "stop" button, when closed, stops motor and press. For an increase or decrease of speed the controller must be hand-operated. When the equipment is stopped for any reason, the controller must be placed at its off position before starting is again possible. No-voltage and overload protection are employed.

Full-Automatic Control System

One "full-automatic" control system on the market possesses the feature of being entirely automatic through push buttons. Each push-button station has five buttons, but as many stations as desired may be used. The five buttons are marked "Jog," "Fast," "Slow," "Safe Stop" and "Run," and the successive features of operation are as indicated in the paragraphs that follow:

Closing the "safe stop" button at any station prevents starting from any of the stations until the "run" button at this particular station is closed. This is an important protective feature. "Inching" or jogging the press along is accomplished by the so-called "jog" button, the press moving only as long as this button is held closed and stopping as soon as it is released.

The "fast" button starts and accelerates the press, acceleration continuing gradually as long as this button is held closed. On releasing the "fast" button the press then continues to run at the speed attained just before the button was released. Similar operation with decreasing speeds follows the closing of the "slow" button. Immediate stopping is brought about by the "safe stop" button. This scheme is designed to be fool-proof and accident-proof and represents a notable development in automatic control practice.

Examples of printing plant motor and control applications are shown in accompanying illustrations.[2]

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[2] Figs. 1D and 1E are due to the Sprague Electric Works of the General Electric Company; Figs. 1A, 1C, 1F and 3 to the Westinghouse Electric & Manufacturing Company; Fig. 1B to the Reliance Electric & Engineering Company, and Fig. 2 to the Wagner Electric Manufacturing Company.

The [motor-truck] manufacturers and dealers fully realize that steel is to-day the world's most needed metal and that, in view of the urgent war demands of this nation and its allies, it is well-nigh treasonable to consume a pound of it that can be saved. With this in view, the manufacturers and dealers pledged themselves to reverse their practices of normal times, and, instead of selling through solicitation as many trucks as possible and furnishing new trucks to replace old ones, to use their utmost endeavor to induce owners and operators to repair and use the trucks they have as long as possible, to operate them fully loaded, and through shifts of drivers and otherwise to keep them in use during the greatest possible portion of each day, to the end that each unit shall perform a maximum of service and thus reduce proportionally the necessity for building new trucks.—*War Industries Board.*

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

INTELLIGENT INSPECTION PREVENTS POWER-HOUSE LOSSES

Man Added to Station Force to Report Necessary Repairs to Chief Engineer and See that Repairs Are Made

Periodical inspection of power-house equipment can be made a profitable power-house practice. An especially thorough inspection of equipment taken out of service for repairs should be insisted on, in the opinion of J. M. Strike, chief engineer of the Acme Power Company, Toledo, Ohio. This system has been tried out by William Long, superintendent of production of the Toledo Railways & Light Company, and has proved so successful that a boiler inspector was added to the permanent organization. His duties are to inspect all boilers and boiler equipment and to report the necessity of repairs.

MAINE COMPANY STATES ITS POTHEAD PRACTICE

Finds Potheads Useful and Economical on Both Overhead and Underhead Circuits—Save Money at Railroad Crossing

For both overhead and underground construction the Central Maine Power Company has found it pays to use disconnecting potheads. On pole lines they are installed even with the cross-arm, using the terminal bushing, which can be disconnected. They were selected for this particular purpose on account of their neat appearance and the flexibility they permit. On lines leaving power houses they are particularly adaptable, giving a wide range of choice in arranging feeder circuits coming from the switchboard by way of underground ducts and up the side of the pole. This method of construction has been found to require less building material and fewer cross-arms and insulators than are needed by the old method of carrying the feeder circuits out through the side of the building to the pole line.

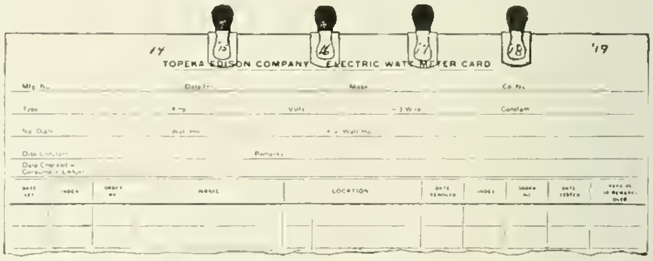
A typical case in which potheads were used to help solve a railroad crossing problem occurred at Waterville, Maine. The company there has a four-wire three-phase distribution line on 35-ft. (10.7-m.) poles. On account of a new overhead railroad bridge being built across the highway, it was necessary to remove the wires from their established places. To do this the company could either use 65-ft. (19.8-m.) poles to go over the track with the proper clearance or go underneath the track with underground cable. After figuring all expenses, it was found to be 20 per cent cheaper to dead-end the line at each side of the bridge and use 110 ft. (33.5 m.) of four-wire No. 2 5000-volt armored cable with potheads on each end, mounted near the cross-arm on each dead-end pole. This plan had the further advantage of placing the cable about 2 ft. (61 cm.) below the surface of the road, out of the way for all time. On this installation as well as on other similar jobs the company has always found it necessary to install lightning arresters very close to all cable terminals.

The company finds another use for potheads when supplying large power customers with 2200-volt service. On such jobs the circuits are put underground on the customer's property, and brought up directly at the customer's private distribution station to avoid all liabilities from high-tension wires on private property.

MAKING METER-DEPARTMENT RECORDS EASY TO HANDLE

Status of Test Work Is Shown at a Glance by Signals Attached to the Top of the Cards—Simplicity of Method Recommends It

Meter records of the Topeka (Kan.) Edison Company are kept on 5-in. by 8-in. (12.7 to 20.3 cm.) cards, one side of which carries the usual data concerning the rating of the meter and the locations it has occupied during its life, while the other side gives space for information regarding its accuracy when tested. In order to make it easy to pick out the cards of meters which should be tested, signals are attached to the tops of the cards. The signals consist of paper clips made by the B. Graff Company of Boston. One of these is attached to each card in one of four positions, indicating when the meter was tested. One position means 1915, another 1916, another 1917 and another 1918.



METER INFORMATION CARD WITH SIGNALS ATTACHED

Thus, when it is desired to test meters, it is easy for the department head to go through the file and pick out the cards of the meters that should be tested, and from these cards to make up a route for the testers to follow.

Some difficulty has been experienced in making the cards stand straight in the card file, because the signals make the cards thicker at the top than at the bottom. This trouble has been reduced considerably, however, by bending heavy pieces of galvanized iron to the shape of an inverted V and standing them in the drawers.

GRAPHICAL SOLUTION OF ILLUMINATION PROBLEMS

Flux-of-Light Method for Constructing Chart from Which Number of Lamps for Different Installations May Be Determined

BY N. S. DICKINSON
Newark (N. Y.) Technical School

To determine the number and size of lamps required to light a room effectively the chart shown in the accompanying illustration has been developed by the author. With the dimensions of the room, nature of ceiling and walls—that is, light or dark in color—and the kind of work to be performed in the room known, it is an easy matter to find the number of lamps of any size needed. An example worked out (Fig. 1) illustrates the ease with which the problem can be solved.

The four-quadrant diagram of Fig. 2 shows the method by which the diagram was evolved. Its construction is based on the formula that: Number of lamps = (area of horizontal plane × efficiency) ÷ (utilization factor × light flux per lamp). The graphic method is facilitated by the fact that all terms of this equation are of the first degree. The lines in quadrant 2 (Fig. 2) are drawn for 55, 50, 45 and 40 per cent utilization factors using direct lighting units. Their assumed equivalents for semi-indirect lighting are 37, 33, 30 and 27 per cent respectively, as indicated in the right-hand vertical scale of Fig. 1. The compact arrangement obtained in Fig. 1 is constructed from Fig. 2 by placing all of these straight-line curves in the first quadrant.

Standards of the Illuminating Engineering Society were used in selecting the illumination requirements for various installations. Light flux in lumens for different type lamps was taken from the Data Book, Schedule 1, Edison Lamp works.

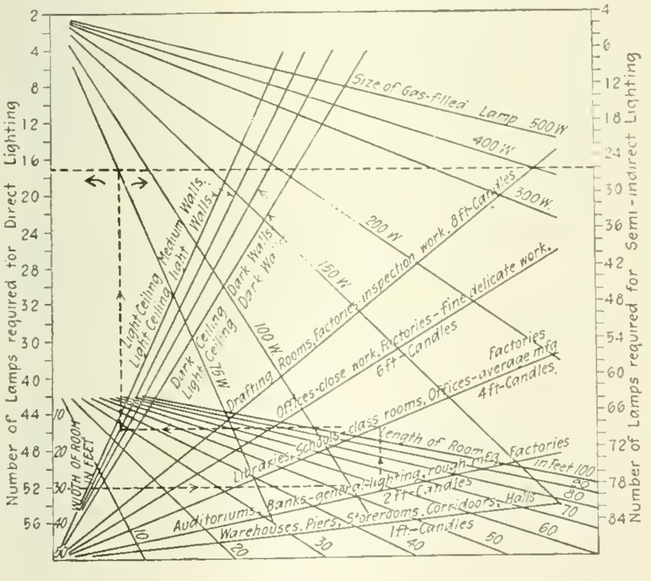


FIG. 1—CHART FOR SOLVING ILLUMINATION PROBLEMS

Assuming that it is desired to light a room 30 ft. (9 m.) by 60 ft. (18 m.) which has a ceiling light in color and medium walls, and which is to be used for general office work, the following procedure is carried out: From the 30-ft. (9-m.) mark on the "Width of Room" move horizontally to the 60-ft. (18.-m.) "Length of Room" line (follow dotted line), then vertically upward to line marked "Offices," again horizontally to line "Light Ceiling, Medium Walls," and then upward to size of lamp lines. If a 75-watt lamp is used, the number of direct or semi-direct units is determined from the scales in the left-hand and right-hand sides of the chart respectively.

Bowl-frosted or half-frosted lamps should always be used for direct lighting installations, unless the lamps are mounted more than 15 ft. (457 cm.) above the floor, and even then they are preferable. Contrary to the general opinion, bowl frosting reduces the useful light flux not more than 5 per cent or 6 per cent. The reduction of glare effected by their use more than compensates for the slight loss of light flux, and therefore really produces more comfortable and effective lighting conditions.

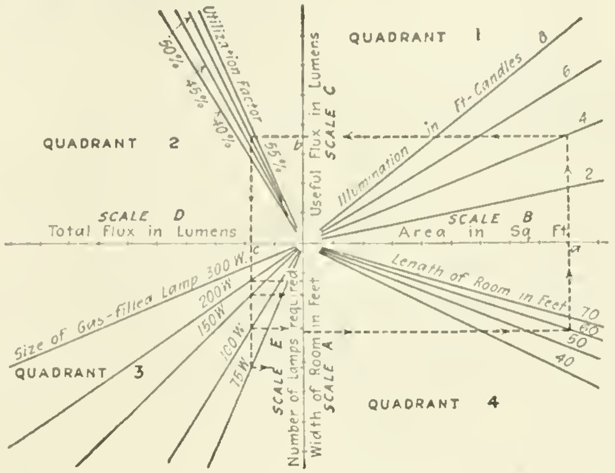


FIG. 2—CHART DRAWN IN FOUR QUADRANTS FROM WHICH FIG. 1 IS DERIVED

The recommendations of the manufacturers should always be carefully followed when selecting reflectors for an installation, as it is important to obtain a type and size of reflector designed for the spacing, mounting height and size of lamp to be used.

DRIVING POLE STUBS WITH A MOTOR TRUCK

Pile Driver Made in Telephone Company's Shop with Which Stubs Were Driven at a Cost of Six Dollars per Pole

An important toll lead between Los Angeles and Long Beach, on the system of the Southern Division, Pacific States Telephone & Telegraph Company, had been seriously damaged by flood waters. On this account, and also because of the silty nature of the soil, plans had been made to abandon the line for another route. The construction department, however, developed and successfully carried out a plan for reinforcing the existing lead with pile stubs.

The equipment used consists essentially of a pile driver having guides which could be attached to the pole to be reinforced. The hammer, made of concrete, was raised in the guides by means of a steel rope which was operated from a winch mounted on a motor truck and driven by the automobile engine. Piles 18 ft. (5.5 m.) in length were driven to a depth of 14 ft. (4.3 m.) alongside the poles and the poles secured to these stubs in the usual manner. The labor cost per pile driven was $6. The lead was thus made safe at about 10 per cent of the cost of a new line, and the net saving was approximately $7,500. The cost of the hammer and guides was $35.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

RECORD FOR APPLIANCE SALES IN DOHERTY ORGANIZATION

Figures Received for First Six Months Indicate that the Total for 1918 Will Exceed $2,500,000

The sales of gas and electric appliances by the new-business departments of the Doherty Organization for the first six months of 1918 indicate a large rate of increase, as shown by the following comparative table:

Year	Sales Value	Year	Sales Value
1914	$396,110	1916	$1,224,390
1915	694,363	1917	1,870,000

	Sales Value
Six months, 1918	$1,073,696
Six months, 1917	769,885

Estimating the remaining six months of 1918, it is expected the total for the year will exceed $2,500,000.

UTILIZING SURPLUS CAPACITY OF WATER-WORKS STATION

Features of Contract Securing for Utility 225 Kva. of Energy Without Involving Capital Expenditure

The enormous demand for power upon central-station companies has presented a problem to operators which it is becoming increasingly difficult satisfactorily to meet. The exigencies of war have not only made it imperative that central stations shall utilize every possible piece of generating apparatus which they can obtain but many of them are also supplying their newly acquired power users by means of purchased energy. In the past year many lines have been constructed for the interchange of energy between central stations in adjacent cities. Many contracts have been entered into between central stations and large industries manufacturing their own electrical energy for use by central stations of every kilowatt over and above the needs of the industry concerned.

Another interesting phase of the situation, which will possibly be a partial solution of the difficulties of some central stations, has now come to light through arrangements being made by the utility companies for the purchase of energy from municipalities operating their own waterworks systems. A contract of this nature lately entered into in a Middle Western city of the 25,000 population class calls for the purchase of the entire output of electrical energy generated by a 225-kva. generator over and above the pumping requirements.

Under the terms of the contract the waterworks bind themselves to furnish such electrical energy at all times, and the company to receive and pay for such energy to the extent of its demands for a period of three years; and provision is made that if during the term of the contract the waterworks shall have any additional electrical energy for sale the company shall have the option to purchase it at the same rate and under the same terms as provided in the contract for the purchase of the energy generated by the 225-kva. generator.

The rate provided to be paid by the company to the waterworks for the electricity so purchased is somewhat in excess of the actual cost of generation by the company's own generators, but the advantage of having an immediately available supply of electrical energy for war-time demands outweighs this small difference.

Provisions are made, of course, for the accurate measurement of energy received by the company under the contract and for rebating pro rata to the party suffering from any inaccuracy discovered. The contract further provides that during the life of the contract the company shall not be required to pay the waterworks for electrical energy purchased so long as the city is indebted to the company for street-lighting service, and that in the event of the city paying the company for its street-lighting service in scrip or warrants the waterworks will accept such scrip or warrants at full value in payment for electrical energy purchased by the company from the waterworks.

The contract for the purchase of this energy was made conjointly with the renewal of the street-lighting contract existing between the city and the company. It provides the waterworks with a means of disposing of excess electrical energy generated at a profit and gives the company a reserve supply of power which it so much needs.

CHARGING $1 OR MORE FOR RECONNECTION IS FAVORED

Labor Scarcity and Tight Money Lead Central-Station Managers to Drastic Treatment of Slow Payers and Vacationists

Among central stations of the Middle West there is a growing tendency to enforce more strictly rules concerning a charge for reconnecting a customer's service when it has been disconnected for non-payment or other causes. The general policy seems to be to make a charge of $1 for this reconnection. There are some managers, however, who favor increasing this amount to $2. Strict enforcement of this rule is said to do much to cut down unnecessary labor charges incident to disconnecting in order to collect money and reconnecting after payment has been made. A firm policy on this matter has the further advantage of making collections easier and payments more prompt. This latter feature is considered important under prevailing financial conditions.

Among those who favor the two-dollar charge are some who have many customers that ask for disconnection during the summer months while they are away from their city residences. It is figured that if the company has its investment in lines, transformers and meters for these customers idle during the summer months, more than a reconnection charge of $1 should be made for the periodic discontinuance of service.

ROUND-TABLE DISCUSSION OF LABOR PROBLEM IN IOWA

Central-Station Men Give Opinions on Increasing Wages with Some Data on Power-House Labor Prices

One of the features of the recent convention of the Iowa Section of the National Electric Light Association was the discussion of the labor situation. This brought out with great clearness the serious trouble with which the public utilities of Iowa, and of the entire Middle West as well, are confronted. Mr. Hamlin of Mason City said that while labor in his city was not unionized, a sense of fairness had made it necessary to raise the wages of all employees. Men must be paid enough wages to enable them to meet their bills. It is simply a matter of getting together with the men and figuring out in each case what they can get along on. The real labor problem is not "Shall we advance wages?" but, rather, "How much shall we advance them?" Utilities would appreciate this fact better if they looked more closely into the cost of labor turnover. When all the items pertaining to the expense of training men are considered, it will easily be seen that it is better to pay an old employee a little more and retain him than to let him go and fill his place with a man at the same price or a little less. At the same time, an intelligent employee should be made to see that steady work at a job in an essential industry would be better for him in the long run than frequent short jobs in industry temporarily prosperous during the war.

W. H. Abbott of Omaha, who is connected with plants operating in small towns where no labor organizations exist, related an experience in one town where the power-house labor got together and threatened to shut down the plant if an exorbitant wage were not paid. The situation was solved by presenting the facts to the local representative of the State Council of Defense. The chairman of this committee took the situation in hand, telling the men that their act was in fact treasonable, as they were shutting down an essential industry in war time. The men went back to work, and wages were later adjusted. In the fifty properties served by the company which Mr. Abbott represented he stated that it had been the policy to give the employees a large number of small wage increases rather than a fewer number of larger raises. He pointed out that the recent wage increases granted railroad employees by the government had made the continuance of this policy difficult, as the establishment of the railway wages gave employees a definite mark to aim at and made their demands more insistent.

Speaking on methods of holding labor, R. E. Brooks of Red Oak said that many employees of his company are in the draft age and were placed in deferred classification on account of their employment. Under these conditions he said the men hesitate to leave the employ of the company. Nevertheless, when a man asks for an increase in wages his request is usually granted.

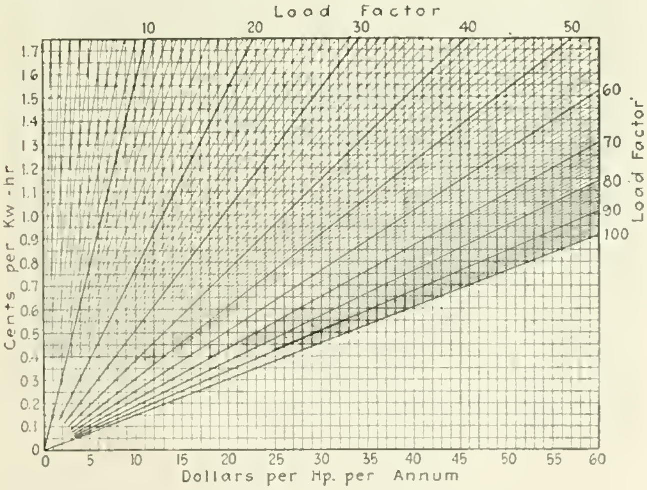
A discussion of power-house labor costs by M. G. Linn of Des Moines, R. C. Clifton of Ida Grove, G. T. Hughes of Sheldon and C. O. Ingersol of Marion brought out that the following wages are being paid: Sheldon—twelve-hour shifts, $85 per month for firemen and engineers. Red Oak—formerly eight-hour shifts for $60, recently changed to an hourly basis, because it gives the men an opportunity to do extra work and earn overtime pay. This gets the company's work done and gives the men more money. Ida Grove—firemen, $75; engineers, $85; electricians, $100. Marion—firemen, twelve-hour shifts, $75 to $80; engineers were formerly pand $85, now paid $90, and it is expected that they will have to change to an eight-hour shift.

George E. Cornelius said he was paying his engineers $100 and firemen $82.50 for twelve-hour shifts. He expressed the opinion that it was better to pay increased wages to the firemen than to lose them frequently, as a good fireman can save the company considerable money and a poor fireman can lose quite a sum for it in a very few hours.

TO DETERMINE INCOME AT KNOWN LOAD FACTOR

Chart Used by Canadian Company Makes It Possible to Know the Rate per Horsepower-Year at Any Energy Rate

The rate research committee of the Canadian Electrical Association published in its report at the recent annual convention a form of rate curve in use by one of the member companies of the association and which, the committee states, had not hitherto been published. By the use of this plan, as shown, any rate schedule can be compared with any other rate schedule within the limits of the schedule as to price.



CONVENIENT FORM OF RATE CURVE

The lines radiating from the original are load-factor lines, and as the rate is given, the total rate per horsepower-year is immediately readable. The procedure is to trace up the known load-factor line until it hits the horizontal line corresponding to the rate for this service. The reading directly below this point will give the dollars per horsepower-year.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Indirect Construction of Rigorous Diagram for Revolving-Field Motors.—V. GENKIN.—The use of circular diagrams in the practical study of asynchronous motors with revolving field is restricted for two reasons: In the case of large motors functioning with a very small slip the diagram does not give the characteristics pertaining to normal operation with enough precision; in the case of motors of small power where diagrammatic results have great practical utility the simple form of diagram cannot be employed to advantage because of the relative importance of the stator resistance. The author describes a graphic process which permits the transformation in a very simple manner of the Blondell-Heyland-Behrend circle into a rigorous diagram which may readily be applied.—*Revue Générale de l'Electricité,* June 29, 1918.

Iron Commutators.—B. G. LAMME.—About twenty-seven years ago the writer made extended tests on the use of iron street-railway commutators. The machines soon developed "high mica" and the commutators gradually blackened, the contact surfaces blistered and sparking gradually increased until the commutating conditions became prohibitive from the operating viewpoint. It was not recognized at first that the high mica was the result of burning rather than the cause. Quite complete tests were also made with aluminum street-railway motor commutators. This material served better than iron, in the sense that burning and blackening and high mica did not appear so quickly. However, there was no tendency to polish, and the commutator soon assumed a dull appearance, which gradually changed to a blackened and burnt condition. In large machines one serious condition might be encountered with other than copper commutators. At present these machines are built for quite high peripheral speeds of the commutators, and construction difficulties are encountered which would make any increase in their length or diameter very objectionable. It is thus obvious that the use of iron in commutators, while possibly worth consideration under present or near-by conditions, is not in the direction of an advance in the art. In fact, it is a big step backward.—*Electric Journal,* July, 1918.

Lamps and Lighting

Lighting of Office Buildings.—A general discussion of lighting units and fixtures, systems of illumination and their application to local conditions.—*Electrical Dealer and Contractor,* August, 1918.

Generation, Transmission and Distribution

High-Power Central Stations.—L. CONGE.—First part of an article in which the author, recognizing the necessity of great central stations controlling electrical distribution over large regions, comments on the lack of uniformity in their arrangement and advocates standardization of equipment and lay-out. He divides high-power central stations into four classes: (1) Generating stations (usually hydroelectric) in which all the power produced is distributed at high tension to distant substastations; (2) transformer stations, where electricity received from the generating station is stopped down and distributed at medium tension to the network; (3) hydroelectric or thermoelectric generating stations distributing directly at medium tension part of the energy produced and transforming another part for transmission at high tension; (4) generating stations (usually thermoelectric) which distribute directly at medium tension all the energy produced. The principal conditions to which all these installations should respond, to the effacement of every other consideration, are, in their order of importance, reliability of service, flexibility of operation, economy, and possibility of extension. A scheme proposed for a hydroelectric generating station and an installation of step-up transformers is detailed in this installment.—*Revue Générale de l'Electricité,* June 22, 1918.

Efficient Combustion of Coal.—New and important developments in burning coal economically and the utilizing of pulverized coal are discussed.—*Journal of American Society of Mechanical Engineers,* July, 1918.

Selection of Mechanical Stokers.—The kinds of plants and coals to which different types of mechanical stokers are adapted are outlined and limitations to their use in small plants are cited. The subject is considered as follows: Reclassification of coals on ash-content basis, effect of fuel-bed disturbance, the field for the mechanical stoker, classification of stoker plants, coal classification, types of boiler plants, adaptability of stokers to different requirements, location of non-coking coals, how to burn green lignite successfully. The article also contains tables of different kinds of coals and analyses thereof.—*Journal of American Society of Mechanical Engineers,* July, 1918.

Application of the Automatic Railway Converter Substation.—C. S. BURLINGHAM.—This article discusses the essential features causing the substation to operate when power is required and to shut down when there is no demand. The equipment consists of various mill-type contactor switches on the alternating-current side, the usual remote-control alternating-current switching equipment, a few relays, a polarized motor-relay and resistances. The starting and stopping, the protective devices used and advantages of automatic substations are dealt with.—*Sibley Journal of Engineering,* Cornell University, July, 1918.

Gas Firing of Boilers.—T. M. HUNTER.—This gives a number of tables of heat losses, calorific values, composition, etc., of coke-oven, blast-furnace and producer gases in order to enable results obtained from gas-fired boilers to be tested. The main reason for blast-furnace gas not being used with greater success is that it carries large quantities of dust, resulting in decreased evaporation and frequent cleaning of the plant. Regenerative coke-oven gas has higher calorific value than blast-furnace gas, but the efficiency is still low. It is important that gas should be dry when burned, as water vapor reduces the flame temperature and wastes a large quantity of sensible heat. The cost of cleaning gas is about 2d. (4 cents) per 35,000 cu.ft. by either the wet or dry process. Heat transference and means for improving it are discussed.—*Science Abstracts, Section B*, May 31, 1918.

Some Fundamentals of Power-Factor Correction.—R. A. McCARTY.—The theoretical treatment of power factor correction is given with the aid of vector diagrams. The author points out the use of synchronous condensers for this service and the use of the over-excited synchronous motor with added mechanical load. Converters may only be used for power-factor correction to a limited extent on account of armature and field heating. He points out that static condensers might be used for the purpose, but this scheme has not been commercially developed to any great extent.—*Association Iron and Steel Electrical Engineers*, March, 1918.

Traction

New South Wales Government Tramways.—Details are given of track construction, types of car (which are arranged for multiple-unit operation if desired) and a unique system of route signs. Statistical information is also embodied in this article.—*Electric Railway Journal*, July 6, 1918.

Installations, Systems and Appliances

The Bocaquilla Plant.—Description of the hydroelectric power house at Bocaquilla, on the Conchos River, State of Chihuahua, Mexico. The dam is 74 m. (242 ft.) high, and the artificial lake impounded is said to be largest in the world, having an area of 175 sq.km. and a content at the 70-m. (230-ft.) level of 3,150,000,000 cu.m. (about 4,200,000,000 cu.yd.). Double Francis turbines rated at 10,000 hp. are directly connected to alternators generating 6250 kw. at 400 volts, 1130 amp. and 360 r.p.m. The energy is raised to 63,600 volts and will eventually be transmitted at 110,000 volts. The high-tension line, 76 km. (47.2 miles) in length, feeds the mining district in Parral. The electrical equipment was furnished by the General Electric Company and the hydraulic machinery by Escher, Wyss & Company, Zurich, Switzerland.—*Revue Générale de l'Electricité*, June 22, 1918 (abstracted from the *Schweizerische Bauzeitung*).

Practical Alternating-Current Problems.—WILLIAM R. BOWKER.—The writer discusses the operation of rotary converters and their interconnection with polyphase current apparatus. The most desirable methods of starting and operating are explained, the article being illustrated by schematic diagrams of connections. —*Electrical Engineering*, New York, July, 1918.

Electric Furnace for Annealing and Forging of Steel. —WIRT S. SCOTT.—To secure even moderately successful results with carbon beds it was found that resistor material must be of the purest carbon or graphite, of which it was difficult to obtain a supply sufficient for operating furnaces. When such a furnace was maintained at sufficient temperature to turn out steel at 1800 deg. Fahr. (980 deg. C.), it was found that the temperature at the bottom of the resistor bed was approximately 3600 deg. Fahr. (1980 C.). This high temperature causes difficulty in furnace maintenance. Experiments were made to determine the suitability of silicon carbide as resistor material. The decomposition of this material takes place at about 4000 deg. Fahr. (2200 deg. C.). It may be molded in block form and used in the ceiling or walls, thus equalizing furnace temperatures. The resistor has a high negative temperature coefficient. Semi-automatic control has been developed, but full automatic control is anticipated. The furnace has thus far given good results in forging, vitreous enameling and for reheating glassware.—*Proceedings Iron and Steel Electrical Engineers*, April, 1918.

Electrochemistry and Batteries

Purification of Sulphuric Acid for Storage Batteries.—Sulphuric acid for storage batteries should be chemically pure at a concentration of about 22 deg. Baumé, or even 34 deg. After having diluted it to the degree desired and having filtered it, it is essential to add 40 cu.cm. to 50 cu.cm. of a solution at 7 deg. Baumé of sulphur of barium for each 50 l. to 60 l. (52 qt. to 63 qt.) of acid. This mixture should be stirred and allowed to stand until no more sulphydric acid is given off. All the metallic impurities are thus precipitated and a very pure acid can be obtained by decantation.—*L'Industrie Electrique*, June 10, 1918.

Zorzi System for the Electrolytic Production of Hydrogen and Oxygen.—G. CARRARA.—The electrolytic cells of the new system devised by Zorzi are chiefly characterized by the absence of diaphragms and by the peculiar shape of the electrodes. Each of these is formed of sixteen iron bells open at the top, soldered to iron bars and equally spaced, each iron bell being covered by a glass one also open at the top. A larger glass bell covers the columns so as to lead the gas into a collector pipe. The gases developed at the surfaces of the iron bells are therefore immediately sent through the collector pipe, so that the diffusion of gases is reduced to a minimum. The cells are made of cement, sixteen cells forming a battery. The H and O collector pipes are connected to trunk collector pipes, which lead the gases to the gasometers. The electrolyte is a soda solution of density 1.17. The degree of purity of the gases obtained by the new system is very high—1.92 per cent of H in O and 0.34 per cent of O in H. Owing to their large content of electrolyte, the Zorzi cells allow of working at very different current densities without the purity of the gases being practically influenced. The new system is employed in the Neuport-Macchi works at Varese for oxyhydrogen and oxyacetylene soldering.—*Science Abstracts, Section B*, May 31, 1918 (abstracted from *Elettrotecnica*, March 5, 1918).

Telegraphy, Telephony and Signals

Telephone Lines in the United States.—G. VALENSI. A reprint of the extended report on American telephone practice made to l'Ecole Supérieure des Postes et Télégraphes on Oct. 12, 1917. The methods of construction, the use of aerial cables and the various means employed to locate defects are among the points discussed.—*Revue Générale de l'Electricité*, June 22, 1918.

Scientific and Industrial Research

(Printed in the Third Issue of Each Month)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Co-operative Work.

Conducted by Prof. Vladimir Karapetoff
Cornell University, Ithaca, N. Y.

PROMOTING CO-OPERATION IN INDUSTRIAL RESEARCH

Development of Existing Agencies Urged Central Laboratories and Publication of Standards Based on Research Recommended

At the recent convention of the American Society for Testing Materials held in Atlantic City Alfred D. Flinn, secretary of the United Engineering Society, Engineering Foundation and Engineering Council, spoke of the necessity for further development and coördination of the existing agencies for industrial research. The National Research Council, the national engineering societies and their library, some government bureaus, many industrial establishments and educational institutions are conducting research of one kind or another, but they must be brought into a much closer relationship with one another.

Speaking more particularly of the part that the Engineering Foundation might play in this work of coördination of research, he mentioned: (1) the Engineering Societies' library, which needs larger additional funds for the creation of a great card catalog of scientific literature to enable many problems to be answered directly, without loss of time and money for research; other scientific libraries should be linked with this one; (2) great engineering laboratories should be established at two or three places in the country, to investigate engineering problems of public character; (3) the determining and publishing of engineering standards based on research work; (4) a research periodical wholly free from commercial basis, to convey the results of research to the profession and to the general public; (5) information as to the existing research centers and facilities, their equipment and facilities, and the problems under investigation. A preliminary list of such laboratories was appended to Mr. Flinn's paper.

INDUSTRIAL RESEARCH OF THE ONTARIO COMMISSION

Line Regulation, Insulator Troubles, Relay Protection, Inductive Interference and Best Types of Meters Among Subjects Considered

W. P. Dobson, assistant engineer of the Hydroelectric Commission of Ontario, says that the commission has recently conducted or is now conducting: "investigation of line regulation and the operating characteristics of the various machines on the system, insulator troubles, relay protection, abnormal conditions of voltage and current, inductive interference in telephone lines in the neighborhood of the high-tension lines, design tests on new types of apparatus, *e. g.*, insulators, meters, etc."

"A great variety of special tests have been made," so Mr. Dobson says, "among which may be mentioned the determination of the coefficient of expansion of various alloys to discover one with the same coefficient as insulator porcelain; heating of cables under heavy current; mechanical tests on insulators, bus supports, etc., rating tests on fuses, short-circuit tests on high-tension fuses, etc.

"The work of this laboratory also includes special investigations to determine the best make or type of meter for any particular purpose. These include the determination of the characteristics under varying conditions of load, frequency, temperature, power factor, wave form, etc., and also of the design characteristics."

Among special oscillograph tests may be mentioned an investigation of the voltage resonance due to the presence of electrolytic lightning arresters on 13,200-volt lines, a study of abnormal voltages appearing under certain conditions of transformer connections, flashovers of rotary converters, etc.

In addition to these special tests, which are of the nature of industrial research, the laboratory is carrying on regularly a large amount of routine testing in the following departments: (1) High-tension and general testing laboratory; (2) electrical standards and meter laboratory; (3) lamp-testing laboratory; (4) illuminating engineering laboratory; (5) structural materials laboratory; (6) photographic laboratory. This work includes acceptance tests of electrical goods purchased, examination of second-hand apparatus, insulating materials, oil, calibration of meters and of meter transformers, life tests on lamps, photometric tests, study of illumination, and investigation of cement and of concrete aggregates and mortars.

Research Work Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Technical Theory and Practice" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

HEADLIGHTS, AUTOMOBILE.

Careful tests of headlighting conditions were recently made under the auspices of the committee on automobile headlighting specifications of the Illuminating Engineering Society and the lighting division of the standards committee of the Society of Automotive Engineers. The tests were held on a piece of road between Pelham Parkway and the Morris Park station in New York. The purpose of the tests was to get the judgment of a large number of observers on two points—first, the illumination required to render visible a man in dark clothing at distances of 150 ft. (45.7 m.) and 250 ft. (76.1 m.) from the observer; secondly, to determine how much each observer would tolerate in the way of glare in his eyes from two headlights placed 100 ft. (30.5 m.) from his own lamps, and to one side of them, with his own lamps adjusted at the intensity which he required for observing the man on the road 250 ft. (76.1 m.) away.—*C. H. Sharp, New York City.*

TELEPHONE, ARTIFICIAL CABLE.

I was able to talk through 1000 miles of artificial cable in the following manner: I used a regulation telephone artificial cable with a distributed capacity of 80 microfarads and 8000 ohms resistance. Additional resistance, up to 10,000 ohms, and additional capacity up to 150 microfarads, could be connected into the circuit at will. An ordinary detective circuit of the Armstrong regenerative type was used with an auxiliary circuit crossed with a condenser of 0.02 mfd. and with the cable shunted across the condenser. When one side of the bridge was grounded with a distributed capacity the voice was lost entirely; but I found that by preventing the oscillations from entering the cable, except as impacts, I was able to transmit the human speech in sections with certain sections left out. These were so small in comparison with the aggregate that commercial conversation was entirely feasible.—*S. N. Baruch, San Francisco, Cal.*

Readers' Views and Comments

Steps Toward Coal Saving

To the Editor of Electrical World:

Sir: Your editorial article in the July 20 issue of the Electrical World in regard to "Coal Saving" is a timely reminder of the fact that not only is a large amount of our fuel shortage due to our inefficient use of that fuel, but also that pure waste of it in many small ways is a considerable factor in that shortage. In connection with our quarterly conference held on July 19 I had to prepare a report on the question of fuel and I append part of it:

"In my visits around Texas, among members of my association and those who are not members and among the largest as well as the small and medium-size utilities, I have seen from 25 cents to 50 cents per ton of coal or lignite wasted in its man-handling from car to ash pit. I have seen an additional 'two bits' go up the smokestack in free carbon, carbonic monoxide and lost available heat. I have seen this repeated in the quality and temperature of feed water, I have seen it rerepeated in uninsulated piping and apparatus, and I have seen it go still further in its misuse in the prime movers and the exhaust. I have seen in Texas a waste in fuel efficiency of from 50 per cent to 65 per cent, thousands and hundreds of thousands of dollars of needless waste in the aggregate. Few of us can hope to reach 20 per cent efficiency, but we need not drop to 10 per cent and even as low as 5 per cent—because every single percentage which we needlessly waste by inefficiency means cents and dimes and dollars of profit out of our pockets, means unnecessary haulage when cars are so vitally needed and means a waste of labor when labor is getting as 'scarce as hens' teeth.' The utilities of Texas could, with but little financial cost to themselves, save millions of cubic feet of gas, thousands of barrels of fuel oil and thousands of tons of coal and lignite by strict attention to the elimination of waste in the use of the above fuels."

I would add that the question of "firing" is generally the one least slighted. Nearly every one using fuel has had the matter of its "combustion" so strongly placed before him that in nearly every case some attempt is made to obtain the actual combustion of the fuel on the grate bars in a more or less efficient manner. My researches in this matter for a number of years have proved to me that a very large loss in fuel efficiency occurs before the fireman's shovel touches it and after its combustion. I have found most wasteful methods of handling right up to the furnace doors—and every ounce wasted in this manner when multiplied by the thousands of such cases not only means many unnecessary cars of fuel hauled but it also means many dollars added to the "billing cost" of that fuel which is finally received and used. In addition to this are the many obstacles placed in the way of the heat units entering the boiler, the soot and scale on the outside of the shell or tubes, the scale on the inside of them and the preheater, cracks and apertures in the setting, wrong arrangement of fire wall and baffles, and wrong location and use of dampers. These, however, are only the beginning. Once the steam is loosed from the boiler there is often a steady loss in its temperature accompanied by an increase in its water content up to the time that it enters the prime movers. Direct steam leaks, steam carriers exposed to radiation, unnecessary bends and valves which retard its flow, all tend to loss of either the steam or its necessary heat and pressure. Once in the prime mover, lack of proper lubrication, lost motion or leakage past valves may again result in loss of efficiency. And when the steam has completed its more or less efficient work in the prime mover and its auxiliaries it is often the case that the exhaust steam has both heat and pressure which are thrown into the atmosphere as if they were of no further value—a large percentage of the B.t.u.'s available for further useful work being "put into the dump."

If these losses were confined to the hundreds of thousands of small fuel users, even then the total waste of fuel would be appalling, but my observation has shown that they are not so confined. Many of the larger plants are ignorantly or idly wasting from 2 per cent to as much as 5 per cent or 6 per cent of their fuel either directly or indirectly. The extremely large plants —public utility and otherwise—that use fuel are generally doing so with an efficiency that approaches from 15 per cent to even as much as 20 per cent, but their saving—notwithstanding their size—is a small amount compared with the loss of the many of smaller size whose efficiency in the use of fuel as a whole runs from as low as 5 per cent to an average maximum of not over 12 per cent to 13 per cent.

Close observation and experience in this matter have led me to the full belief that the crying need with reference to fuel at this moment is the lessening or stoppage of millions of small "fuel leaks" and inefficiencies going on in nine-tenths of the places where fuel is now being used for the various kinds of steam production, and I am also of the opinion that a dominant percentage of the savings which would result from a lessening or stoppage of these inefficiencies may be made with so small an amount of total investment for the purpose that 90 per cent of these fuel wasters would make more net profit out of such investment than they are now doing on a similar amount in their regular business. I believe that it is the duty of every publication such as the Electrical World to "keep it before the people" in every issue that the crying sin of the moment is the needless waste of fuel, that one of the highest types of civil-life patriotism is in its saving, and that the largest portion of its saving may be made, not by a lesser needful use of it, but by a more careful and efficient method of use from mine to exhaust head.

Dallas, Tex. H. S. Cooper.

Self-Inductance of Coils

To the Editor of Electrical World:

Sir: In a letter published on page 1330 of the issue for June 22, H. E. Weightman states that the Brooks-Turner formula for self-inductance of coils is sufficiently accurate for practical manufacturing conditions, and that the longer formulas published in my article in the Electrical World of Feb. 9 on the "Self-Inductance of Long Reactance Coils" are not necessary. Presumably the same criticism would be applied by him to the similar formulas given in my article on "The Self-Inductance of Short Reactance Coils," in the issue of May 25.

For several years, since the Brooks-Turner formula was published, I have used it to calculate roughly the self-inductance of coils, and I consider it a remarkable and an admirable example of the approximate expression in concise form of a complicated relation. However, instead of its possible error being 2 or 3 per cent, as inferred by Mr. Weightman, it is at least 5 per cent for practical commercial coils.

For example, the coil described in Problem II of my article on long coils mentioned above has proportions which are usual for current-limiting reactors. The self-inductance of this coil, as calculated in the article, is 0.07700 henry, but the self-inductance according to the Brooks-Turner formula is 0.0804, thus indicating an error in the latter formula for this case of 4½ per cent.

A formula which can produce such a large error is usually undesirable for use in manufacturing reactance coils to specifications, where a certain value of reactance is required.

The dimensions of large current-limiting reactors are determined by the molded spacers, and not by the size of the conductors. Even with smaller coils, the dimensions are largely determined by the mold size and are only partly influenced by the variations in conductor size cited by Mr. Weightman.

The accuracy with which the inductances of several coils made according to the same design agree with each other and with a carefully calculated value indicates that the practice adopted and advocated by Mr. Weightman of taking off some turns after testing (which is a poor engineering practice if it can possibly be avoided) is due possibly not so much to variations in the material as to the fact that Mr. Weightman used a faulty formula. A little more calculation would save considerable labor and cost.

Hamilton, Canada. H. B. Dwight.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

HYDROELECTRIC DEVELOPMENT FAVORED BY DIRECTOR McADOO

He Suggests that Country's Vast Water-Power Resources Be Developed for Railroad Electrification and to Relieve Fuel Shortage

Director General of Railroads McAdoo, on his return to Washington on Monday, after a two months' tour of the West, expressed the opinion that the great unused water-power facilities of the country ought to be developed to supply electricity for electrification of the railroads. This program might be recommended to Congress, Mr. McAdoo intimated, if government control of the railroads continues for any considerable period; but that is too problematical for any serious discussion.

Director General McAdoo holds the opinion that there is sufficient unused water power in the country to operate a large part of our railroad system if it is coupled with the developed water properties, now operated largely by public service corporations.

Electrification of the roads, Mr. McAdoo pointed out, would mean the elimination of the major burden now imposed on the railroads, *i.e.*, the tremendous coal haul. In addition, it would release to other more essential uses the great labor army now engaged in mining and handling this fuel. Finally, it would conserve the fuel resources of the country for use in sections where water-developed electricity is unavailable.

ELECTRIC WELDING SUPPLANTS RIVETING IN SHIP WORK

England Tries Out First Rivetless Vessel and Great Savings Are Predicted—Welded Ships to Be Built by U. S. Shipping Board

The first steel vessel built without rivets has just been tried out somewhere on the south coast of England. With a full cargo and in rough weather she answered satisfactorily the most severe tests imposed upon her.

The vessel is 125 ft. (38.1 m.) between perpendiculars, 16-ft. (4.9-m.) beam, and has a displacement of 275 tons. More than 240 man-hours were saved in construction and an economy of more than 1000 lb. (45.3 kg.) of metal was effected by the absence of rivets

Instead of the plates of this vessel being riveted and calked, they are joined together by electric welding. The shell, up to and including the bottom seam of the bilge plate, is continuously welded inside and out. The cross-seams are similarly treated. The outside is continuously welded and the inside "tack-welded," that is to say, a short section is welded and then another section of about twice as much is skipped. The frames, floors deck brackets and non-water-tight bulkheads are tack-welded, and the water-tight bulkheads continuously welded. In the case of the deck plates butt-welding has been adopted, the plates being arranged end to end, without any overlap. It is considered that the mode of construction that is being followed allows a good margin of safety.

The cost of electrodes, owing mainly to the present limited use, was considerable, but it is estimated that in the future demand competition will reduce the price 60 per cent. It is possible to build a vessel, six experimental ships show, at a saving of from 25 to 40 per cent in time and of about 10 per cent in material. The United States Shipping Board, it is said, has been in close touch with this experimental work, with the result that arrangements are in hand for the manufacture of sections of 10,000-ton standard ships, in the production of which riveters will become welders. Unlike the ship just tested, these vessels will not be entirely rivetless, but they will have, it is computed, only about 2½ per cent of the number of rivets originally intended.

PRIORITIES HEARING HELD ON HEATING APPLIANCES

Judge Parker Asks Committee to Go Through List and Cut Out Every Appliance Not Government Essential

The war service committee of the electric heating appliance manufacturers had a conference in Washington on Friday, Aug. 9, with the priorities committee of the War Industries Board. The committee consists of the following: W. M. Stearns, chairman, General Electric Company; F. D. Goode, Cutler-Hammer Manufacturing Company; George A. Hughes, Edison Electric Appliance Company, and Robert Kuhn, American Electrical Heater Company.

The object of the meeting was to supply information and evidence to the priorities committee of the conservation of raw material, fuel and labor in the manufacture, use and sale of electric heating appliances. There are altogether 190 manufacturers of electric heating appliances in the United States. An indication of the importance of the industry is shown by the volume of business for the year 1917—$13,000,000—of which about $1,500,000, or approximately 12 per cent, was direct and indirect government work.

The electric heating appliance work given a Class A listing by the priorities committee consists of ranges, ovens and other cooking equipment for battleships, destroyers and submarines, cantonments, naval training stations, field kitchens, etc.; air and water heaters for ships, battleships, destroyers, submarines, hospitals, explosive plants, etc.; electrically heated clothing for aviators, electric heaters for machine guns, soldering irons and glue pots for aircraft production, munition and explosive plants, etc.

The committee submitted considerable information showing how electric heating appliances conserved labor and land transportation, together with tabulated data as to the volume and distribution of business, the location of manufacturing plants, number of employees, percentage of women employees, and amounts of raw material used in the past, on hand at present and required for the future. The committee also offered a pledge on the part of the electric heating manufacturers to coöperate fully with the government in the conservation of materials, fuel, labor, transportation, etc., and the committee further offered to act on behalf of the War Industries Board in policing the industry, so as to effect the greatest possible conservation of material, keeping down the output to the least possible point during the period of shortage of materials that is consistent with meeting a strictly war-time demand for appliances essential to the civilian population.

Priorities Commissioner's Request

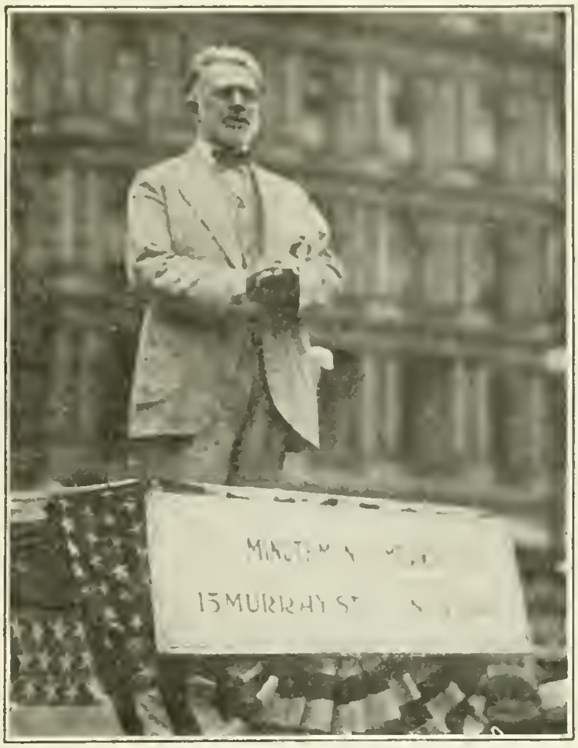
Judge Edwin B. Parker, Priorities Commissioner, expressed his interest in and approval of the growth and development of the electric heating business and his desire, under normal conditions, to see the expansion of such business. He pointed out, however, that the country was facing a serious shortage of essential materials, such as iron and steel, copper, brass, aluminum, etc., and that every pound and ounce possible must be saved. He said:

> First, through your committee, or through some other agency, steps should be taken to cut out absolutely the sale of new electrical heating equipment in those sections where electric power is short.
>
> Second, your salesmen, your distributers or agents should be instructed to reverse their ordinary selling practices and educate the people to use the appliances that they have just as long as it is possible for them to use them and to repair them as long as they can repair them, without replacing them with new equipment.
>
> Third, there should be no effort to replace, under any circumstances, a wood-burning range with an electric range, and there should be no effort to replace a coal-burning range that will last until after the war, where the coal is available, but we should undertake to make the existing apparatus and appliances last until after the war where it is possible to do so, rather than to replace them with new apparatus or appliances in any form.

Judge Parker asked the committee to go through the electric heating industry and use freely the knife and "cut right down to the quick" every appliance produced that is not essential and then return with a program to submit which will show the extent to which these different products can be cut out or curtailed to reduce the consumption of raw material for the rest of this year, with a tentative program for the following year.

This, therefore, the committee believes, means coöperative action by the War Industries Board and the war service committee of the electric heating manufacturers and the manufacturers themselves which will put the industry on a definite war basis and cut out all the non-essential elements of production, and, while it will reduce the volume of business and earnings, will insure the production of the essential appliances in public demand.

Public Utility Men in War Saving Stamp Drive



Henry L. Doherty addressing crowd in City Hall Park, New York, on the necessity of backing the government with funds for carrying on the war.

COMPETING PUBLIC UTILITIES URGED TO INTERCONNECT

Merchants' Heat & Light Company and Indianapolis Light & Heat Company Urged to Pool Their Systems During the War

In handing down its decision affecting the rates of the Merchants' Heat & Light Company and the Indianapolis Light & Heat Company, the Public Service Commission, after increasing certain surcharges, pointed out that some additional relief might be obtained by a correction of existing conditions by the companies themselves. The recommendations made by the commission to the companies operating in Indianapolis are as follows:

> In the electric field occupied by petitioners there was no great objection in normal times to duplications that assume different importance in these days, when operating costs make it necessary for these utilities to seek relief, and when they seek all the relief at the expense of patrons served. In this war period there must be taken into consideration by the commission the existence of two complete institutions and inevitable duplication of at least certain heavy overhead expenses and also losses, or waste, arising from failure to coördinate operation of five different plants such as would be the case under an unified war-period operation.
>
> There has existed, at least within a very recent period, a competitive rivalry or war of extermination that at times has known no bounds and that has been wasteful in many ways. Petitioners urge that, under an understanding recently reached, competitive solicitations and practices are to be held in abeyance, but an analysis of the estimates for the year ending June 30, 1919, reveals that the items of accounting under which such competition—from advertising to solicitation and "throwing out each other's meters"—are

carried show increases instead of decreases, although the increases are not large. The conditions are such, however, that there is a constant waste of money and labor that is not compatible with the period of economics in which the country is now living.

The really sinister side of these conditions now is coal waste. Consulting engineers of repute and managers of other utilities have placed as high as 75,000 tons a year the unnecessary use of coal arising from no connection between or coördination in the operation of the five plants of petitioners. While petitioners deny that larger consumption of coal could be saved, still it is admitted that 10,000 tons of coal could be saved if there were physical connections and war-period poolings and readjustments, such as are being carried on at many other points. Even such a saving as is admitted would amount to the needless movement and use of 200 to 225 carloads of coal, or enough to meet the demands of a town of 2000 or 2500 people.

The Legislature, in enacting the Shively-Spencer Utility Commission law in normal times, wisely did not place in the hands of such commission coercive powers of consolidation or pooling, but in meeting the unusual conditions now presented such waste and other conditions press for consideration. The commission is led to believe, by advice of consulting experts and by consulting conditions elsewhere, that some increases now called for as measures of relief would not be necessary were the services unified either by one ownership or effective pooling for war-period operation.

The commission is of the opinion that owners of these public utilities should not be permitted under these conditions, over which only they have control, to shift all the burden of such waste and duplication. Those financially interested in these institutions may increase their earnings by bringing them into unity, either by merging or by practical pooling of interests for war-period operation. Such a unification is certainly urged as a measure of economy directly in line with the general policies of economy that are now being applied nation-wide, and if not done voluntarily, the federal government will be justified in taking steps forcibly to cause readjustments for the saving of coal, labor and materials.

MANY PUBLIC UTILITY COMPANIES GET RELIEF

Increase in Rates Generally Allowed by Public Service Commissions from Coast to Coast as a War Measure

An interesting summary has been prepared by the National Public Utilities Committee showing the action of state commissions affecting rates for the period extending from May 18 to July 13, 1918. In this period of less than two months many increases were granted by state commissions to every class of utility from Massachusetts to California.

In the sale of electricity commissions allowed straight increases to thirty-two different companies, and in eight cases temporary increases or surcharges were granted. In only one case was an increase in rates denied. The companies affected were in Illinois, Indiana, Missouri, Montana, New Jersey, North Carolina, Oklahoma, Utah, Wisconsin and Wyoming.

In summing up conditions in the first six and a half months of 1918, the National Public Utilities Committee says:

> Some relief has been secured. Between 600 and 700 rate increases have already been reported since Jan. 1, 1918, and relief in other forms has been noted in a number of cases. In a few states the commissions have issued sliding-scale orders, so that the rates of the companies affected will automatically follow the fluctuations in operating costs above a fixed normal point. In some states the commissions have adopted a policy of allowing surcharges on bills to cover the increased costs of operation due to war conditions. In a number of instances complaints calling for a decrease in rates have been dismissed.
>
> A very important development in several jurisdictions is the adoption by the commissions of a war emergency procedure, eliminating appraisals of property and other time-consuming investigations regarded as necessary in normal times. Broadly speaking, a majority of the commissions having full rate-fixing powers have shown a disposition to grant relief; several have fallen short of reasonable expectations, and a few have apparently failed to recognize the recommendations of the President.
>
> Public service, corporation or railroad commissions now exist in every state except Delaware, but many of these commissions have no jurisdiction over public utility rates, and several have had their rate jurisdiction curtailed by decisions of the courts upholding rates fixed by franchise or contract. Reports from the states where commissions do not have full rate jurisdiction and where companies are compelled to secure relief from municipal authorities indicate very critical conditions. In these localities the efforts of the companies to secure revenue sufficient to meet the increased cost of labor and materials brought on by war conditions have generally failed, and further efforts are apparently foredoomed to failure. This situation demands federal intervention and the establishment of some machinery by the federal government that will save the communities affected from untimely disaster and spare the nation's financial structure the shock of the wholesale bankruptcy of the companies involved.

BOSTON EDISON COMPANY RATE CASE MUST PROCEED

Commission Decides that Petition for Reduction Must Be Heard, Despite War Conditions and Uncertain Outcome

The commercial rate case of the Edison Electric Illuminating Company of Boston must be heard despite war conditions, according to a finding of the Massachusetts Gas and Electric Light Commission, dated Aug. 9. The petitions in question (Macfarland et al. vs. Edison Electric Illuminating Company) were filed in 1916, but by mutual consent have been deferred pending the conclusion of the recent celebrated street-lighting rate case of the same company. At a recent hearing the company moved to postpone further consideration of the petitions during the war against Germany. In support of its motion the company urged the improbability of any order for a reduction in price under the present abnormal conditions, the lack of the requisite time and money for a proper presentation of its side of the case, and the futility of any investigation of the facts upon which rates reasonably may be based in view of the instability of the factors entering into the problem. In opposing the motion the petitions urge that the postponement asked, if granted, would amount substantially to a denial of a hearing to the petitioners.

The commission holds that the law requires it to hear complaints concerning price, the board's discretion being with respect to their disposition when heard. The Legislature doubtless intended to leave the conduct of such cases to the sound judgment of the board, but not to authorize it either directly or indirectly to refuse the complainants a hearing. In its ruling the board says:

> It is true that the motion is for postponement only, but the duration of such postponement is indefinite and may be

for a considerable period. Since the war began there have been many increases in rates by companies under the board's supervision. Some require affirmative action by the board, but many do not, and the only opportunity for customers to have such increases reviewed has been by complaint under this same section [of the statute]. The board has believed that all such cases, whether the customer or the company were the moving party, should be promptly heard and has acted upon this belief.

It may be claimed that the complaints under consideration differ because filed before the war began, with a view to the conditions then prevailing, and that the company has not meantime raised its maximum net price. It has, however, increased its other prices by the introduction of a so-called "coal clause," and this feature has been brought in issue by an amendment to the pending complaints. Unless the board is to postpone for the duration of the war the consideration of all proceedings under the statute where maximum prices have not been increased, it cannot properly allow this motion, and in the opinion of the board this policy would be inexpedient and unwise, even assuming that it has authority to do so.

In stating this conclusion, the board recognizes the unusual burdens and anxieties which this period of stress has brought to this and all the companies under its supervision and the primary importance to the communities served of continuous and adequate service. It is not unmindful of the difficulties of reaching any reliable results as to fair and reasonable rates at a time when the costs of operation and financing all companies providing public service are exceptional and unprecedented, nor of the embarrassment to all concerned, and even futility under the circumstances, of protracted rate hearings. The latter consideration, however, relates to the conduct of such cases and is plainly within the direction of the board as they proceed.

In deciding such cases as have arisen since the war began, the board has also repeatedly expressed the view that in abnormal times it is expedient not to attempt to reach any final judgment, but rather to make such temporary readjustments in price as may be necessary to preserve the efficiency and financial integrity of the companies and to protect the consumers from any exploitation under the guise of war conditions and to defer any final settlement of rate questions to the return of stable conditions and normal costs. But this is a consideration which has to do with the conduct of the cases and their disposition after they are heard, and not with the issue raised by this motion. The motion to postpone is accordingly disallowed.

CITY OF SEATTLE WINS IN SKAGIT BOND FIGHT

Capital Issues Committee Authorizes Issuance of $5,500,000 for Construction of Hydroelectric Station to Serve War Industries

The city of Seattle has been authorized by the Capital Issues Committee at Washington, D. C., to sell $5,500,000 in bonds for the construction of a hydroelectric plant on the Skagit River to serve war industries.

This clears the way for immediate action by the city toward the development of a 35,000-kw. unit of the power project, as no vote of the people is necessary for authorization of the bonds.

The project had been reported adversely by the capital issues sub-committee of the San Francisco Federal Reserve Bank, but was brought before the national committee at Washington, D. C.

Three sites for development of hydroelectric power are available on the Skagit River, and the city has priority rights on all of them. The present bond issue, now authorized, is designed to cover the first site, or the Gorge Creek development, which is to furnish 35,000 kw.

COAL SITUATION DISCUSSED BY FUEL ADMINISTRATION

Indiana Central-Station Men Are Given Advance Information on Scope of New Order and Have Opportunity to Ask Questions on Local Problems

"War conservation of power and light" was the topic of an address delivered by Howell Van Blarcom, assistant to Charles E. Stuart of Washington, D. C., chief of the power and light division, United States Fuel Conservation, before the Indiana Electric Light Association on Aug. 30. Mr. Van Blarcom pointed out that, while the first estimate showed that there would be in the coming year a shortage of 100,000,000 tons of coal, subsequent estimates showed the shortage would be around 35,000,000 tons. He even intimated that the shortage might possibly not be quite so much, but he stated emphatically that the conservation program must be carried on just as if there had been no change in the original estimate and as if the country still stood to be 100,000,000 tons short for the year. As a reason for this policy he cited the fact that there is a steel shortage which can probably be overcome if there is an adequate supply of coal. He also reminded the delegates that the inconvenience which coal users are being subjected to in this country is really only a minor consideration compared with the dreadful shortage of fuel which is facing our allies.

Mr. Van Blarcom predicted that there will be curtailment of industry in New England. He said there is now building about 1,000,000 kw. of turbine capacity in this country, but even if all of this could be shipped to its destination and installed in the New England states, it could not turn out a single kilowatt-hour, owing to the physical impossibility of getting coal to run additional plants. He predicted that three-fourths of this turbine capacity will never reach the destination for which it is now intended but will be diverted into other parts of the country where it will be possible to place it and send coal to it. He also brought out in this connection that the War Industries Board does not intend to place any more orders for government equipment unless an adequate supply of power can be secured in the community seeking the order.

Concerning the necessity of saving coal in power plants, Mr. Van Blarcom said that careful and resourceful firing of furnaces must have immediate attention. He also said that the uneconomical isolated plants would have to be shut down, perhaps only during the summer months or perhaps for the duration of the war. Interconnection between public utility plants is desired by the Fuel Administration. It is the desire, of course, to make it easy for all of these transfers of loads to be effected, but steps must be taken to save the coal very soon.

The speaker stated definitely that within a short time there would be issued an order that would take up many phases of coal saving interesting the central-station men. It will deal with lamp policies, the changing of which is expected to effect a saving of from 1,000,000 to 2,000,000 tons of coal. The order contemplates reducing the sizes but not the number of lamps. Carbon and "gem" lamps are to be gradually eliminated. Free renewal is to be discouraged, and all policies calculated to induce the customer to buy a larger lamp than is absolutely necessary for his needs must go by the board. Even in replacing carbon lamps with tungsten lamps central stations will be asked to make the change in such a manner as to give the customer the same amount of light he has been having, instead of making it on a wattage basis.

The order will affect other businesses as well as public utilities. Among these are the ice companies, some of which are operated in conjunction with central stations. As soon as weather conditions will permit it, ice companies in every locality will be required to pool their manufacturing facilities, and instead of running several plants lightly loaded in an inefficient manner, one plant or two plants will be run at full capacity and the demands of all ice companies will be supplied from these plants. In industrial establishments factory conservation committees consisting of employees will be formed. The committees will go into the subject in detail.

It is also part of this plan to connect every hydroelectric plant with some steam station so that all of the available water power can be utilized to save coal.

The discussion that followed Mr. Van Blarcom's address consisted mainly of questions. The first of these pertained to the status of the domestic motor-driven refrigerators. The inquirer asked whether the Fuel Administration would countenance the use of motor-driven refrigerators, rather than ice, to which Mr. Van Blarcom replied that it was entirely a matter of coal saving, and if the domestic motor-driven refrigerator could be operated with the consumption of less coal than would be required to produce the ice, it should by all means be employed. In reply to a question about means of getting manufacturers now already on central-station service to arrange their operations so as to take some energy in the valley of the central-station load curve to save coal, Mr. Van Blarcom intimated that the question should be taken up before public service commissions.

In explaining the lamp situation the speaker stated that the lamp manufacturers have been brought together and that those making carbon lamps, by going over their orders, determined what output of carbon lamps was absolutely necessary for such uses as the navy drop-cord extensions and other places where lamps were subjected to excessive jarring. To fill the needs of such places will probably take only 25 per cent of the former output of carbon lamps. The production of this output will be turned over to the factory which makes only carbon lamps.

On the question of continuing the daylight-saving plan throughout the year, Mr. Van Blarcom suggested that the officials at Washington would be very glad to know what is the consensus of opinion of the Indiana Electric Light Association. He said the question of whether this should be continued throughout the year or should be used only during the summer months was now up for discussion.

In closing, the speaker intimated that isolated plants using an excessive amount of coal per kilowatt-hour should be reported to the local fuel administrator. In case this official is unable to prevail upon them to take service from the central station and discontinue operating inefficient plants, it is the duty of every one cognizant of the situation to report it to the Fuel Administration at Washington, D. C.

GOVERNMENT NEEDS RADIO AND TELEPHONE INSTRUCTORS

Men Having Practical Teaching Ability and Who Are Not Subject to the Draft Are Being Sought for This Work.

It is anticipated that twenty-four institutions of this country will probably be engaged in the training of drafted men in special classes of radio and telephone work. Instructors are needed for this work. The training which these men should receive in radio is of special type. The instruction can be given by the combined engineering and physics faculties in no one institution. The training to be given the telephone electricians calls more especially for electrical engineering instructors.

The ELECTRICAL WORLD has been asked to assist the committee on education and special training of the War Department to help obtain instructors for the different institutions. The committee believes that there are many available men who will never be in Class 1 of the draft, even with the draft age extended, and who may well qualify as instructors. It is its idea to depend upon men of practical teaching ability not subject to the draft. Nor is it necessary that these men have a knowledge in detail of radio work, because it is well known that there are not a large number of men so trained. Candidates should address the committee at the Old Land Office Building, Washington, D. C., if they are available for this type of work in institutions.

INDUSTRIES ASKED TO CO-OPERATE TO SAVE FUEL

Massachusetts Manufacturers Are Earnestly Striving to Save a Million Tons of Coal This Year and Avoid Shutdowns

"Massachusetts manufacturers can save this year more than 1,000,000 tons of soft coal if they all co-operate in the war-time fuel conservation move," declared James J. Storrow, federal Fuel Administrator for New England, in a recent interview. Three thousand industrial plants in Massachusetts are in danger of a curtailment of their supply of coal next winter unless increased coöperation is rendered in the campaign against fuel waste. Seventeen hundred of these plants are already enlisted in the work of coal saving along the lines planned by the engineering committee which is assisting the administration. The plan includes the establishment of factory committees to cut down needless losses in the use of lighting, power and heating service.

In western Massachusetts this work has been taken up with great enthusiasm, and 71 per cent of the industrial plants west of the Connecticut River are co-operating with Mr. Storrow's organization. The city of North Adams, with every one of its twenty-two industrial plants pledged to conserve steam coal, heads the list of Massachusetts municipalities, and Boston is tenth, with 73.8 per cent of its manufacturing establishments engaged in active coöperation. The state has been divided into five districts in which fuel-saving work is being carried on. In the southeastern district, where the poorest showing has so far been made, only about 45 per cent of the plants have enrolled in the campaign.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Increase in Street-Lighting Rate.—The Pennsylvania Public Service Commission in allowing the Montgomery & Muncy Electric Light, Heat & Power Company to increase its street-lighting rate in Muncy Borough held that where the evidence shows a large increase in cost of production an increase in rate will be approved—especially when it is shown that a similar rate for like service is already in effect in other communities.

Company Practice.—The Pennsylvania Public Service Commission, in a decision affecting the Coalport Light, Heat & Power Company, holds that an order by the commission requiring twenty-four-hour service throughout its territory is substantially complied with even though the service company omits daylight service on Sunday where there appears a necessity for it only in emergency by an occasional patron. This is especially so when the service company is small and lacking in reserve power and employs this idle time in keeping its plant in serviceable condition. A rule of the service company by which it proposes to relieve itself of liability for damage resulting from use of power has no place among the filed rules and will be eliminated. Where a deposit of $5 is required by the service company rules, which, by the evidence, appears to be excessive, the deposit will be reduced.

Consolidation in Massachusetts.—In approving consolidation of the Stockbridge Lighting Company, Lenox Electric Company and Great Barrington Electric Company, the Massachusetts Board of Gas and Electric Light Commissioners says in part: "The lines of the Lenox and Great Barrington companies are in towns contiguous to Stockbridge. Neither the Lenox nor the Stockbridge company has ever generated the electricity which it distributes. The Lenox company has purchased energy from George Westinghouse or his estate, which the latter had in turn purchased from the Stockbridge company. The last-named company has purchased its electricity in part from the Monument Mills and in part from the Great Barrington company. The Monument Mills and the Great Barrington company have hydroelectric developments on the Housatonic River which produce the electricity in question. It is manifest that the three properties, while only recently brought under a common control, have been developed as integral parts of one system. The proposition to make their physical union complete by their legal merger should prove of distinct advantage to the public. It will do away with most of the present complex contractual relationships for the supply of electricity and should insure more economical financing and operation of the system. By reason of the proposed consolidation the facilities for furnishing and distributing electricity will not be diminished, and no increase will be effected either in the aggregate capital stock or in the aggregate debt of the three corporations."

Kansas Commission Rules on Service Extension.—In a recent case of the Kansas Gas & Electric Company, Wichita, before the Kansas Public Utilities Commission a ruling was established on customers' war-time extensions. The order is to be effective until twelve months after the signing of a treaty of peace between the United States and Germany and Austria. The commission found in part: "In making extensions to supply service to intending consumers the Kansas Gas & Electric Company has heretofore incurred certain indebtedness now due and accruing due; that, owing to present financial conditions due to the existence of the war, the company is unable properly to finance its business or to raise money to pay its indebtedness or make all necessary extensions for the service of consumers; that, if extensions costing in excess of $20 each are requested by intending domestic consumers of electric energy, or extensions costing any sum are requested by intending power customers, it is necessary that the cost of all power extensions and the cost of extensions to domestic consumers in excess of $20 for each extension be advanced and loaned to the company by the consumer desiring service by means of any such proposed extension, such advance or loan to be repaid by the company with interest thereon at the rate of 6 per cent per annum. . . . In case an advance or loan is made by the consumer to the company for the purpose of erecting or installing an extension or aiding therein, the company should each month credit such consumer's account for electric energy or power furnished to consumer over the line constructed by means of such advance with an amount equal to 33⅓ per cent of consumer's bill for electric energy or power furnished by the company during the preceding month until such loan or advance with interest thereon is paid in full; provided, however, that no credit shall be allowed during any period in which consumer is in default in payment of bills. . . . In estimating the cost of any extension to be made for the service of a consumer there should be allowed for engineering, supervision and use of tools and equipment not exceeding 5 per cent of the cost. Any sum or sums bona fide invested by the company in the erection and installation of service extensions for consumers in accordance with the foregoing findings should be charged by the company as, and held to be, a part of its capital investment."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Northwest Electric Light and Power Association.—The next annual convention of the Northwest Electric Light and Power Association will be held in Portland, Ore., on Friday, Sept. 13. George L. Myers is secretary of this association.

A. I. E. E., Indianapolis-Lafayette Section.—E. B. Schley was elected chairman and William H. Beck was elected secretary at a recent meeting of the Indianapolis-Lafayette Section of the American Institute of Electrical Engineers.

American Gear Manufacturers' Association.—The semi-annual meeting of the American Gear Manufacturers' Association will be held at the Onondaga Hotel, Syracuse, N. Y. on Sept. 19, 20 and 21. Announcement of the program will be given at a later date.

A. I. E. E., Fort Wayne Section.—On July 11, at the Fort Wayne Works of the General Electric Company, Chairman J. J. Kline gave a report on the Institute's annual convention at Atlantic City before the Fort Wayne Section of the American Institute of Electrical Engineers.

N. E. L. A. New England Section.—Notice has been issued by Miss A. O. Bursiel, secretary, that the tenth annual meeting of the New England Section of the National Electric Light Association will be held at the Hotel Kimball, Springfield, Mass., on Sept. 27 and 28. There will be three sessions devoted entirely to subjects connected with the share of the central stations in the war program. All entertainment features will be omitted.

California Association of Electrical Contractors and Dealers.—The monthly meeting of the California Association of Electrical Contractors and Dealers held at Oakland, Cal., on July 30, with over 100 in attendance, was largely devoted to the work of the co-operative campaign. L. H. Newbert, chairman of the campaign committee, outlined objects and progress of the campaign; R. M. Alvord, in reporting on publicity committee work, showed how individual members could help and called for their aid; M. L. Scobey explained how the dealer can aid in and profit by the educational work; H. C. Reid told why the contractors should support the co-operative movement; D. E. Harris discussed the effect of priority policies on the electrical industry and how unessential work of salesmen could be reduced. The topic of the final speaker, Albert H. Elliot, was "Loyalty to the Association."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Many Byllesby Men in Service.—A bound booklet recently issued by the publicity department of H. M. Byllesby & Company shows that 695 employees of H. M. Byllesby & Company and affiliated companies are now in national service. This is more than 14 per cent of the total employees of the company. This booklet not only gives the names of the men, but gives their rank and their army or navy addresses.

War Courses at Lehigh.—President H. S. Drinker, Prof. C. L. Thornburg and Prof. F. P. McKibben of the faculty of Lehigh University returned recently from Washington, D. C., where they had a conference with the committee on education and special training of the War Department in regard to the military training adopted by Lehigh University. As a war measure Lehigh University has recast its four-year courses so that by the elimination of a part of the usual vacations and by intensive work students are now enabled to gain the university's degrees in engineering and arts and science in three years. Lehigh will inaugurate in September a three-year course in ship construction and marine transportation.

Developed Power in State of Washington.—The Bureau of Statistics and Immigration of the State of Washington has issued a book on manufacturing opportunities in that state which speaks of water-power conditions as follows. "While the electrical industry as a whole is increasing at a tremendous rate in various parts of the country, the Pacific Coast has experienced a greater increase in water-power development within the last few years than any other section. Yet of all the vast potential power, the total amount developed in Washington is now only slightly over 300,000 hp. Conditions are rapidly changing, however. Since many new industries have sprung up during the past twelve months and many more are now being established, it has become necessary to increase also the amount of power available."

New Army Training Corps.—The War Department has obtained the services of Dr. R. C. McLaurin, president of the Massachusetts Institute of Technology, as educational director for the new army training corps which is being created under the auspices of the department's committee on education and special training. This announcement is made in Washington coincident with the statement that the work of the corps is now in full swing, and that three summer camps were opened July 18 for professors and advanced students in colleges who will take part in the student training corps next fall. The committee has called three conferences to formulate detailed regulations under which the army training corps shall be administered. The three summer camps are established at Plattsburg, N. Y., Fort Sheridan, Ill., and Presidio, Cal.

Marconi Business.—During 1917 the business of the Marconi International Marine Communication Company increased by nearly 100 per cent in gross revenue, according to the directors' report, which has just been issued. The gross revenue for 1917 amounted to £470,657, an increase over the preceding year of £200,476. This increase was derived principally from rentals of additional ships fitted. However, it is pointed out that necessary restrictions in respect of private messages at sea have continued and prevented revenue being received from this source.

Norwegian Government Adopts Electric Trucks.—After careful investigation, says A. Jackson Marshall, secretary Electric Vehicle Section, National Electric Light Association, the Norwegian government has placed initial orders with American manufacturers for fifty heavy-duty electric trucks to be used in various communities for the distribution of food. Water powers are plentiful in Norway, and as a result energy for electric vehicle charging is available in large quantities at small cost. The electric vehicle successfully competed with the "gas" car when gasoline cost 15 cents a gallon and energy 5 and more cents per kilowatt-hour. The superiority of the "electric" in Norway is evident now, when gasoline, when available, costs $1 or more per gallon and energy about 2 cents per kilowatt-hour.

Indiana Commission's Work.—The Public Service Commission of Indiana, on completing its first year's work under the reorganization of May 1, 1917, presented a brief report showing the work accomplished during the fiscal year. At the beginning of the year the formal docket consisted of 634 open cases on formal docket May 1, 1917, and 884 cases filed during the year ended April 30, 1918, making a total of 1518 cases pending in a year. Of this number 1442 cases were disposed of during the year, leaving only 76 cases open. The war's abnormal conditions resulted not only in an unprecedented filing of formal cases, but at least 100 per cent more complaints were received. Most of these were disposed of immediately outside the records. In addition to these there were disposed of in the informal docket 542 adjustment cases and 140 inspection cases, making a total of 682 informal cases disposed of. Added to the formal docket cases this makes a total of 2124 docketed cases disposed of during the year. Moreover, the year began with 634 cases open and closed with only 76 cases pending. In making this report the commission stated that it felt it was in a position to handle to-day's business to-day.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Local and Special Acts.—An act of 1910 providing that existing rates of a utilities company for supplying water, gas and electric light to a certain city should not be thereafter increased without the consent of the mayor and common council is a local and special act, the Court of Appeals of Maryland held in Mayor and Common Council of Westminster vs. Consolidated Public Utilities Company (103 A. 1008). In view of the law creating the Public Service Commission and constituting it a body for determining rates of public utilities companies, and repealing all laws in conflict therewith, the act of 1910 prohibiting increase in rates of the Westminister utilities company without the consent of mayor or common council was invalid, as in violation of Constitution, Article 3, 33, prohibiting enactment of a special law for any cause for which a general law of the state makes provision.

Obligations of Long-Term Contract.—The code of 1907, empowering a municipality to contract for furnishing electricity to a city or town, authorizes a municipality to contract for its inhabitants for a fixed and reasonable period, and such contracts are protected under the inviolable contract clause of the state and federal constitutions, the Supreme Court of Alabama held in Mobile Electric Company vs. City of Mobile (79 S. 39). A contract under authority of the code between a municipality and an electric company to furnish light and energy to the city for ten years, and fixing maximum rates for supplying citizens, "to remain in force perpetually," though void in so far as it makes the rate perpetual, will be enforced during a period of thirty years in analogy to constitution, 1901, 228, limiting terms of franchises to that period. A bill by a municipality to enjoin an electric company from increasing its rates and from depriving the subscribers who failed to pay the increased rate, while in the nature of a bill for specific performance of a contract, does not call for the continuous performance thereof through a series of years and is not therefore without equity. A city may maintain a bill to enjoin an electric company from increasing rates as to its citizens, notwithstanding that the citizens could redress the wrong individually or collectively, the object being to prevent a possible loss or inconvenience to them by non-compliance with the contract between the city as the representative of the consumers and the company to furnish light, the company being a public service corporation.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

John Fisher has been appointed chief engineer of the Western Light & Power Company, Boulder, Col., succeeding A. Jordine.

H. T. Reuler has been appointed chief engineer of the Atchison (Kan.) Railway, Light & Power Company, succeeding H. C. Bryant.

Durham Evans has been promoted to succeed Sam Browne as superintendent of the Gainesville district of the Georgia Railway & Power Company.

Sam Browne, superintendent of the Gainesville district of the Georgia Railway & Power Company, has resigned and has entered the government service.

D. A. Roberts has been appointed superintendent of the Southern Illinois Railway & Power Company, Harrisburg, Ill., succeeding C. F. Richardson, resigned.

George E. Foster has been appointed electrical superintendent of the Schenectady Power Company, Schaghticoke, N. Y., to succeed Raymond D. Sherman, resigned.

E. G. Shore, local superintendent for the Mount Whitney Power & Electric Company at Porterville, Col., has resigned to take charge of the electrical work of H. R. Parsons.

H. E. Drevenstedt, for the last three years general superintendent of the Salem (Ohio) Electric Lighting Company, has resigned to become connected with the General Utilities & Operating Company, Baltimore, Md.

Alfred C. Wilson, who has been assistant engineer of the electrical department of the Georgia Railway & Power Company, Atlanta, Ga., has been promoted to engineer of the department, succeeding J. O. Hardin, resigned.

C. F. Richardson, formerly superintendent of the Southern Illinois Railway & Power Company, Harrisburg, Ill., has resigned to become assistant general superintendent of the Indiana Railway & Light Company. Before going to Harrisburg late in 1912, he was superintendent at Brazil, Ind., of the Terre Haute, Indianapolis & Eastern Traction Company.

J. O. Hardin has resigned as engineer of the electrical department of the Georgia Railway & Power Company, Atlanta, Ga., to become electrical engineer for Lockwood, Greene & Company, Boston, Mass. Mr. Hardin will remain in Atlanta in charge of the Southeastern district. He joined the power company forces in 1912, having previously been employed by the General Electric Company.

Paul P. Haynes of the Public Service Commission of Indiana has been appointed a member of the special war committee of the National Association of Railway and Utilities Commissioners, with headquarters in New York City. Mr. Haynes succeeds Max Thelen, chairman of the Railroad Commission of California, who has resigned to become surveyor of contracts in the War Department, with offices in Washington, D. C.

H. H. Hermes, manager of the new-business department of the Oklahoma Gas & Electric Company, Oklahoma City, Okla., has been appointed illuminating administrator for the State of Oklahoma.

Lieut. Fulton Mandeville, formerly of the commercial department of the Louisville (Ky.) Gas & Electric Company, has been promoted to the rank of captain in the 327th Machine Gun Battalion of the Lincoln Division. Captain Mandeville was graduated from the officers' training camp at Fort Benjamin Harrison last year and received a commission as first lieutenant.

Thomas A. Wynne, president-elect of the Indiana Electric Light Association, is vice-president and treasurer of the Indianapolis Light & Heat Company. Mr. Wynne, as chief engineer for the Indianapolis company, has been responsible for many developments, including the planning of extensions to the main generating station of the company, the use of storage-battery auxiliaries and the construction of a large subaqueous coal-storage pit. He has also been very prominent in the Jovian Order, having been Jupiter for the 1916 term and previous to that Jovian Statesman for Indiana.

H. U. Wallace, for the past six years vice-president and general manager of the Western Light & Power Company, with headquarters at Boulder, Col., has resigned and accepted appointment as major in charge of engineering and construction, Quartermasters' Department, with headquarters at Washington, D. C. Mr. Wallace was at one time chief engineer of the Illinois Central Railroad and general manager of the Lake Shore Railroad. He was appointed receiver of the Denver, Laramie & Wesler Railroad when that system got into financial difficulties a little more than six years ago.

Halford Erickson, formerly chairman of the Railroad Commission of Wisconsin and recently of the firm of Hagenah & Erickson, Chicago, has been elected vice-president of the Louisville Gas & Electric Company, Louisville, Ky. Prior to becoming a member of the Wisconsin commission in 1905, when it was organized. Mr. Erickson was for nine years Labor Commissioner of the state. He was born in Sweden, where he received his early education. In 1884 he came to the United States and took his academic training in Minneapolis, Minn. In 1890 he entered the employ of the Chicago, St. Paul, Minneapolis & Omaha Railroad, where he remained for six years.

William Bennetts has been appointed electrical superintendent of the Western Light & Power Company, Boulder Col., succeeding Harley Hard, resigned.

C. J. Peterson, who has been connected with the Stillwater (Minn.) division of the Northern States Power Company for eight years as hydroelectric superintendent, has been appointed general superintendent, succeeding C. J. Clarey.

J. N. Mahoney, for twelve years a member of the engineering department, has tendered his resignation from the Westinghouse Electric & Manufacturing Company, to open consulting offices in New York. For the last eight years Mr. Mahoney has been in charge of designing switches, fuses and circuit breakers for the Westinghouse company, and he is largely responsible for progress that has been made in this class of apparatus. Previous to this work he was connected with the railway engineering department in charge of control design. Mr. Mahoney is a member of the American Society of Mechanical Engineers, the American Society of Mining Engineers, the American Institute of Electrical Engineers and the American Electrochemical Society.

D. A. Hegarty has been appointed vice-president of the Western Light & Power Company, with headquarters at Boulder, Col., succeeding H. U. Wallace, resigned. Mr. Hegarty was formerly vice-president and general manager of the Little Rock (Ark.) Railway & Electric Company, general manager of the New Orleans (La.) Railway & Lighting Company when it was operated by Ford, Bacon & Davis, general manager of the Houston (Tex.) Lighting & Power Company, and since last year was again in the service of Ford, Bacon & Davis, working on appraisals, reports, increased fare and rate cases. Mr. Hegarty has taken an active part in the American Electric Railway Association, being formerly president of the transportation and traffic division, and has been a member of committees of the National Electric Light Association and also of the Association of Municipal Improvements. In 1917 he was elected first vice-president of the Southwestern Electrical and Gas Association.

Obituary

Ray Tompkins, for seventeen years president of the Elmira (N. Y.) Water, Light & Railroad Company, died at his home in Elmira on June 30.

John D. Peck, president of W. K. Ostrander & Company, died last week at his home in Brooklyn, N. Y., at the age of sixty-seven years. Mr. Peck had been at the head of this business for thirty-five to forty years, and when the business was incorporated about fourteen years ago he was elected president. Mr. Peck was born in Connecticut.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

NEW ENGLAND MARKET FOR ELECTRIC RADIATORS

Fuel Administration Asks Boston Householders to Use No Coal for House Heating Prior to Dec. 1—Other Places May Be Included

Far-seeing jobbers are now making plans to handle an increased number of electric radiators this fall, in view of the threatened coal shortage facing the country. A very significant ruling was made a few days ago at Boston by the Fuel Administration for New England. Householders in the city proper have been asked to use no coal for residence heating until Dec. 1. New England is about 6,000,000 tons short on steam coal, and while anthracite has been coming into the market fairly well this summer, the outlook is very serious for the winter supply.

Last winter the electric radiator market was virtually sold out at times in Boston, and in some cases it was necessary to send a jobbers' representative to the factories in order to obtain anything like a satisfactory number of equipments for the retail trade. Even at the current cost of energy for lighting service, the electric radiator was widely used in the extreme weather of last winter to take off the worst chill in bathrooms, bedrooms and even in living rooms.

Long before Dec. 1 the weather in New England grows sharp, and there is every prospect that the central station will be called upon this fall to supply energy to radiators as a means of mitigating the severities of late autumn. It is expected that the ruling regarding the use of coal for residence heating will have to be extended to other places than Boston, and the necessity of house heating from some source is so inescapable that unless central-station service is greatly curtailed the demand for electric radiators is likely to exceed that of last year by a large percentage.

SHORTAGE OF SPOOLS FOR MAGNET WIRE AND LEAD CABLE

Explanations of the Low Stocks—Ordinary Trade Accumulations Fail to Meet Demand—Metal Devices Substituted

Attention was recently called to what may be considered a minor but is yet an important phase of the electrical trade in the rather acute shortage of spools for magnet and annunciator wire. The shortage is ascribed to various causes. A great deal of magnet wire has been exported, but the spools were not expected to be sent back, as is the custom in the domestic trade. The war created a heavy demand abroad, but the restraint recently placed on exportations, even to neutral countries, has reduced this business to a minimum. Attempts to ship magnet wire in coils proved a failure and were abandoned, as the insulation was affected by moisture during the sea voyage and the rough handling in stowing and discharging cargo. Spools had therefore to be employed with the package wrapped in metal casing.

The practice is to charge the full value of spools in the invoice, with credits given when they are returned. Ordinarily the spools were shipped back within a few weeks, but with the freight congestion six months and more would pass before they reached their destination. A year ago the spool shortage was more acute than now. Conditions at the present time, however, are such that the market is being combed to obtain a sufficient supply. Some wire manufacturers and distributers are experiencing more difficulty than others in gathering a sufficient assortment of spools to meet the demand, and this may possibly lead to a higher price for magnet and annunciator wire.

Substitutes for brasswood and pine spools are being used with marked success. Two large Eastern manufacturers are using a copper-plated steel spool with a welded reinforced head which far outlasts the wooden kind and is claimed to be safer and more economical in the long run. A compressed-paper spool has also been tested, but though answering for small weights of about 5 lb., those who have given it a trial say it does not serve for 50 lb., the usual quantity sold the trade.

A shortage of reels for lead cable also exists in some quarters of the manufacturing field. As the government now controls the output of lumber, assertions are made that this is the basic reason for the curtailment in the supply. A recent government order called for reels made up on special specifications for which a priority order had to be obtained to secure the particular lumber designated. It has been said, moreover, that the government is buying cable reel and all. As a result the reels are not as a rule returned to the jobber.

DIFFICULTIES EXPERIENCED IN HANDLING GOVERNMENT ORDERS

Cost of Checking and Hunting Up Items Is Found to Make Much of the Business of an Unprofitable Character

So much of the business of electrical concerns is of a war nature that any change from the customary way of doing business is necessarily of considerable consequence to the manufacturers and jobbers. Particularly in this connection the methods so far employed by the government in handling orders come up.

The difficulties experienced, especially by the electrical jobber, who handles such a multiplicity of government orders for shipment to so many different places at a narrow margin of profit, are finding expression very frequently.

A few of the points in question are here outlined and indicate how the practices differ from those regularly employed in commercial transactions.

Notwithstanding the quantities of detailed instructions on government orders, the most important instruction to the seller to whom goods are to be charged apparently receives little or no attention.

When government vouchers are returned to jobbers or manufacturers for their receipt they seldom show the order or requisition numbers on which they apply. In this case it is very difficult, especially where the number of orders runs large, to identify the charge and to keep the accounts checked on the ledgers.

On the other hand, a check when sent in not infrequently shows a voucher number. Since, however, it is seldom that the number is contained in previous papers so that it can be recorded, it is of small value or none in identifying the invoices which the check is supposed to cover. As a rule checks bear the phrase "For switches" or "For electrical supplies," or something of a similar nature. There are, however, so many like orders, especially where the entry does not have some outstanding feature such as size, that it is a particularly trying job to search out the right order.

Furthermore, checks are received marked "War Department" or "Treasury Department," but inasmuch as a concern trading with the government in any volume will probably have several branches under these headings, checks so marked offer no further clew to the identification of the order. This is more evident in those cases where such a check is sent to cover a number of invoices, and where occasionally it has been subject to a reduction because of rejected material of which the seller has received no previous notification.

Another difficulty experienced by those dealing with the government is in connection with the lost bills, cases of which are very numerous. Furthermore, a large number of government orders specify that original bills of lading shall be surrendered with invoices. When this is done and the bill lost the seller has no original receipt on which a claim can be made, and as a result a considerable amount of time is consumed in making the collection which under ordinary commercial practice would not occur.

As stated in the beginning, a concern, especially an electrical supply jobber, that monthly is making large numbers of shipments to a great many different army, navy and other government designations, each made up of a mass of small articles, often finds the margin of profit under such conditions inadequate.

A suggestion has been made that many of these difficulties and others would be minimized if the government should adopt a standard form of order blank with a special order number according to the segregation of the accounts.

METAL MARKET SITUATION

Official Copper Price Continued at 26 Cents Until November 1—Tin Lower

Of particular importance this week is the announcement from Washington, with confirmation by the President, of the continuation of the 26-cent price for copper until Nov. 1. Consumers had complained that too much instability would result in a too frequent change in official price and that consequently they would not be so anxious to look ahead very far for copper stocks. It was decided therefore that hereafter all contracts placed for future delivery of copper should be made stipulating the price as of date of shipment and date of placing order. As soon as the announcement regarding the official price had been made public there were many orders placed. The government is understood now to have enough copper in sight to serve its requirements.

Spelter has stiffened somewhat, while tin, on the other hand, in anticipation of the government price under the prevailing market, is selling for less than it has during the past month. Scrap metals were in better supply.

NEW YORK METAL MARKET PRICES

	—Aug. 6—	—Aug. 13—
	£ s d	£ s d
Copper:		
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26 00	Govt. price 26.00
Electrolytic	Govt. price 26 00	Govt. price 26 00
Casting	Govt. price 26 00	Govt. price 26 00
Wire base	29 25	29 25
Lead, trust price	8 05	8.05
Antimony	13 00 to 13 25	13 50 to 13 75
Nickel, ingot	40 00	40 00
Sheet zinc, f.o.b. smelter	Govt. price 15 00	Govt. price 15 00
Spelter, spot	8 35 to 8 50	8 80 to 8 90
Tin, Chinese *	92	91 00
Aluminum, 98 to 99 per cent	Govt. price †33 10	Govt. price †33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	23 50 to 24 50	23 50 to 24 50
Brass, heavy	14 50 to 15 00	14 50 to 15 00
Brass, light	11 50 to 12 25	11 50 to 12 25
Lead, heavy	7 12½ to 7 50	7.12½ to 7 50
Zinc, old scrap	5 50 to 5 75	5 50 to 5 75

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* No Straits offering. † In 50-ton lots or more; carload, 33 10 cents per lb.; 1-ton to 14-ton lots, 33 20 cents per lb.

THE WEEK
IN TRADE

GENERALLY speaking, the trade seems to be marking time until the officials at Washington clear up certain matters. The conduit situation is now pretty generally understood, and stock is everywhere short. The hot weather has apparently made no reduction in the total sales volume. Fans have moved pretty rapidly in the East, but not so well elsewhere.

Labor for the week was remarkably stable in comparison with previous weeks. There is, however, a very acute shortage, particularly in jobbing establishments. Those remaining find it necessary frequently to work late into the night in order to clean up the day's work.

A few changes in price have been noticed, but these have either been due to local conditions, such as taking care of large freight charges, or else are belated advances. The keeping of copper at 26 cents may deter some manufacturers from increasing prices until after Nov. 1, when copper again comes up for consideration. Inasmuch, however, as all contracts for copper hereafter will be based on price at delivery, buyers may reasonably expect to see many electrical lines go over to this practice. Some have been doing this for some time.

NEW YORK

New York has just gone through a record hot spell, but, unlike last year, there was no apparent let-up in business. Jobbers are doing a large business and report that in the neighborhood of 90 per cent of it was war business of some sort. This percentage will undoubtedly increase as the government requirements absorb more and more of the available raw materials.

Building is at the lowest ebb yet, with no indications of an increase. New apartment houses are badly needed. The week showed virtually no change from the preceding one. Prices were unaltered and deliveries seem generally to show no better treatment.

FANS.—The extraordinary hot weather of the previous week resulted in a rush for fans. It now seems that the market will be as bare of fans this year as it was at the end of the 1917 season. Both alternating-current and direct-current fans were in demand. Owing to the purchases by the government there were not so many direct-current oscillators available this year for general distribution. During the past hot spell the volume of sales was mostly in the smaller sizes, principally because the earlier sizes had gone off the shelves earlier in the season.

CONDUIT.—While conduit, along with other iron and steel products, has for some time been on the priorities list, it is understood that the regulations regarding its supply have been greatly stiffened during the past ten days. There appears to be conduit available for war work. There seems little likelihood at the present time of any conduit being released for other construction work.

SECOND-HAND APPARATUS.—A very brisk market prevails for motors and generators of over 50-hp. rating. Utilities, mainly in the Middle West and the South, are making inquiries in the local market for used generators. Smaller apparatus has been quiet for the past two months. The supply of used equipment is becoming considerably harder to find. However, much of the equipment coming on the market does not appear to have been used very much. Occasionally, of course, some real old apparatus turns up.

LAMPS.—In spite of the many factors that are acting to curtail lighting, the demand for lamps at this season is keeping up with that of last summer. All of the "Mazda" lamp manufacturers are making strenuous efforts to push local distribution by establishing agency outlets. This is following naturally upon the announcement of the lamp merchandising policy of the New York Edison and the United companies. Local stocks of standard sizes appear to be satisfactory at present, although one prominent manufacturer is firmly convinced that a shortage will follow.

WIRE.—Copper wire remains unchanged in price as a result of the continuation of the 26-cent copper price until Nov. 1. Prevailing rubber-covered for this week is 34 cents.

CHICAGO

While the copper producers did not get their expected increase at Washington on Aug. 7, prices in general have not remained stationary in the Central Western territory. The trend is still sharply upward. Volume of business remains about the same in spite of the fact that this is the open season for vacations. A great deal of interest is centered on the activities of the United States Fuel Administration, and attempts are being made to foresee what the effect will be on certain classes of trade. One responsible representative of this body said this week in a public address that 75 per cent of the 1,000,000 kw. of turbine capacity now building in the United States, and intended largely for Eastern central stations, would be diverted to places where it is needed in the Central West because it would be impossible in the East to get the coal to run the turbines even if they were installed. This statement, if it is correct, presages a rapidly increasing industrial activity for the Central West because the War Industries Board will surely place additional government work in territory where the power supply is ample. The Fuel Administration's active part in helping to close inefficient isolated plants and to interconnect large generating systems is expected to create a considerable additional demand for tie-line equipment and stokers. At the same time, this work will probably place in the second-hand market many small engines, generators and boilers. The government's policy on incandescent lamps, which will soon be announced, is expected to increase the demand for tungsten lamps of smaller sizes and to decrease the demand for carbon and "gem" lamps. Maintenance material for ice plants will no doubt sell earlier this year than usual if the Fuel Administration carries out its plan to centralize ice production as soon as cooler weather will permit it.

STANDARD PORCELAIN.—There has been a general revision upward in porcelain prices. While formerly there were a great many classifications, this has been changed so that now one set of discount applies to tubes and another to all other standard goods. The advance amounts to between 10 per cent and 15 per cent.

HARDWARE.—Pole-line bolts, braces and the like have increased in price between 20 per cent and 25 per cent.

GLASS INSULATORS.—Jobbers have advanced the price on glass insulators an additional 10 per cent this week.

SCHEDULE MATERIAL.—There are so many facts to consider in connection with the advanced cost on Schedule I material that jobbers have not yet definitely fixed the amount of advance this material will carry.

FANS.—Twice fans have taken a spurt, but the arrival of cool lake breezes each time prevented the movement from attaining anything like the desirable proportion.

CONDUIT.—In industrial plants and new power houses it is now becoming common to see temporary open wiring and to have it explained by the statement that conduit cannot be secured.

COAL-HANDLING MACHINERY.—Small concerns making inexpensive coal-handling machinery for central stations and industrial plants have grown large over night owing to the demand for their goods.

HOUSE-WIRING MATERIALS.—Housing problems are beginning to confront more and more Middle Western cities, creating a demand for house-wiring materials.

BOSTON

Little change is to be seen in the volume of business from week to week. Jobbers are constantly rushed to fill war and essential orders, and the principal difficulty seems to be to obtain the necessary material and supplies from the manufacturers. It looks as though congestion would be the rule and not the exception on the railroads for months to come. Jobbers on the coast are able in some cases to utilize the New York-Boston steamship service to advantage, but only a small percentage of the total "imports" into New England from other sections can be handled in this way. There is some talk about extending the so-called "return-load" system of truck service, which has attained such extensive development in Connecticut, into eastern Massachusetts. Prices are remarkably steady at present and collections are reasonably good.

Labor conditions are less disturbed in the electrical field, a second strike at the Lynn works of the General Electric Company having been nipped in the bud by the refusal of the War Industries Board examiners to continue their inquiry if employees remained away from the shops. Stocks are fairly large in staple lines, but more and more the jobber is finding it no easy matter to obtain reliable deliveries, and consequently he has to carry far more of an investment than would be the case under normal conditions. The central stations are sitting tighter than ever as regards new construction and commercial development work. The momentum of past campaigns and the intrinsic appeal of electrical products, however, continue to yield very fair sales returns.

WIRE.—Wire is quoted on a 34-cent base at Boston. Government business predominates, without much change in the market. Jobbers are now at work in the effort to capture some of the wiring supply business associated with the construction of houses for war workers in various parts of New England.

CONDUIT.—Spasmodic shipments are coming in, but the general market is very much restricted. Odd lots may be picked up now and then, but whoever starts out to-day to purchase pipe without a priority order or its equivalent is likely to be disappointed in short order.

ELECTRIC LOADING MACHINES.—The demand for these equipments is remarkably good. There has been no recent price change, and deliveries depend largely upon plant capacity. Motors for these equipments are now readily obtained. The Concord Machine Company, Concord Junction, has now sold five equipments for the coal-handling service at Camp Devens.

FARM-LIGHTING SETS.—A good summer business is reported, with excellent prospects for fall trade. Prices have held steady since March, and it is not expected that a further increase will be required for the present. The demand for 3-kw. sets exceeds the local supply.

ELECTRIC RANGES.—Despite the absence of any extended advertising a very good electric range business is being handled. The threatened coal shortage is a factor in this, together with the food-saving characteristics of a well-run installation. One range sells another in a given neighborhood, and a steady increase in installations is noted.

DRY CELLS.—Sales of flashlamp cells are in excellent volume, and the supply is very satisfactory at present. Dry cells of ordinary types are moving well, with steady prices. The recent increase of about 12½ per cent in the price of flashlamp cells of a prominent type does not appear to have affected the market much.

POLE-LINE MATERIAL.—The small amount of new construction being handled by the central stations has enabled the jobbers to build up substantial stocks of this equipment for immediate shipment. Most of the recent buying has been in connection with war-plant service.

SECOND-HAND MOTORS.—Stocks are very well filled in the sizes up to 50 hp. or thereabouts. A good deal of repair work is under way.

INDUSTRIAL ELECTRIC TRUCKS.—Deliveries of from three to eight weeks were quoted in an opening of bids for government pier service. Prices are firm.

ATLANTA

Reports received from various sections of the Southeast would indicate that the volume of business continues heavy, with the possible exception of a few lines that are beginning to show a sagging off. This is to be expected, as residential and other building permits are down to a low ebb. Present construction is mostly along government or quasi-government account. Each day witnesses a curtailment in all lines other than essential. This condition is reflected in the demand for electrical materials ordinarily used for this work.

Deliveries covering steel products seem to be growing longer, and it is almost impossible to secure anything for non-essential work.

The Birmingham Coke & By-products Company has been organized, with a capital of $3,000,000, for the manufacture of solvent ammonia, naphtha and other chemicals. The entire output of this plant has been contracted for by the United States government. It is reported that the Baldwin Locomotive Works will establish a plant in Birmingham, Ala. Plans have been completed for the first unit at Kingsport, Tenn., covering a half-million-dollar chemical plant. During the last few weeks a large amount of capital has been invested in coal mines, and as the production of coal is behind normal requirements, these plants will be rapidly developed and electrical equipment for them will secure a high priority rating. The American Lumber Company of Florida, formerly the German-American Lumber Company, has recently purchased turbine and motor equipment costing $30,000. The government has big plans under way covering the expansion of this plant, but definite information is not available at this time.

SCHEDULE MATERIAL.—Jobbers report that the ordinary demand for this material has dropped off decidedly of late, owing to the fact that very little house wiring is being done, and no building to speak of, for some time ago the government requirements were very heavy, and the market to-day is spotty as the demand depends a great deal on cantonment expansion. Shipments are slowing up.

FLASHLAMPS.—The volume of sales appears to be decreasing. Factory shipments are very poor, which jobbers state is due to a slowing up of production at the factories.

FANS.—The increase in temperature of the last few days, as compared with that experienced during the past week, has tended to create an active market for fans, and they are moving briskly. There appears to be ample stock on hand to supply requirements.

HEATING APPLIANCES.—With the exception of flatirons, this class of material is dormant this week, possibly owing to the fact that a 10 per cent advance in prices was registered Aug. 1.

SEATTLE—PORTLAND

In spite of the between-season period jobbers and dealers report unabated activity in business. Northwest jobbers state that sales volumes equal if they do not exceed the past two weeks. Domestic sales have been especially satisfying, while shipyard volumes are maintained at the usual high standard. Domestic sales were featured by heavy movement of washing machines and other labor-saving devices. Business curtailment as result of war conditions is imminent, and the prospect is causing some anxiety. Difficulties in securing certain much-needed stocks, including steel, conduit, etc., are increasing and are augmented by requirements that stocks in many lines must be obtained on government order. Portland jobbers report that sales of motors in that district to shipbuilding companies continue at a fair rate owing to steady expansion of yards. The electrical equipment for arc welding recently installed in Portland shops is filling a long-left want. Other electrical labor-saving devices, such as special motor-driven machines for turning ship bars and surfacing ship timbers, are proving extremely satisfactory.

The spruce division recently issued specifications for a large electrically operated sawmill to be installed at Toledo, Ore. The conduit situation in Portland is precarious owing to scarcity of stock and to recent orders restricting sales.

Practically every city in the Northwest, with the exception of Spokane, reports a tremendous gain in amount of new building, especially resident construction, advancing strides in Portland being particularly noted. Seattle's home-building campaign, for which plans are now being perfected, shows prospects of surpassing expectations. Taking advantage of favorable weather conditions, the lumber mills of Oregon and Washington are speeding up operations to meet government demands for fir and spruce. Continued activities in wooden shipyards requiring heavy quantity of lumber are expected. Pacific Northeast sash and door factories are to be closed by government within two weeks, so that more clear fir can be had for airplane stock.

SAN FRANCISCO

Business is good, although all signs point to the fact that the demand in essential electrical lines will soon far exceed the supply available, as is already the case with conduit and its allied material. There is a preponderance of power projects in new work reported. Further economy in the use of electricity in many essential branches is secured by lightless Mondays and Tuesdays in the stores and by recommendations to householders.

APPLIANCES.—Dealers report a better movement in small cooking utensils. A new "Majestic" radiator is being prepared for the fall trade on the line of the original model but capable of angle adjustment.

SEWING MACHINES.—Indications point to a vigorous campaign for the fall. The scarcity of help and the nation's trend toward economy will intensify previous demands, which will also be raised by the perfected Red Cross organization. A recent advance in Western Electric machines of $2 list is reported, making the vibrating or standard model now sell for $41.50 f.o.b. Pacific Coast points.

LAMPS.—Eastern factories are far behind in their delivery, and scheduling and apportioning of orders on even more drastic lines are anticipated. It is conservatively reported that the average Pacific Coast shipyard breaks 250 lamps per day, so that mere maintenance is enormous. On automobile lamps small deliveries will be almost impossible.

LAMP CORD.—Local stocks are good and demand fair, except for weatherproof and desk cords. It is understood that orders for these shipbuilding cords are now subject to priority certificates at the factory.

PORCELAIN.—Various adjustments in the selling prices of small knobs, tubes and cleats are reported to comply with existing freight conditions, this advance tallying about 10 per cent for standard pieces. The city of Oakland has passed an ordinance permitting the use of knobs and tubes in entrance wiring for residences, so as to compensate for the conduit shortage and to release conduit for urgently needed government work.

SWITCHES.—It has been reported that one or two interior California cities have been considering the use of open switches on account of the steel shortage, but nothing definite has been done, nor is sentiment with such a move. A 10 to 25 per cent advance in the price of patented inclosed safety switches has become effective, but the demand continues great. The general sale of open switches, however, is less than that of last year because of the drop in the amount of residential work, and the lack of heating campaigns prevalent last year has this year been compensated for to a certain extent by pumping work caused by the drought.

FANS.—The interior of California, the source of most of the fan demand, is now in the height of the hot season, but so far fan sales have been very disappointing, and they are likely to remain so.

RANGES.—Some encouraging work in the sales of electric ranges is reported from the Hawaiian Islands. Some good orders have been cabled in and those on the ground report good ground on which to build future sales.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List Per 1000 ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95 00
No. 8 stranded	115.00
No. 6 stranded	160 00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	12½%—57 25

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	12½%—66.75

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	12½%—97 75

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	12½%—126 80

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20% to List
Coil to 1000 ft	5% to 15%

	No. 12 Solid
Less than coil	+20% to List
Coil to 1000 ft	5% to 15%

Twin-Conductor

	No. 14 Solid
Less than coil	$115 00 to $80 00
Coil to 1000 ft	98.80 to 75.00

	No. 12 Solid
Less than coil	+20% to + 5%
Coil to 1000 ft	5%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	12%
1/5 to std. pkg	20%
Std. pkg	44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to 12%
1/5 to std. pkg	List to 20%
Std. pkg	25% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 40	$0.40
12 to 50	.35—.36	.35—.36
50 to barrel	.31—.32	.32—.33
Barrel lots	.28—.289	.29—.299

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 40	$0.40
12 to 50	35	.35
50 to barrel	.319 to .322	.329 to .332
Barrel lots	.289 to .292	.299 to .302

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5 00
⅜	250	7 50
½	100	10 00
¾	50	13 00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45 00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75 00— 82 50	$69 75— 75 00
⅜-in. double strip	75 00— 82.50	72 00— 75 00
½-in. single strip	100.00—110 00	93 00—100 00
½-in. double strip	100 00—110 00	96 00—100 00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00 to $78.75	$63.75 to $71 25
⅜-in. double strip	78.75	71.25
½-in. single strip	100.00 to 105.00	75.00 to 95.00
½-in double strip	105 00	93.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
5/16	$0.05½	1	$0 25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
5/16-in.—	25 00–55 00	24 00–24 45	21 50–23 00
¼-in.—	30.00–60.00	27.00–27 28	23.50–26.00

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
5/16-in.—	$60 00	$30.00	$26.50
¼-in.—	$65.00	$32.50	$29.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb	7% to 12%	10% to 15%
2500 to 5000 lb	9% to 14%	12% to 17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb	+5% to 6 8%	+3% to 8.8%
2500 to 5000 lb	9.8 to +20%	11.8% to list

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5 00 to $6.00
Discount	30%

CHICAGO

List price	$5 50 to $6 00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp	100	$0.25
35-amp. to 60-amp	100	.35
65-amp. to 100-amp	50	.90
110-amp. to 200-amp	25	2 00
225-amp. to 400-amp	25	3.60
450-amp. to 600-amp	10	5.50
600-Volt		
3-amp. to 30-amp	100	$0 40
35-amp. to 60-amp	100	.60
65-amp. to 100-amp	50	1.50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5 50
450-amp. to 600-amp	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$5.00 to $5.50
1/5 to std. pkg	4.50 to 4.75

Standard packages, 500. List, each $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$7.00
1/5 to std. pkg	$5.15 to 5.75

Standard packages, 500 List, each, $0.07

LAMPS, MAZDA

105 *to* 125 *Volts*

Regular, Clear:	Std. Pkg	List, Each
10 to 40-watt—B	100	$0 30
60-watt—B	100	35
100-watt—B	24	70
75-watt—C	50	70
100-watt—C	24	1 10
200-watt—C	24	2 20
300-watt—C	24	3 25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30	24	.77
Round Bulbs, 4⅜-in., Frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft Net
Less than coil (250 ft.)	$30 20—$35 90
Coil to 1000 ft	26 95— 27 18

CHICAGO

	Per 1000 Ft Net
Less than coil (250 ft.)	$35 00
Coil to 1000 ft	26 00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24 00

CHICAGO

Net per 100	$21 75 to $30 00

OUTLET BOXES

Nos	List, Per 100
101—A, A 1½, 4 S.C., 6200, 320	$30 00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S	30.00
103—C.A., 9, 4R, B 1½	25 00
106—F.A., 7, C.S., 1½, 3 R	20 00

DISCOUNT—NEW YORK

	Black	Galvanised
Less than $10.00 list	25% to 33%	20% to 27%
$10.00 to $50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$21 00 to $38 00
1/5 to std. pkg.	17 85 to 19 00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$16 80 to $24 15
1/5 to std. pkg.	15 80 to 21 00

Standard package, 2200. List per 1000, $20.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500 5½ N.C.—Solid	Std. Pkg 4000 Nail-it N.C.
Less than 1/5 std pkg	$16.00 to $20 50	$32 00
1/5 to std. pkg	13.60 to 15 60	27 20

CHICAGO

Per 1000 Net	Std. Pkg 3500 5½ N.C.—Solid	Std. Pkg. 4000 Nail-it—N.C.
Less than 1/5 std. pkg	$11 70 to $18 40	$33 85 to $36 80
1/5 to std. pkg.	$10 15 to $16 00	26 60 to 32 00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
¼-in cap key and push sockets.	500	$0 33
¼-in. cap keyless socket	500	.30
¼-in cap pull socket	250	60

DISCOUNT—NEW YORK

Less than 1/5 std pkg	10% to +10%
1/5 to std. pkg	5% to 8%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List to 10%
1/5 std pkg	16⅔%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0 80
60-amp. S. P. S. T	1 20
100-amp. S. P. S. T	2.25
200-amp. S. P. S. T	3.48
300-amp. S. P. S. T	5.34
30-amp. D. P. S. T	1.20
60-amp. D. P. S. T	1.78
100-amp. D. P. S. T	3 38
200-amp. D. P. S. T	5.20
300-amp. D. P. S. T	8.00
30-amp. 3 P. S. T	1.80
60-amp. 3 P. S. T	2 68
100 amp. 3 P. S. T	5 08
200-amp. 3 P. S. T	7 80
300-amp. 3 P. S. T	12 00
Low Grade:	
30-amp. S. P. S. T	0 42
60-amp. S. P. S. T	.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T	1.22
100-amp. D. P. S. T	2 50
200-amp. D. P. S. T	4 50
30-amp. 3 P. S. T	1.02
60-amp. 3 P. S. T	1.84
100-amp. 3 P. S. T	3.76
200-amp. 3 P. S. T	6 76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+5% to Net
$10 to $25 list	11% to 15%
$25 to $50 list	14% to 20%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16% to 25%
$15 to $50 list	24% to 28%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+15% to +5%
$10 to $25 list	11% to List
$25 to $50 list	5% to 14%
	Low Grade
Less than $10 list	+5% to 5%
$10 to $25 list	8% to 16%
$25 to $50 list	24% to 28%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single pole	250	$0 28
5-amp. single-pole, ind	250	32
10-amp. single-pole	100	48
10-amp. single pole, ind	100	.54
5-amp. three-point	100	54
10-amp. three-point	50	76
10-amp., 250-volt, D. P	100	66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0 45
10-amp. three-way	50	70
10-amp double-pole	50	70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std pkg	+10%
1/5 to std pkg	5% to 8%
Std pkg	23% to 25%

DISCOUNT—CHICAGO

Less than 1/5 std pkg	10% to 20%
1/5 to std pkg	List to 16⅔%
Std. pkg	25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0 34
No. 160	60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	40% to net	30% to net
$2 00 to $10 00 list	10% to 50%	5% to 40%
$10 00 to $50 00 list	20% to 60%	10% to 52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2 00 list.	25% to 40%	15% to 30%
$2.00 to $10.00 list	25% to 50%	15% to 40%
$10.00 to $50.00 list.	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6 00
Discount	30%

CHICAGO

List price	$6 00 to $6 50
Discount	25% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools.	$0 434—$0 4625
No. 18, full spools	384— 4425

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0 65 to $0.69
No. 18, full spools	55 to .575

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft
14	$15 00–$20 00	$12 50–$15 00	$11 00–$11 25
12	21 29– 27 10	19 35– 23 20	17 05– 17 42
10	29 70– 37 80	27 00– 32 40	23.75– 24 30
8	41 90– 53 35	38 10– 45 70	33.35– 24 29
6	60 30– 84 40	54 27– 72 35	51 55– 53 05

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft
14	$19 00–$21 00	$14 00–$16 00	$12 50–$13 25
12	27 53– 28 70	23 86– 28 70	22 02– 24 50
10	33 02– 40 10	30 48– 40 10	27 44– 34 23
8	46 09– 56 50	42 54– 48 23	38 99– 41 34
6	91 18– 91 30	61 76– 77 84	52 18– 66 72

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net	
Less than 25 lb	$37 75	$38 40
25 to 50 lb	36 40	37 75
50 to 100 lb	32 40	36 75

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$37 00 to $39 72
25 to 50 lb	36 00 to 38 72
50 to 100 lb	35 00 to 37 72

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

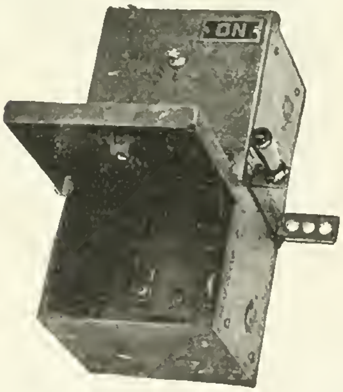
Lamp of Many Uses

What is known as the "U-Ti-Lite" lamp, adapted to a number of purposes, has been developed and placed upon the market by the Peerless Light Company, Halsted, Adams and Green Streets, Chicago, Ill. The lamp may be utilized in any position and can be attached to supporting fixtures by means of tight-grip clamps of the rubber-clad spring type. When not in use the clamps fit into the base. The rubber-protected base permits its use on any highly polished surface without fear of scratching. The metal base is of such size and weight that the lamp will not readily tip over. A swivel permits adjusting the lamp to any angle, while the metal shade is mounted so that it can be turned to give the best concentration of light.

Safety Switch for Industrial Use

A double-door cabinet is the feature of the "Maco" safety switch that has been placed upon the market by W. A. McCombs & Company, Union Arcade Building, Pittsburgh, Pa. These two cabinets are separated by a fiber partition, one space holding the fuses and the other holding the switches. It is impossible to get into the fuse compartment of the switch until the switch is in the "off" position, or to close the switch until the fuse compartment door has been closed. The door over the switch compartment is held closed with a lock.

All switches are arranged for a quick break, the operating mechanism being part of the operating yoke and not of the quick-break attachments on blades of the switch. This feature makes the switch very rugged. Provision is made for locking the switch in the "off" position with three padlocks, thus permitting three men to work on the same line.

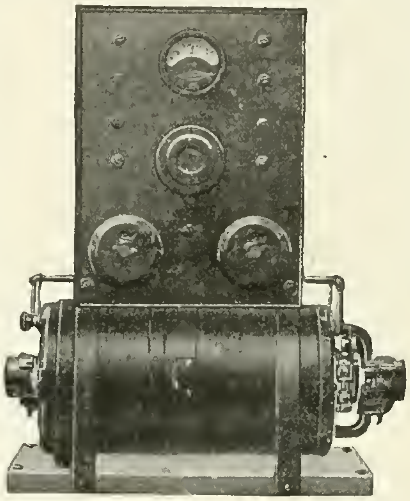


BARRIER PREVENTS ACCIDENTAL CONTACT WITH LIVE PARTS

A standard type A switch is used in the box, and should replacement be necessary any type A switch may be installed with very little trouble. This allows the steel cabinet to be used indefinitely.

Battery-Charging Sets for Auto Batteries

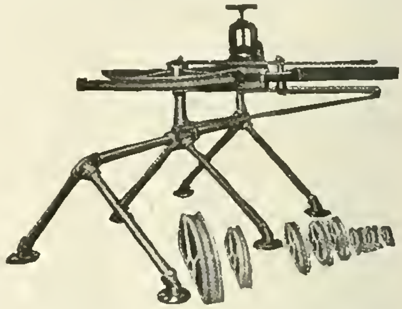
Motor-generator sets with or without control panels are being manufactured by the Perfection Storage Battery Company, Rhodes Avenue and Fortieth Street, Chicago, for charging low-voltage storage batteries. The motors are supplied for standard alternating-current or direct-current circuits and the generators for ratings of 85 watts to 300 watts and pressures of 7 volts to 40 volts. The generator is shunt-wound with a rising characteristic and will produce the correct tapering charge. As shown in the accompanying illustration, the outfit is mounted on a base on which is also mounted the switchboard control panel.



MOTORS AND GENERATOR ON COMMON BASE WITH CONTROL PANEL

Pipe-Bending Machine

When bends must be made in conduit care has to be taken to prevent deformation of the tube and to avoid sharp bends, otherwise trouble will be experienced in pulling in the cable. Furthermore, the material must not be damaged since the protection afforded by the conduit would be sacrificed thereby. Likewise, for pipes carrying water or steam, the friction will be increased by poorly made bends. With the hand-operated pipe-bending machine made by the American Pipe Bending Machine Company, 37 Pearl Street, Boston, these difficulties are avoided, the makers say, and the work does not require skilled men.



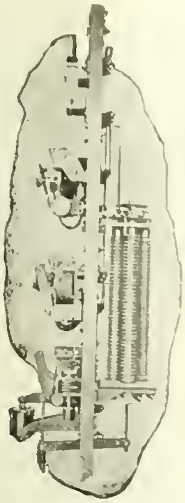
PIPES MAY BE BENT RAPIDLY AND WITHOUT INJURY WITH THIS DEVICE

The machine includes a vise in which the pipe or conduit is clamped and a wheel with a concave rim around which the pipe is bent by a roller attached to a long lever. Bends of different curvature can be made by changing the forming wheel and adjusting the position of the roller on the lever. Among the features of the machine are (1) that the pipe can be bent in a horizontal direction, (2) that the framework is made of pipe and is therefore relatively light, (3) that it can be set up quickly. Similar machines are made for bending tubes and solid bars.

Automatic Motor Starters

For automatically starting alternating-current motors of the polyphase squirrel-cage type that require a gradual start the Allen-Bradley Company, 495 Clinton Street, Milwaukee, Wis., has developed a starter of the primary resistance type. This starter, known as the type KD, consists of two magnetic switches and a variable magnetically operated resistor. These starters are made in four forms, consisting of different combinations of overload relays and a knife switch.

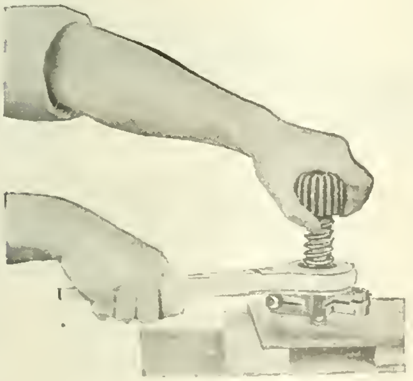
The operation is as follows: When the pilot circuit, through which these switches are controlled, is energized it operates a double-pole magnetic switch, which connects the motor to the line through a variable resistance of the graphite compression type. This resistance is of such value that an initial current of about full load will flow. Simultaneously with the closing of this first clapper, the operating mechanism of the variable resistance is set in motion, which gradually cuts the resistance out of the circuit and accelerates the motor to full speed. The operation of this resistance mechanism is controlled by means of an oil dash-pot which is adjustable. When this operating mechanism reduces the resistance to the minimum it closes the operating circuit of the second clapper switch, which shunts the resistance entirely out of the circuit, thus putting the motor directly across the line. The circuit which shunts out the resistance is closed through fuses or overload relays, and at the same time the first clapper switch is opened, thus introducing the overload protecting devices.



MOTOR STARTED SLOWLY BY SERIES OF MAGNET SWITCHES

Adjustable Tool to Cut Holes in Sheet Metal

To reduce the labor of cutting holes in steel cabinets, boilers or tanks or in other materials such as slate, marble or fiber, a tool has been developed which is known as the "Jiffy" adjustable cutter. It consists of a steel casting on which are mounted two cutting tools. The steel casting is rotated by means of a ratchet wrench, pressure being applied to the cutting tools by means of a heavy coil spring. The device is held in place by a round stud with a flanged nut which is placed in a ⅜-in. (0.96-cm.) pilot hole in the metal.



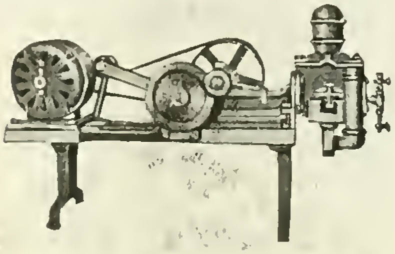
NEAT AND FAST METHOD OF CUTTING CIRCULAR HOLES IN VARIOUS MATERIALS

The tool is made in two sizes, each of which is adjustable within certain limits. The No. 1 type is used for cutting holes 1.25 in. to 3 in. (3.2 cm. to 7.6 cm.) in diameter. The No. 2 cuts holes from 1⅜ in. to 6 in. (9.6 cm. to 15.2 cm.). The No. 12 is a combination of the No. 1 with the swing chuck of the No. 2, thus making the cutting range 1.25 in. to 6 in. in diameter.

The tool can be operated in positions otherwise usually inaccessible because of its ratchet feature and its "flat" design. Furthermore, work can be done much faster and neater with it than by the old method of cutting holes with a hammer, cold chisel and punch. This device is being marketed by Koch & Sandige, 19 South Wells Street, Chicago, Ill.

Electric Force Pump for Residences

For all domestic purposes, water system service, etc., the Peters Pump Company, Kewanee, Ill., has placed upon the market a force pump which it claims has a very high efficiency. The makers also say that this machine is silent in operation, powerful, compact and reliable. It may be adapted to wells or cisterns up to 25 ft. (7.6 m.) vertical lift. The pump is driven by a repulsion induction motor with 200 per cent full load starting torque, the power being transmitted by means of a back gear with a ratio of 3 to 5, which permits operation at large overloads.

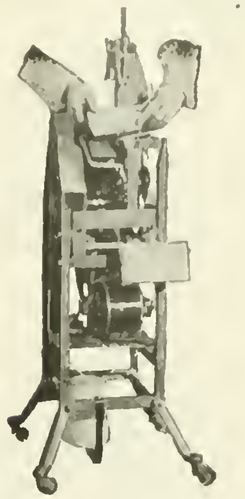


SILENT AND EFFICIENT HOUSE PUMP

If desired the machine can be provided with a two-pole automatic switch complete with fuse plugs and cut-out which is accurate, simple and easy to connect. This is set to cut in at 20 lb. (1.4 kg. per sq.in.) pressure, and cut out at 45 lb. (3.2 kg. per sq.cm.), but is adjustable to any desired pressure.

Package-Tying Machine

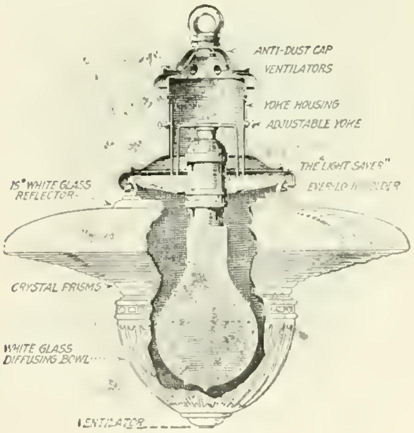
Improvements have been made recently in the letter-tying machine manufactured by B. H. Bunn & Company, 9970 Charles Street, Chicago, and described in the Sept. 27, 1913, issue of the Electrical World, which give it a much bigger field of usefulness. It is used for tying and sorting mailing matter in convenient bundles for ready handling, giving high speed and uniform results. Instead of handling letters of only one size, a single tying machine is now used for an endless variety of catalogs and other circular matter. Machines are being supplied to the War Department and the Department of Agriculture at Washington, and a special machine is being sent to the Treasury Department for tying heavy packages of Liberty bonds.



EFFICIENT MEANS OF TYING MAIL

Fixture Adaptable to Different Sizes of Lamps

A grip holder which does away with the set screws usually required to hold the diffusing shade of the lamp and an arrangement for quickly adjusting it for the use of 100, 200, 300 or 400-watt lamps are features of a commercial lighting fixture manufactured by C. G. Everson & Company, 70 West Lake Street, Chicago. The fixture is known as the "Mon-o-lier," and for it the manufacturer claims high efficiency in light distribution. It is said to be particularly adaptable for lighting stores, factories, banks, auditoriums or other large interiors. As may be seen from the illustration, the bowl of the fixture is made up of a 15-in. (38.1-cm.) white-



SET SCREWS ARE NOT USED IN THIS FIXTURE

glass reflector above and a white-glass diffusing bowl below, the two being connected by a series of prisms. Ventilation is obtained through a hole in the bottom of the white-glass diffusion bowl and through ventilators in the top of the shade holder.

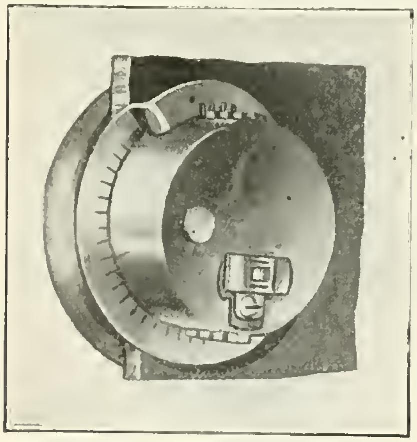
Motor-Driven Compressor Plants

Economical installations can be made by use of an A-F-S motor-driven stationary compressor plant where floor space is available, according to the maker, the A-F-S Machine Company, Toledo, Ohio.

This plant is equipped with electric control for automatically stopping and starting the compressor so that constant air pressure may be maintained. The crank case of the compressor is entirely closed, making it dust and dirt proof. The crank case and air cylinder are separate pieces, thus permitting easy access to the piston, rings and connecting rod. Light quick-acting poppet valves are also in the intake, while ball valves requiring no regrinding are used for the outlet or discharge. This combination of valves gives the highest possible efficiency, according to the maker. The compressors may be driven either by belt or high-speed chain.

Accurate Self-Winding Electric Clock

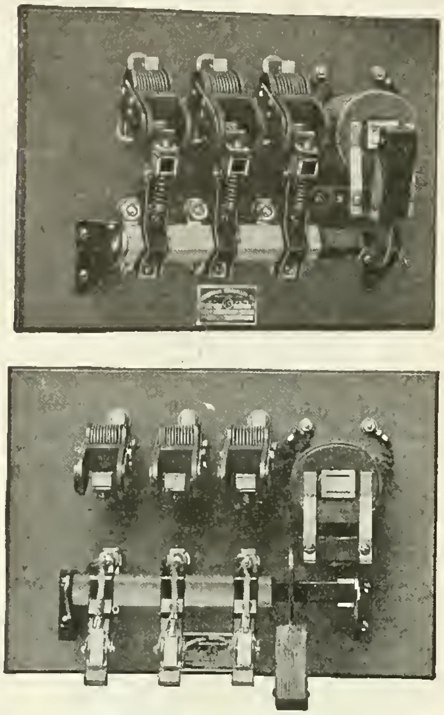
An electric clock which, it is said, will give correct time continuously has recently been placed upon the market by the Connecticut Clock Company, 929 Singer Building, New York City. The clock winds automatically from a storage battery or dry cells, and an ordinary dry cell will operate it. The clock contains a seven-jewel compensated movement which is so mounted that, according to the makers, it cannot be seriously affected by vibration. The case is compact and fitted with the "Connecticut" lock ring which prevents it from jarring loose from its support.



ELECTRIC CLOCK WHICH CANNOT BE SERIOUSLY AFFECTED BY VIBRATION

Alternating-Current Magnetic Contactor

For controlling power and light circuits the Industrial Controller Company of Milwaukee, Wis., has placed upon the market two types of alternating-current magnetic contactors—two-pole and three-pole. Each switch is mounted on a square shaft at one side of the closing magnet, the shaft being held by a bearing at either end. This contactor is so designed that by the removal of a small U-shaped clamp the magnet armature may be slid along the shaft and the contactor opened widely, permitting free access for the removal of the coil, contacts, etc., in case repairs or replacements are necessary.



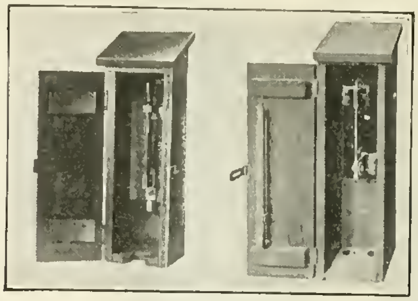
MAGNETIC CONTACTOR CLOSED AS IN OPERATION AND OPEN FOR REPAIRS

The magnet armature is arranged so that by automatic action it properly seats against the pole piece of the magnet, which arrangement practically eliminates all humming and vibration in the contactor and requires no bearing adjustment when assembling. These contactors are manufactured in 30, 75 and 150-amp. sizes.

Low and High-Voltage Pole-Line Switches

Line-sectionalizing switches recently developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., for high-voltage installations, are shown in the accompanying illustration. These switches embody several safety features. The box holding the lower-voltage switch is so designed that when the switch is opened the switch handle drops into a slot in the bottom of the box. This allows the door of the box to be closed and locked, thus making the closing of the switch by persons unauthorized to do so impossible.

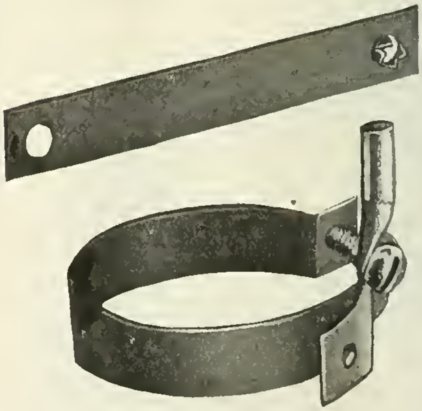
The switch of Fig. 2 is a heavy-type service switch inclosed in a wooden box which can be locked with the switch either opened or closed. This switch is operated by an insulated hook stick which is separate from the switch. It is hung inside the box cover when not in use. The smaller of these line switches is for voltages up to 750 and for capacities of 200, 400 and 600 amp. The heavy switches are for voltages up to 1500 and capacities of 1200 amp.



FIGS. 1 AND 2—750-VOLT AND 1500-VOLT LINE SWITCHES

Extensible Pipe-Grounding Clamp

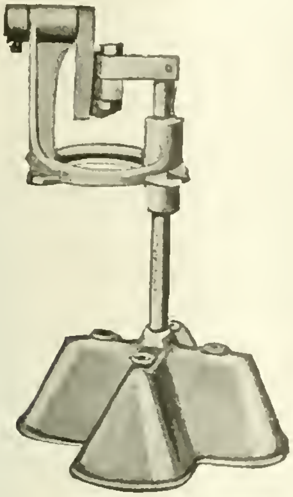
A convenient pipe clamp for making electrical "ground" connections is being marketed by the Charles M. Rose Company, 136 Prince Street, New York. A strap of annealed copper, fastened to the bolt at one end, is drawn around the pipe and secured at the other end by passing through a slot in the lug and being bent back upon itself. To accommodate pipes of diameters from ⅜ in. to 2½ in. (0.95 cm. to 6.25 cm.) more or less of the strap is drawn through the slot in the lug. One-inch (2.54-cm.) extenders are used for larger pipes by placing the burred eyelet through the hole in the end of the strap and hammering the two pieces together. As many extenders may be used as may be necessary for large pipes. The tinned lug for receiving the ground wire lies snugly against the pipe.



ONE STANDARD LENGTH OF STRAP AND ONLY 1-IN. EXTENDERS NECESSARY

Attachment for Dolly Washer

The vacuum producer illustrated herewith is made for attaching to washing machines manufactured by the Globe Manufacturing Company, Perry, Iowa. The four-leaf-clover-shaped cup or vacuum producer is made of heavy cast iron and is electro-galvanized. In this cup are four valves which let out the air on the downward stroke and which close on the upward stroke, thus making the cup air-tight. This produces a vacuum which draws the soapy water through the clothes. The four movements of this mechanism in operation are as follows: Downward, forward, backward and upward. This motion is calculated to move all of the clothes in the tub.



VACUUM WASHING MECHANISM KEEPS CLOTHES IN MOTION ALL OF THE TIME

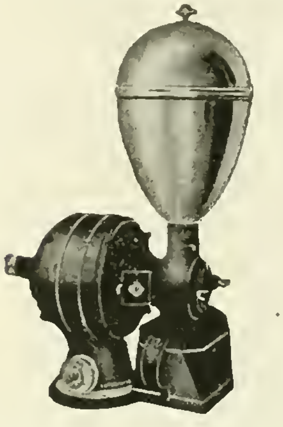
Adjustable Lamp for Shops

To assist the mechanic who must direct light into places difficult to reach, the Herwig Art Shade & Lamp Company, 2140 North Halsted Street, Chicago, has developed the adjustable portable unit shown herewith. With this cast-metal stand, which is suitable for factories as well as garages, the lamp may be adjusted to various heights. It can be made low enough to go under an automobile or other machine and throw light upward or it can be adjusted to place the lamp 4 ft. 10 in. (1.47 m.) above the floor. To give this great degree of flexibility the stand, which is mounted on casters, is provided with an upright lamp support made of two pieces. This upright carries the extension arm, which can be swung freely around the pipe upright, and a universal joint at the end of the arm has a double-acting ratchet and swivel movement, which allows the lamp to be set at any angle. Thirty feet (9.1 m.) of cord is supplied.

PORTABLE LAMP STAND OF GREAT FLEXIBILITY

Electric Coffee Grinder

To meet the requirements of a small grocer, the Enterprise Manufacturing Company of Philadelphia, Pa., has placed upon the market a new line of rapid grinding coffee mills, a type of which is shown in the accompanying illustration. The machine is fitted with a ¼-hp. motor directly connected to a shaft of the cutter. It can grind 1.5 lb. (0.67 kg.) of coffee per minute and can be regulated to grind coarse or fine while in operation. The device is fitted with granulating grinders only, and can be used with either direct or alternating current.



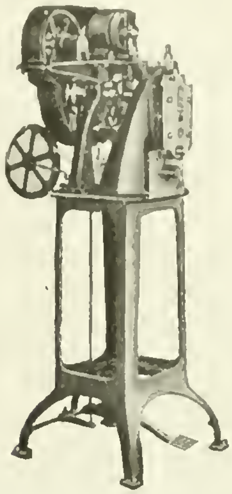
WILL GRIND 1½ LB. PER MINUTE

Box-Corner Staying Machine

By simply attaching a plug to an ordinary lighting socket, a box corner staying machine manufactured by the M. D. Knowlton Company of Rochester, N. Y., can immediately be placed in service. The machine is operated by a Westinghouse motor mounted on the top of the frame of the machine and geared directly to it. Because it is supported on caster wheels the machine can be readily moved about the factory.

It is claimed that the corner formed by this machine is stronger than the original board on account of the great pressure used and the fact that the board is neither punctured nor weakened by the continuous fastening.

A feature of the machine which is of special interest is the Knowlton safety device which replaces the old-style link in the machine head. It serves a double purpose of a pressure transmission and of a protection to the operation. The safety device is designed in such a manner that when the head is lowering there is no driving connection until the head comes within a distance of approximately 5/32 in. (0.4 cm.) of the anvil. Any obstruction thicker than this prevents the device from locking and exerting pressure.



SAFETY DEVICE PREVENTS PRESSURE EXCEPT AT PROPER TIME

Electric Washing Machine with Safety Wringer

An electric washer of the dolly type has recently been placed upon the market by the Empire Electric Manufacturing Company, Kansas City, Mo. This machine has a cypress tub supported by stave legs. It can be equipped with electric motors for either 30 or 110-volt service. The gears are covered to prevent injury to the operator, and a safety device is provided on the wringer which allows it to be stopped instantly.

Small Lighting Sets

Compactness, simplicity, ruggedness and minimum weight are the features claimed for the small lighting sets that are being manufactured by the Steam Motors Company, Inc., Springfield, Mass. These sets are furnished for the Emergency Fleet Corporation vessels and consist of a generator and steam turbine mounted on one base. The fact that there are only two bearings helps to produce smooth operation and eliminates misalignment and vibration troubles. The total over-all length of a 10-kw. set is 3 ft. 3 in. (0.99 m.) and the net weight 1150 lb. (521 kg.).

The turbine has a horizontal split casing with steam inlet and exhaust in the lower half. Only one turbine packing gland is necessary because an improved type of labyrinth packing is used. These sets are made in capacities from 3 kw. to 50 kw.

Trade Notes

Government Orders

The following orders have been placed by the various government departments:

ORDNANCE DEPARTMENT — General Electric Company, Schenectady, N. Y., compound-wound d.c. motor; Charles A. Templeton (Inc.) Waterbury, Conn., electric detonators; Chicago Pneumatic Tool Company, Philadelphia, heavy-duty electric drills; Mechanical Appliance Company, Milwaukee, Wis., motor-generator sets; Packard Electric Company, Warren, Ohio, rubber-covered high-tension cable; Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., electric motors.

NAVY BUREAU OF SUPPLIES AND ACCOUNTS — July 22, Wetmore-Savage Company, Boston, Mass., slow-burning wire; Ideal Electric & Manufacturing Company, Mansfield, Ohio, generating set. July 23, Worcester (Mass.) Electric Manufacturing Company, switchboards; Mutual Electric & Machine Company, Detroit, Mich., panels. July 25, Bailey Electric Supply Company, New York, wire. July 26, General Electric Company, Schenectady, N. Y., searchlamps; Standard Underground Cable Company, Pittsburgh, Pa., lighting wire. July 30, Standard Underground Cable Company, Pittsburgh, Pa., copper cable; Eck Dynamo & Motor Company, Belleville, N. J., motors. July 31, Standard Underground Cable Company, Pittsburgh, Pa., wire; Indiana & Insulated Wire Company, Jonesboro, Md., cable.

GOVERNMENT ORDERS, BUREAU OF AIRCRAFT PRODUCTION.—Dyneto Electric Corporation, Syracuse, N. Y., 100 battery-charging sets; Alien Property Custodian, Washington, D. C., 10,000 Splitdorf magnetos; Ward Leonard Electric Company, Mount Vernon, N. Y., 200 battery charging panels; Standard Underground Cable Company, Pittsburgh, Pa., 193,680 ft. of cable; John A. Roebling's Sons, Trenton, N. J., 21,000 ft. of cable; Manhattan Electrical Supply Company, Jersey City, N. J., 6100 connectors; General Radio Company, Cambridge, Mass., 2500 receiving sets; Western Electric Company, New York, N. Y., 280 amplifiers, 300 transmitting sets, service development of two high-power output amplifiers, telephone supplies, etc., and cable; American Propeller & Manufacturing Company, Baltimore, Md., 100 air fans.

BUREAU OF AIRCRAFT PRODUCTION, —July 11, De Forest Radio Telegraph & Telephone Company, New York City, 2000 SCR-54-A radio sets; Western Electric Company, New York, ten wavemeters. July 13, Marconi Wireless Telegraph Corporation of America, New York City, 1500 wireless sets; Liberty Electric Corporation, Port Chester, N. Y., 2000 radio sets. July 15, Disco Electric Manufacturing Company, Detroit, Mich., 1000 synchronizing generators. July 16, Western Electric Company, New York City, development of special equipment; Disco Electrical Manufacturing Company, Detroit, Mich., 5310 synchronizing generators; General Electric Company, Schenectady, N. Y., 25,000 regular tubes, 30,000 ballast lamps; Standard Underground Cable Company, Pittsburgh, Pa., 18,000 ft. cable. July 18, Western Electric Company, New York, N. Y., 10,000 radio sets. July 18, Western Electric Company, New York, electrical supplies, 1500 splicing clamps, 320 grips, 17,612 bridle rings; Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., 2000 airplane radio-telegraph transmitting sets; International Radio Telegraph Company, Brooklyn, N. Y., 2000 airplane radio-telegraph transmitting sets. July 19, Western Electric Company, New York City, 10,000 antenna systems. July 25, Western Electric Company, 463 West Street, New York, N. Y., 10,000 head sets, complete with plugs and cords; Dyneto Electric Corporation, Syracuse, N. Y., 55 electric generating sets.

HOLLAND AND DENMARK COMMODITY LIST.—The War Trade Board has announced the adoption of a set of regulations with respect to the exportation of certain commodities to Holland and Denmark. A list of commodities which will be given consideration is appended to the announcement. No electrical goods are specified with the exception of lighting fixtures. In this case only those made up of iron or steel will be considered.

TRADING WITH THE ENEMY.—Accumulative supplements to enemy trading lists, revised, containing additions, removals and corrections from March 15, 1918, to July 12, 1918, have been issued by the War Trade Board.

BRITISH FOREIGN TRADE CONTROL. —The Bureau of Foreign and Domestic Commerce has recently issued current series No. 29 entitled "British Control of Imports and Exports," with list of prohibitive goods. Copies of the pamphlet may be obtained from the Superintendent of Documents at the Government Printing Office, Washington, D. C., at a price of 5 cents.

MUST NOT PURCHASE FOR EXPORT PRIOR TO ISSUANCE OF LICENSE.— It is the policy of the War Trade Board to discourage and prevent exporters purchasing, manufacturing or producing articles for the fulfillment of specific export orders until an appropriate export license has been issued. The attention of the War Trade Board has been directed to a number of instances in which manufacturers before obtaining export licenses have made articles for specific export orders which were useless for domestic consumption but which under the regulations of the War Trade Board could not be exported. It is essential for the proper conservation of commodities in the United States that this practice be stopped, and it is the purpose of the War Trade Board to refuse licenses to exporters who violate this policy.

LARGE QUANTITY OF WOOD-STAVE PIPE.—The desirability of wood-stave pipe is again officially recognized by the United States government as evidenced by the placing of a further order with the Continental Pipe Manufacturing Company, Seattle, Wash., for 230,000 ft. of machine-banded wood-stave pipe, varying in size from 6 in. to 18 in. in diameter. It will require more than one hundred railroad cars to deliver this order. This pipe is being made of Douglas fir lumber, already world-famous for its many uses in supplying the war needs of the United States and its allies. It will require more than 1,000,000 lb. of wire and 1,500,000 ft. of lumber to complete this one order. The three large plants of the Continental Pipe Manufacturing Company in the Douglas fir belt of Oregon and Washington have previously furnished pipe on government orders amounting to 200 miles, or 625 carloads.

SPLITDORF ELECTRICAL COMPANY LICENSED TO USE ENEMY-OWNED MAGNETO PATENTS.—The Federal Trade Commission has announced that it has licensed the Splitdorf Electrical Company of Newark, N. J., to use in the manufacture of magnetos certain patents hitherto exclusively used in this country by the Bosch Magneto Company, but found by the commission to have been owned or controlled entirely by Robert Bosch of Stuttgart, Germany. The Bosch company, an American corporation, in opposing the grant of licenses to Splitdorf, presented evidence to show Robert Bosch in 1913 had agreed to sell the patents to the Bosch Magneto Company for $275,000. From the evidence submitted, however, it appeared that the legal title is still held by Robert Bosch, and the patents stand in his name in the U. S. Patent Office. The commission, therefore, held the patents are enemy-owned or controlled, and as such subject to licensing to American firms. The Splitdorf company is manufacturing magnetos for army airplanes and was directed by the War Department to embody the Bosch devices. Splitdorf engineers contend their own devices are equal to or superior to the Bosch devices specified by the army, but have modified their magnetos to conform with the government specifications. The licenses are non-exclusive, and are to run during the duration of the patents.

SHIPMENTS TO OR THROUGH THE UNITED KINGDOM, FRANCE, ITALY AND BELGIUM.—The War Trade Board, after consultation with the United States Food Administration, the United States War Industries Board and the war missions of the respective European allied governments, announces the adoption of a simplified procedure, effective Aug. 12, 1918, for the issuance of export licenses for shipments which are destined to the United Kingdom France, Italy or Belgium (excluding their colonies, possessions and protectorates), either directly or by way of any other country or colony, or destined to any country or colony by way of the United Kingdom, France, Italy and Belgium, excepting shipments destined to Switzerland by way of France or Italy. The purposes of the new procedure are to save ship tonnage and to prevent the useless consumption of material and labor by preventing the manufacture of articles which may not be exported or which the government of the country of destination does not wish to have imported. Application for such licenses now must include one of each of the following papers, properly executed: (a) An application on form X, to which should be attached (b) such supplemental information sheets as may be required by the rules and regulations of the War Trade Board to be used in connection with shipments of certain commodities or shipments to certain countries (as form X-1, X-2, etc.); (c) a new supplemental information sheet, form X-115. In form X-115 the applicant is required to give certain information and make certain agreements in conformity with the purposes above mentioned. Applicants must also show thereon that permission to import or purchase (if required) has been duly granted by the government of the allied country to or through which the shipment is to be made. Applications for licenses to export to France must have attached thereto a copy of the French government "attestation." Applications filed with form X-115 attached should be mailed directly to the War Trade Board, Washington, D. C. They will then be referred by the War Trade Board to the war mission of the allied country to or through which the shipment is to be made and to the United States War Industries Board or to the United States Food Administration, if necessary, and these applications will be considered by the War Trade Board in accordance with its rules and regulations. This will relieve applicants for export licenses from the necessity of applying to the war mission, to the War Industries Board or to the Food Administration, as required by War Trade Board Ruling No. 104.

Western Electric Company Changes

LEO M. DUNN, manager of the Philadelphia house, has been appointed assistant Eastern district manager. The Philadelphia and Pittsburgh houses will be under his supervision. He recently was appointed manager of the Philadelphia house after serving in a like capacity at Pittsburgh for five years. Mr. Dunn has been with the company since 1910.

FREDERICK H. LEGGETT, manager of the New York house, succeeds Mr. Clifford as Eastern district manager. He will have supervision of New York, Philadelphia and Pittsburgh. Mr. Leggett has been working for the company for twenty years, beginning in the clerical department in New York. Since that time he has spent three years in Tokyo as secretary of the Nippon Electric Company, Ltd., has been manager at Antwerp, foreign sales manager at New York and Pacific district manager at San Francisco.

E. P. CLIFFORD has been appointed office manager of the engineering department, West Street, New York City, reporting to the chief engineer and having supervision over the clerical branch, the employment division, the medical division, the restaurant and the financial division. Mr. Clifford has been with the company since November 14, 1892, when he began as an office boy in the clerical department in New York. He was made chief clerk shortly afterward and remained in that position until 1902, when he went to Chicago as chief clerk. He was transferred to Philadelphia in 1903 and a year later was back in Chicago doing clerical inspection work. After several years in that position he became manager of the New York house and Eastern district supervisor, and in 1917 he was promoted to the position of Eastern district manager.

THE NEW PROCESS SPECIALTY COMPANY, Milwaukee, Wis., has moved from the Enterprise Building to its new factory at 230-232 Hanover Street. This move was necessitated to provide greatly increased facilities for the manufacture of high-grade jigs, dies, gages, tools and special machinery.

C. A. BIRD has been placed in charge of the new Pittsburgh office of the General Devices & Fittings Company, Chicago. This office is at 1303 Arrott Building. Mr. Bird has done much research work in the line of high-tension phenomena and has prepared many papers on conductor calculations and allied engineering subjects. He was formerly one of the district engineers of this company's Cleveland office and while there had charge of Pittsburgh district work. Increasing demand for engineering service made it necessary to station Mr. Bird in Pittsburgh with a suitable staff of assistants.

J. H. FENTON of the Los Angeles office of the Westinghouse Electric & Manufacturing Company has recently been appointed manager of the industrial division of that office, which includes jurisdiction over the Tucson and El Paso offices.

THE BOOTH-HALL COMPANY, 565 West Washington Boulevard, Chicago, Ill., has contracts for building Booth-Hall electric steel furnaces for the following companies: Consumers' Steel Company, Chicago, Ill., one 3-ton furnace for producing tool steels; Ecorse Foundry & Machine Company, Ecorse, Mich., one 3-ton furnace for producing steel castings. This makes a total of ten Booth-Hall furnaces installed and building.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY has this week advised the trade that it has permanently discontinued the manufacture of armored cable, armored cord and flexible steel conduit, its schedules "X" and "Y." This step, the company states, was taken in order that it might devote its entire energy to other lines, including a large amount of government business, both direct and indirect, as well as its "safety service" externally operated line of knife switches. In taking this step the company has canceled all orders for the above materials now in its works, and no further orders, of course, will be taken.

SHIPPING BOARD OFFICIALS TALK TO HURLEY EMPLOYEES

At a recent loyalty meeting of the Hurley Machine Company, Charles Schwab, E. N. Hurley and Charles H. Piez, officials of the Federal Shipping Board, addressed the workers.

E. P. DILLON, manager of the power division, New York office of the Westinghouse Electric & Manufacturing Company, has resigned to become general manager of the Research Corporation of New York. Mr. Dillon joined the Westinghouse company in 1909, having been previously connected with various mining and electrical companies in Colorado. In 1917 he was transferred to the New York office as manager of the railway and power division. For several years he was assistant to manager of the railway and lighting department at East Pittsburgh, being in charge of power house and apparatus work. He was transferred to the New York office as manager of the railway and power divisions in 1917.

THE AJAX ELECTRIC SPECIALTY COMPANY, 1408 Morgan Street, St. Louis, Mo., has just been organized to manufacture specialties and represent manufacturers of staple electrical merchandise and novelties. The Ajax Electric Specialty Company will be headed by Ernst Alschuler, president, who was recently sales manager for the American Carbon & Battery Company and also for many years Chicago manager for the Interstate Electric Novelty Company. James S. Cuming is vice-president and treasurer. He has disposed of his interest in the Central Telephone & Electric Company, of which he was the organizer in 1898, and had been president since that time. Oscar Walters is secretary. He has been in charge of the manufacturing interests of the Central Telephone & Electric Company for the last twelve years.

Trade Publications

POLE-LINE ACCESSORIES.—Additions to catalog handbook No. 9 are now available, W. N Matthews & Brother of St. Louis, Mo., announce.

TANKS.—Specifications of tanks are now listed in a bulletin, No. 246, dated July 25, put out by the Walter A. Zelnicker Supply Company, 325 Locust Street, St. Louis, Mo.

SAFETY SWITCHES.—W. A. McCombs & Company, Union Arcade Building, Pittsburgh, Pa., have issued a folder describing and illustrating their safety switch for industrial use.

EXPANSION JOINTS.—Expansion joints are described and illustrated in a circular distributed by the Ross Heater & Manufacturing Company, 504 Mutual Life Building, Buffalo, N. Y.

AIR AND GAS MIXER.—In a folder called "McKee Proportional Mixer" the Eclipse Fuel Engineering Company, Rockford, Ill., shows how its gas-mixing device is applied to furnaces, etc.

COMPUTER.—In the circular distributed by the Computer Manufacturing Company, 25 California Street, San Francisco, the Ross Meridi-O-Graph and the Ross Rapid Computer are illustrated and described.

HEAT-INSULATING BRICKS.—A folder which may be secured by addressing the Armstrong Cork & Insulation Company, Pittsburgh, Pa., explains the economy of using its insulating bricks in furnaces and ovens.

POWER PLANT APPARATUS.—Surface condensers, multi-head water heaters and expansion joints, etc., are illustrated and described in a circular issued by the Ross Heater & Manufacturing Company, Inc., Buffalo, N. Y.

TOGGLE SWITCH. — Toggle snap switches, schedule F, are illustrated and described in a leaflet that has been printed by Harvey Hubbell, Inc., Bridgeport, Conn. This switch, listed as No. 8101, conforms to the National Electrical Code.

ELECTRICALLY OPERATED BRAKES. —Brakes for use with elevators and hoists where the supply is alternating current, together with dimensions of equipment, are covered in booklet A, distributed by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

LAMP SOCKETS. — "Dim-A-Lite" lamp sockets are illustrated in a folder that has been issued for dealer purposes by the Wirt Company, Armat Street, Germantown, Pa. Advance literature for an intensive merchandising campaign has also been issued by this company.

PORTABLE LAMPS. — Regent portable lamps with "Rozelle" and "Ivre" shades are illustrated and listed in a circular distributed by the Ivanhoe-Regent Works of the General Electric Company, Cleveland, Ohio. These decorative portable lamps in soft rich colors are shown to be exceedingly attractive.

COAL-HANDLING MACHINERY. —Standard installations of the Godfrey coal conveyor are illustrated and described in a circular that has been distributed by John F. Godfrey, Elkhart, Ind. Emphasis is laid on the fact that power plants can greatly facilitate continuous operation by storing their coal now.

FANS AND BLOWERS.—A ninety-six-page guide book pertaining to ventilation has been prepared by the Ilg Electric Ventilating Company, Whiting and Wells Streets, Chicago. This company manufactures ventilating equipment for restaurants, schools, theaters, churches, office buildings, homes, industrial plants, etc.

BRONZE GEARED PUMPS. — Bronze geared pumps are illustrated and described in a circular that is being distributed by the M. L. Oberdorfer Brass Company, Syracuse, N. Y. Their adaptability, construction, testing, sizes carried in stock, capacity, tables of dimensions and ratings are shown in this bulletin.

TOOL MARKING.—The Electro-Stylograph Company, 1 Madison Avenue, New York, is distributing a circular describing apparatus for the permanent and convenient marking of tools, gages, dies, etc., by the application of electric energy. It illustrates the tool-room superintendent marking tools with the "Electro-Stylograph" conveniently and permanently.

DUPLEX WIRE SUPPORTERS AND INSULATORS.—A circular describing the L. F. duplex wire supporters and insulators has been issued by Louis Fort, 128 Hoboken Avenue, Jersey City, N. J. Besides giving a description of the insulator, this catalog tells about the interchangeability and mentions the various types. Reproductions of photographs of these fittings are also given.

RUBBER GLOVES.—The Pittsburgh Glove Manufacturing Company, 413 South Main Street, Pittsburgh, Pa., has issued a catalog describing and illustrating its high-tension glove. These gloves consist of a tough extra-flexible rubber of great strength and high dielectric properties, protected by genuine horsehide gloves, according to this bulletin. They permit free and unrestricted use of the hands.

ELECTRICAL DEVICES.—The Western Electric Company, Inc., 195 Broadway, New York, has issued two folders in connection with the Habirshaw and Western Electric Company advertisements that recently appeared in several popular magazines. These circulars and the reproduction of this advertisement illustrate several electrical devices marketed by the Western Electric Company which, it is held, will help in the campaign for new business this fall. Some of the devices shown are drills, grinders, hammers, floodlamps, sewing-machine motors, industrial-type heaters, glue pots, soldering irons, utility motor, vacuum cleaner, hoist equipments, ventilating outfits and inclosed switches.

New Incorporations

THE GILFORD ELECTRIC COMPANY of Hartford, Conn., has been incorporated by E. S. Gilford, B. Gilford and C. Schonhaus. The company is capitalized at $5,000 and proposes to deal in gas and electrical supplies and equipment.

THE ALLIED ELECTRIC COMPANY of Brooklyn, N. Y., has been incorporated with a capital stock of $5,000 to do a general contracting business. The incorporators are L. Weiss, B. Freidman and J. G. Feldman, 357 Third Street, Brooklyn, N. Y.

THE LIONEL CORPORATION of New York, N. Y., has been incorporated by J. L. Cowen, 48 East Twenty-first street; A. T. Scharps, 154 Nassau Street, and M. Frankel, 42 Broadway, New York City. The company is capitalized at $50,000 and proposes to manufacture electric toys.

THE ROCK HILL (S. C.) ELECTRIC COMPANY has been chartered with a capital stock of $2,000 by J. E. Pryor, Minnie R. Martin and others. The company proposes to do a general electrical construction, wiring and repair business of all kinds, and also to deal in machinery.

FRANK E. WATTS, INC., of New York, N. Y., has filed articles of incorporation with a capital stock of $50,000 for the purpose of doing a general electrical and mechanical engineering business. This incorporators are: F. Murdock, W. C. Chapman and A Pnevin 30 Church Street, New York City.

THE CONTRACTORS' MACHINERY & EXPORT COMPANY of New York, N. Y., has been incorporated by J. N. Morton, W. Catlin, and J R. Rodriguez, 1140 Jefferson Avenue, Brooklyn, N. Y. The company is capitalized at $100,000 and proposes to manufacture boilers, engines, etc.

THE STRATTON LIGHT COMPANY of Kingfield, Me., has been organized with a capital stock of $10,000 for the purpose of generating and distributing electricity for lamps and motors in the towns of Eustis and Copplin Plantation. The directors are: Edwin H. Gross, president; Forrest R. Wing, treasurer and clerk; Merle A. Bates, William A. Lee and others, all of Stratton

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

TINMOUTH, VT.—Work has been started on the dam in the town of Tinmouth to be situated on the Theophilus Noble farm a short distance from the highway leading east to the Ballard farm, owned by the Hortonia Power Company, which, it is estimated, will create an artificial lake covering approximately 1000 acres and give a storage capacity of 1,200,000 cu. ft. of water.

BOSTON, MASS.—For the purpose of an exchange of electricity between the Edison Electric Illuminating Company and the New England Power Company, it is proposed to connect the plants of the two companies by a transmission line. A petition was filed with the Board of Gas and Electric Light Commissioners by the New England Power Company asking permission to construct a high-tension pole line from the Forest Hills station of the Edison company to the Sudbury dam.

CHATHAM, MASS.—The United States government, Bureau of Yards & Docks, has awarded a contract to the Hixon Electric Company, Boston, for the installation of the proposed new underground conduit system at the local station.

NEWBURYPORT, MASS.—The Newburyport Gas & Electric Company is planning to stretch wires to supply electricity to customers at Ipswich.

NEWBURYPORT, MASS.—The Common Council has passed an ordinance that provides that all wires for the transmission of more than 5000 volts of electricity shall be placed in underground conduits.

NORTHAMPTON, MASS.—It has been decided by the Hampshire County Commissioners to equip the town farm buildings with an electric-light plant.

TURNERS FALLS, MASS.—The Turners Falls Power & Electric Company has awarded a contract to Fred T. Ley & Company, 499 Main Street, Springfield, for improvements to its plant.

HARTFORD, CONN.—The Spencer Turbine Company, 620 Capitol Avenue, has awarded a contract for the erection of a one-story and two-story plant, about 75 ft. by 300 ft. and 40 ft. by 75 ft., on New Park Avenue. R. G. Bent & Company, 904 Main Street, Hartford, are the contractors.

STEVENSON, CONN.—Earle Greene will have charge of the work of building the power house at Stevenson.

Middle Atlantic States

BINGHAMTON, N. Y.—The Binghamton Bridge Company has acquired property at Port Dick, near Binghamton. The company is planning to erect a new hydroelectric plant at the site, to include the construction of a concrete dam and a one-story brick power house and the installation of turbines, generators and other equipment.

BROOKLYN, N. Y.—Plans are being prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for extensions and improvements to the electric power plant at the Brooklyn Navy Yard. An appropriation of $750,000 has been granted for the work.

BROOKLYN, N. Y.—The United States government, Navy Department, Bureau of Yards and Docks, is having plans prepared for improvements to the power plant at the local navy yard.

BUFFALO, N. Y.—Electrical machinery will be installed for operating the draw span in connection with the drawbridge now being erected over the Buffalo River at Abbott Road.

MORRIS, N. Y.—It has been voted to light the streets with electricity. The Lynn Tractor Company will receive the contract for lighting.

WESTFIELD, N. Y.—The Borough Council is considering the construction of a new pumping plant, to cost about $35,000.

DOVER, N. J.—The New Jersey Power & Light Company is making rapid progress in the extension of its electric lighting system to Upper Hibernia. The company will furnish service to the mines, workshops, offices and auxiliary buildings of the Wharton Steel Company.

NEWARK N. J.—The Crocker-Wheeler Company, Ampere, N. J., has had plans prepared for the erection of a one-story addition, about 90 ft. by 90 ft., at North Twelfth Street and Fourth Avenue.

MORRISTOWN, N. J.—The Morris & Somerset Electric Company plans extensions to its power plant, to cover an area of approximately 18,000 sq. ft. of floor space.

SOUTH AMBOY, N. J.—The City Council has appropriated $6,000 in its annual budget toward an electric street-lighting system.

EASTON, PA.—Work on the installation of the new 10,000-kw. turbine is progressing rapidly and it will be ready for use by Sept. 1.

ESSINGTON, PA.—Plans have been filed by the Philadelphia & Reading Railway Company for the erection of new shop buildings at its Darby Creek yards, Essington, including new engine house, power plant, and other structures. Contract has been awarded to the Robert E. Lamb Company, Philadelphia.

HAZLETON, PA.—The substation of the Harwood Electric Company was damaged by fire on July 30, caused by a bolt of lightning, with loss estimated at about $5,000. The destroyed section of the plant will be rebuilt at once.

PHILADELPHIA, PA.—The Atlantic Refining Company, Passyunk Avenue, has had plans prepared for the construction of a new addition to its boiler plant, about 60 ft. by 95 ft., one story.

PHILADELPHIA, PA.—The Midvale Steel & Ordnance Company, Widener Building, has had plans prepared for the erection of a one-story power plant, to be constructed at the Nicetown works. The structure will cost about $25,000.

PHILADELPHIA, PA.—The C. H. Wheeler Company has awarded a contract for the erection of a new addition to its boiler plant to John N. Gill & Company, Otis Building, to cost $9,000.

PHILADELPHIA, PA.—The boiler plant located at Twenty-first and Clearfield Streets has been acquired by the Pearce Rubber Company for a consideration of about $90,000. The structure is 160 ft. by 230 ft.

PITTSBURGH, PA.—In connection with other improvements at its plant on Belmont Street, near Ridge Avenue, the Crucible Steel Company, Thirty-eighth Street, will build a new boiler plant and make extensions in its ash-handling system to provide for increased operations. Plans for the work, which is estimated to cost about $20,000, have been prepared.

PITTSBURGH, PA.—In connection with the new seven-story factory building to be erected by the Pennsylvania Chocolate Company on Center Avenue, plans have been prepared for a new brick power plant for operation. The company has taken out a building permit for the new structure, which are estimated to cost $100,000.

PITTSBURGH, PA.—The Pennsylvania Chocolate Company, Center Avenue, has had plans prepared for the construction of a brick power plant addition to its works in connection with a seven-story factory building, the entire work to cost approximately $100,000.

SOUTH BETHLEHEM, PA.—The Philadelphia & Reading Railway Company is planning to commence work at an early date on the construction of a new engine house and power plant at its local works on Saucon Creek. Plans for the latter structure, which will be about 35 ft. by 75 ft., have been prepared.

SLATINGTON, PA.—The Lehigh Valley Transit Company is making improvements in its traction system from Slatington to Slatedale.

TARENTUM, PA.—Ground has been broken by the board of managers of the Allegheny Valley Hospital for the construction of a new two-story boiler plant at the institution, to cost about $10,000.

BALTIMORE, MD.—Contract has been awarded by the John T. Lewis & Brothers Company of Baltimore, a branch of the National Lead Company, for the construction of its new plant on Columbia Avenue to the McIver Construction Company, Law Building, Baltimore. The cost is estimated at about $1,000,000 and includes a main building, 100 ft. by 300 ft., and several smaller buildings. Shrapnel balls will be manufactured at the plant.

CUMBERLAND, MD.—The American Cellulose & Chemical Manufacturing Company, Ltd., which will erect a plant here, closed a contract with the Edison Electric Illuminating Company to furnish power necessary for the operation of the plant.

HOLDEN, MD.—Archer & Stevens, architects, are preparing plans for the erection of a municipal electric-light plant to cost $30,000.

INDIAN HEAD, MD.—Plans have been prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a cold-storage basin, equipped with traveling crane, etc., at Indian Head, to cost about $125,000.

SPARROWS POINT, MD.—Plans are being prepared by the Penn-Mary Steel Company for the erection of an electric light plant at Sparrows Point, to be operated in connection with the shipyards. The building wil be one story high and of reinforced-concrete and steel construction.

WASHINGTON, D. C.—Bids are to be received by the Bureau of Yards and Docks, Navy Department, for furnishing and installing two surface condensers for a 3750-kva. turbo-alternator, two motor-driven circulating pumps, one motor-driven flushing pump and auxiliary pumps for the condensers on foundations provided by the government at Bremerton, Wash., and at Philadelphia. Specification No. 3085 is to be had of the commandants of the yards.

WASHINGTON, D. C.—The Navy Department, Bureau of Yards & Docks, will erect a new addition to the local boiler plant. Plans for the structure, which it is said will cost about $150,000, have been prepared.

RICHMOND, VA.—A boiler plant to cost $4,000,000 will be built at Richmond, Va., by the Newport News Shipbuilding & Dry Dock Company. The general building contract has been awarded. This contract amounts to $1,000,000, and the main structure will be built of steel and will be 600 ft. long by 160 ft. wide.

SEVEN PINES, VA.—The United States government plans to erect about 1000 houses in Seven Pines, including complete water, lighting and sewer systems. Gannett, Seelye & Fleming, engineers, 204 Locust Street, Harrisburg, Pa., have charge of the project.

North Central States

FLINT, MICH.—The City Council has passed an ordinance requiring the electric wires to be placed underground in certain districts. C. S. Mott, Mayor.

GRAND RAPIDS, MICH.—The Michigan Railway Company will build an electric line from Morrice to Flint. C. E. Morgan, general superintendent, Grand Rapids, Mich.

CANTON, OHIO.—The third unit of the new power plant at Windsor, W. Va., will soon be completed. The electric power supply in Canton, furnished by the Central Power Company, will be materially increased. The plant will cost approximately $3,500,000.

CLEVELAND, OHIO.—The Sixth City Light Company has increased its capital stock from $5,000 to $30,000.

DEFIANCE, OHIO.—The power plant of the Auglaize Power Company will be sold at public auction on Aug. 31 at the Defiance Court House, as a result of the foreclosure of a mortgage held by the Guaranty Trust Company of New York. The plant consists of a huge water-power station 2 miles south of Defiance, and it supplies more than fifty northwestern Ohio towns and several interurban railway lines with electricity.

NELSONVILLE, OHIO.—Improvements to the electric-light plant are contemplated. $2,500 will be spent for same.

STRUTHER, OHIO.—The Struther Furnace Company will spend $500,000 to add to the efficiency of its plant. New electric equipment is included in the specifications.

COVINGTON, KY.—Extensions are being made to the plant of the Kelley-Koett Manufacturing Company on West Fourth Street. The company is manufacturing X-ray machines for the United States government.

ANDERSON, IND.—According to Harry J. Williams, consulting engineer, Dayton, Ohio, the municipal electric light plant must be rebuilt. To enlarge the steam department, larger buildings and general rearrangement will cost about $150,000. To provide the money will require another bond issue. Seventy per cent of the industries in Anderson are using power from the municipal plant.

COLUMBIA CITY, IND.—Preliminary plans for the abandonment of the municipal lighting plant, including the $17,000 turbine engine, have been started by the City Council.

HAMMOND, IND.—Work on the twenty-four-mill addition to the Gary tinplate plant of the American Sheet & Tin Plate Company, to cost about $10,000,000, has begun.

INDIANAPOLIS, IND.—The Citizens' Gas Company has taken out a permit to cover the construction of its Prospect Street plant. The estimated cost will be $111,000. Among the items of construction will be an addition to the power plant.

PLYMOUTH, IND.—The Plymouth Electric Light & Power Company has filed a petition with the Indiana Public Service Commission to issue $20,000 in preferred stock.

CARMI, ILL.—It has been voted to improve the water and light system at a cost of $6000, for which bonds have been issued.

CHICAGO, ILL.—A special meeting of the stockholders of the Electric Bleaching Gas Company has been called for Aug. 15 to vote on increasing the capital stock from $500,000 to $1,000,000.

MANKATO, MINN.—The Mankato division of the Northern States Power Company has accepted a contract from the Hubbard Milling Company covering 100 hp. in motors.

WORTHINGTON, MINN. — The City Council is considering the installation of an electric light plant and water-works system, to cost about $10,000.

PIERRE, S. D.—Sealed proposals will be received by the city of Pierre, S. D., at its council room, until 7 p. m. Aug. 26 for the furnishing of the necessary labor, material and machinery equipment required to construct a power plant to furnish water for the city of Pierre. Bids will be received on two 200-r.p.m. Unaflow engines for direct connection to 312-kva. alternating-current generators, f.o.b. Pierre; two 200-r.p.m. Unaflow engines for direct connection to 250-kva. alternating-current generators, f.o.b. Pierre, S. D.; 312-kva., three-phase, 60-cycle, 2400-volt, 200-r.p.m. alternating-current generators, engine type, complete with exciters, f.o.b. Pierre, S. D.; two 250-kva., three-phase, 60-cycle, 2400-volt, 200-r.p.m. alternating-current generators, engine type, complete with exciters, f.o.b. Pierre, S. D.; one seven-panel switchboard, f.o.b. Pierre, S. D.; one 35-kva. 6.6 amp. constant-current series transformer, fo.b. Pierre, S. D.; two 250-hp., 165-lb. working-pressure water-tube boilers, f.o.b. Pierre, S. D.; two 8-in. by 5-in. by 12-in Simplex boiler-feed pumps, f.o.b. Pierre, S. D.; two 300-hp. open-type feed-water heaters f.o.b. Pierre, S. D; one condenser equipment, capacity 9000 lb. steam per hour, f.o.b. Pierre, S. D.; one triplex pump, surface type, 13 in. by 12 in., 150 lb. working pressure, f.o.b. Pierre, S. D. Bids will also be received for a chimney 125 ft. high, a brick power-plant building with concrete coal bin, a 750,000-gal. concrete reservoir, and shingle roof for old wells; also all the necessary labor, tools, material and equipment required to install all machinery equipment. Plans and specifications on file with the city auditor of Pierre, S. D., and with the engineers, Henningson Engineering Company, Omaha, Neb. J. B. Binder, Mayor; J. A. Rose, City Auditor.

KANSAS CITY, MO.—The Kansas City Light & Power Company will erect a substation at Twelfth and Bristol Avenues. A. E. Bettis, superintendent

NOVINGER, MO.—The plant of the Merchants' Light & Power Company has recently been destroyed by fire.

O'NEIL, NEB.—The creamery plant and electric-light plant owned by the McGinnis Creamery & Produce Company was recently destroyed by fire. The loss is estimated at $40,000. Both plants will be rebuilt.

BAXTER SPRINGS, KAN.—It is under consideration that the next civic improvement in Baxter Springs shall be a municipal electric light system.

TOPEKA, KAN.—The Kansas Gas & Electric Company of Wichita has asked permission of the Public Utilities Commission to issue $475,000 of bonds. The Home Light, Heat & Power Company of Pittsburgh asked approval of a $76,000 bond issue.

Southern States

MONTICELLO, FLA.—The city is planning a bond issue for $17,500 to acquire the local electric-light and power plant. J. M. Johnson, Mayor.

BEAUMONT, TEX.—All the properties of the Stone & Webster Engineering Corporation in Beaumont and Port Arthur and the interurban electric line which connects the two places have been consolidated under the name of the Eastern Texas Electric Company, which has just been incorporated with a capital stock of $2,850,000.

MERCEDES, TEX.—In connection with the construction of the proposed precooling plants of Wetegrove & Company, to be located in the Rio Grande Valley, a quantity of equipment, including fans, ventilators and other apparatus, will be installed.

Pacific and Mountain States

EVERETT, WASH.—The City Council is considering plans for the early construction of a power station in the upper Sultana River district. Burns & McConnell, Kansas City, Mo., are engineers.

HILLYARD, WASH.—At a meeting of the City Council the matter of the city of Hillyard purchasing the poles, wires and equipment of the Washington Water Power Company in Hillyard, buying the electricity from the company and selling it to consumers in Hillyard, came up for discussion.

SEATTLE, WASH.—The Todd Dry Dock Company, 1801 Sixth Avenue, Southwest, is to erect a two-story heavy-timbered power house and storehouse to cover 100 ft. by 50 ft. and cost $9,000.

SEATTLE, WASH.—Parker & Banfield of Portland have been awarded a contract at $5,260 for constructing the generator plant at the Washington end of the Interstate bridge and work will begin at once.

SEATTLE, WASH.—The city of Seattle was authorized by the Capital Issues Committee to sell $5,500,000 in bonds for the construction of a hydroelectric plant on the Skagit River to serve war industries. A resolution was adopted authorizing the Board of Public Works to prepare plans and specifications for the Skagit work and the letting of the contract. Three units for development of hydroelectric power are available on the Skagit River, and the city has priority rights on all of them. The bond issue now authorized is designed to cover the first unit, or the Gorge Creek development, which is to furnish 35,000 kw.

SPOKANE, WASH.—Plans are being discussed for the erection of an electric furnace for the production of alloys for war purposes, on a site to be furnished by the Washington Water Power Company.

TACOMA, WASH.—Commissioner of Light and Water H. F. Gronen has been authorized to call for bids for 70,500 lb. of copper wire, for use by the lighting department. The sum of $25,000 has been appropriated.

TONASKET, WASH.—The Okanogan Valley Power Company has started construction of a new power line from Riverside to Tonasket in Okanogan County, Wash.

WENATCHEE, WASH.—A franchise has been granted to the Chelan Water Power Company for constructing a pole line from Entiat to Maple Creek.

MARSHFIELD, ORE — The Oregon Power Company has contracted for supplying additional electric service of approximately 200 hp. to the local sawmills.

PORTLAND, ORE.—Parker & Banfield, contractors, were awarded a contract for constructing the generator plant at the Washington end of the interstate bridge. The contract is for $5,260.

COALINGA, CAL.—The City Council has approved a bond issue for $20,000 to provide for the construction of a municipal pumping plant. The station will be electrically operated.

FRESNO, CAL.—Plans are under consideration by the San Joaquin Light & Power Company for the construction of hydroelectric power stations on Dinkey Creek and the north branch of the King River.

LOS ANGELES, CAL.—The Public Service Department contemplates the purchasing of water rights of Big Pine Creek, in the Owens River Valley, to develop additional power. At the plant it is proposed to establish a big reservoir, cement conduits and three municipal power plants, each having a capacity of 5000 hp making 15,000 hp. in all.

LOS ANGELES, CAL.—The Fairbanks-Morse Company is planning the installation of an electric lighting plant at Big Bear Lake Tavern, to cost about $4,500.

LOS ANGELES, CAL.—The city is planning for the construction of a new electric substation on the tidelands in Los Angeles harbor to be used for the generation of power for municipal use.

NEWPORT, CAL.—The Newport mesa district is considering plans for the erection of an electrically operated pumping plant in connection with the proposed irrigation system at Newport Beach.

OROVILLE, CAL.—A preliminary map of the proposed power development upon the middle fork of the Feather River has been completed by Paul Reicker. The plan is to construct a dam 650 ft. in height at a point in the Bald Rock Canyon. The dam will create a reservoir with a surface area of 10 sq. miles and will impound sufficient water for 2,000,000 acres.

PATTERSON, CAL.—Raymond Wyseur, superintendent of the Mineral Products Company, announced that active operations in the manufacture of magnesia pipe coverings will be started about Oct. 1 at the Patterson plant. Building operations on a boiler house, which will contain two 150-hp. boilers, and on two machinery sheds will be commenced immediately.

SALINAS, CAL.—City Engineer D. F. Davies has been authorized to purchase a quantity of 300-cp. electric lights to replace the 600-cp. electroller lights in use.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company has asked the Railroad Commission for authority to issue and sell $350,000 face value of its 6 per cent debenture bonds and $133,700 par value of preferred stock. The proceeds will be used for the purpose of financing future construction

SANTA BARBARA, CAL.—Plans are under consideration by the City Council for the installation of a new ornamental street-lighting system on Anapamu Street.

SUSANVILLE, CAL.—Supervisor Harry E. Wood says that a movement is on foot whereby it is hoped that electric energy can be furnished to Big Valley ranchers for lighting and irrigation purposes. The plan is to install power lines from the plant at Fall River Mills to Bieber and Big Valley.

WOODLAND, CAL.—A. C. Huston, president of the Yolo Water & Power Company, has announced the completion and permanent operation of the newly installed pumping plant at Clear Lake in Lake County. The new plant has a capacity of 225,000 gal. a day.

WINNEMUCCA, NEV.—E H. Gilman, superintendent of the Winnemucca Water & Light Company, is installing a new Pelton waterwheel at the power plant on the east side of Winnemucca. This is another improvement which is being made by the company to increase the lighting and electric power facilities of the city.

PHOENIX, ARIZ.—The municipal water-works plant is to be equipped with three additional electric pumps.

SWANSEA, ARIZ.—Considerable electrical equipment will be installed in the new 200-ton milling plant being erected at the properties of the Swansea Mining Company.

Canada

LANGLEY, B. C.—The township of Langley recently entered into an agreement with the British Columbia Electric Railway Company, Ltd., for lighting certain of the roads and streets of the municipality, for a term of five years.

VANCOUVER, B. C.—The British Columbia Electric Company is constructing a reinforced concrete substation. The building is to be 100 ft. by 60 ft. The electrical equipment in the new station will consist of two rotary converters of 1000 kw. each and one motor-generator set of 1500 kw.

ALMONTE, ONT.—Taylor Brothers, Ltd., Toronto, have received the contract at $36,000 for a heating system for the school.

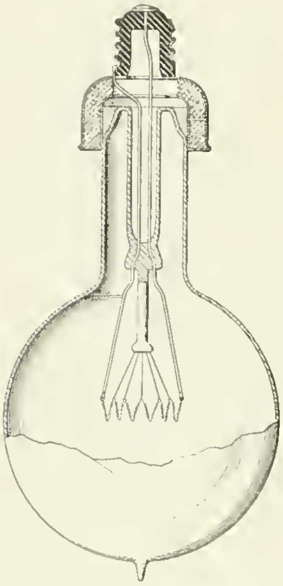
LINDSAY, ONT.—It is expected that the Hydro-Electric Company will make improvements to the lighting system on Kent Street West.

ST. JEROME, QUE.—The contract for a concrete dam for the Canadian Consolidated Rubber Company, Ltd., has been given to the Foundation Company, Ltd., Bank of Ottawa Building, Montreal.

14,493 (Reissue). Switch; Herbert W. Cheney, Milwaukee, Wis. App. filed Nov. 20, 1909. May be employed with safety in buildings such as textile works containing highly inflammable material.

1,271,858. Electric Incandescent Lamp; John H. Dale, New York, N. Y. App. filed March 4, 1916. To lessen the transmission of the heat from the glass bulb to the lamp base by suitable heat-insulating material.

1,271,861. Electric Protective Device; William Deutscher, New York, N. Y. App. filed Dec. 20, 1912 Gives an electrically controlled warning signal when operated.



1,271,858—Electric Incandescent Lamp

1,271,863. Brush Holder for Dynamo-Electric Machines; Charles H. J. Dilg, New York, N. Y. App. filed Jan. 7, 1913. To afford ready access to the brush for the purpose of adjustment.

1,271,873. Magnet-Operated Switch; Rudolph C. Emmerling, John H. Wheelock and Curt J. Rohland, Worcester, Mass. App. filed April 12, 1916. Current alternations will be prevented from causing chattering of the contact points.

1,271,875. Overload Circuit Breaker; Clarence T. Evans, Milwaukee, Wis. App. filed June 28, 1917. Having few and rugged parts compactly arranged for inclosed mounting.

1,271,883. Telephone System; Clarence B. Fowler, New York, N. Y. App. filed Sept. 25, 1917. To provide "busy" testing means in which the difficulties heretofore experienced will not be encountered.

1,271,897. Telephone-Exchange System; Edward E. Hinrichsen, New York, N. Y. App. filed Feb. 20, 1917. Sleeve relay associated with one end of link circuit to control intermittent operation of signaling device.

1,271,915. Machine for Transforming the Frequency of Currents; Marius C. A. Latour and Joseph Bethenod, Paris, France. App. filed Feb. 20, 1914. Apparatus for transforming polyphase currents of nf cycles into polyphase $(n+2)f$ cycles by means of a single transformation.

1,271,924. Electromagnetic Switching Device; Daniel D. Miller, New York, N. Y. App. filed Nov. 27, 1916. Alternating-current electromagnetic switching device which will maintain its contacts open or closed without chattering.

1,271,933. Dry-Cell Battery and Method of Making Same; Herbert R. Palmer, Cleveland Heights, Ohio. App. filed Oct. 16, 1917. To increase the efficiency without materially increasing the volume or weight of the cell.

1,271,980. Electric Lighting Apparatus; Gilbert Wright, Schenectady, N. Y. App. filed March 11, 1914. To make the lamp conveniently accessible when mounted in a lantern.

1,271,981. Socket and Plug Device; Gilbert Wright, Schenectady, N. Y. App. filed March 11, 1914. Should have watertight protection both when the connection plug is in and when it is not.

Record of Electrical Patents

Notes on United States Patents

1,271,984. Commutator and Commutator Bar; Henry L. Zabriskie, Westfield, and Gustave C. Marx, Elizabeth, N. J. App. filed April 3, 1916. Requires a minimum number of operations for manufacture.

1,271,999. Electric Connector; John Berg, Chicago, Ill. App. filed July 30, 1917. To provide a connector whereby the circuit may be established or broken with facility.

1,272,022. Two-Way Repeater Circuits; Mihran M. Dolmage, Washington, D. C. App. filed Nov. 8, 1916. To prevent the so-called "singing" of the two-way repeater system.

1,272,055. Electrical System for Engines; Charles F. Kettering and William A. Chryst, Dayton, Ohio. App. filed July 16, 1914. Engine, when operating under its own power, is used to store up energy for future starting operations.

1,272,056. Ignition System; Charles F. Kettering, Dayton, Ohio. App. filed Aug. 30, 1915. Adapted to be used with engines of the high-speed type.

1,272,063. Electric Iron; Moses Levinson, New York, N. Y. App. filed Nov. 2, 1917. Compact yet highly efficient ironing device, which can be folded and put away in a small receptacle.

1,272,077. Electric Furnace; William E. Moore, Pittsburgh, Pa. App. filed Sept. 7, 1916. To expedite or shorten the time involved in melting and refining steel.

1,272,086. Protective Box for Meter Connections; Clarence D. Platt, Bridgeport, Conn. App. filed Nov. 21, 1917. Means for preventing unauthorized tampering with the meter connections.

1,272,090. Circuit Protective Device; William D. Pyle, Indianapolis, Ind. App. filed July 10, 1917. The circuit will be permanently interrupted until it is manually restored.

1 272,099. Semaphore Signal Mechanism; Gerret Rekers, Rochester, N. Y. App. filed April 21, 1913. The semaphore will be moved from a biased to an operated position by the operation of any well-known form of rotary motor.

1,272,126. Pin-Plug Connector; Ralph A. Schoenberg, New York, N. Y. App. filed June 18, 1917. A pin-plug connector which is simple in construction and cheap to manufacture.

1,272,146. Electric Lamp Socket; George B. Thomas, Bridgeport, Conn. App. filed Feb. 8, 1913. An indicating device by means of which the position of the pull socket switch may be readily ascertained.

1.272,147. Electric Switch; George B. Thomas, Bridgeport, Conn. App. filed Feb. 16, 1916. To be mounted directly upon the busbars of a panelboard.

1,272,148. Charging of Accumulators from a Variable-Speed Dynamo-Electric Machine; John G. P. Thomas, Chiswick, London, England. App. filed March 23, 1914. A system by which substantially constant output is derived from a dynamo-electric machine driven at variable speed.

1,272,163. Lamp Socket; John W. Wiede, Baltimore, Md. App. filed June 3, 1916. A very limited movement is necessary to open and close the circuit.

1,272,166. Loading-Coil Case; Charles R. Young, Bloomfield, N. J. App. filed May 26, 1916. Relates particularly to construction of coil compartments therein.

1,272,167. Rechargeable Dry Cell; Matthew G. Young, Geneva, Ohio. App. filed Sept. 11, 1917. Construction whereby the cell when exhausted can be readily refilled at very little expense.

1,272,184. Advertising Device; Wade H. Babcock, Cleveland, Ohio. App. filed May 5, 1917. Relates to that class in which a series of advertisements are successively shown and illuminated through a window.

1,272,186. Melting Furnace; Thaddeus F Baily and Frank T. Cope, Alliance, Ohio. App. filed Sept. 4, 1917. Resistance troughs are located above and surround the hearth upon which the material to be melted is placed.

1,272,191. Telegraph System; John H. Bell, East Orange, N. J. App. filed July 12, 1917. To provide a telegraph transmitter capable of performing the necessary functions.

1,272,199. Explosion Engine with Dynamomagnetic Ignition; Pierre Bossu, Paris, France. App. filed Aug. 31, 1915. Method of building apparatus so as to render manufacture less cumbersome and much cheaper than hitherto.

1,272,208. Combination Strain Plate and Removable Trolley Frog; Joseph E. Burgess, St. Louis, Mo. App. filed Aug. 1, 1914. Whereby the trolley frog can be removed and a new frog placed without disturbing the guy wires and trolley wires.

1,272,221. Telephone-Exchange System; Henry P. Clausen, Mount Vernon, N. Y. App. filed Dec. 13, 1916. Signaling means whereby the work of the terminating operator is greatly simplified.

1,272,247. Jar for Submarine and Like Batteries; Bruce Ford, Philadelphia, Pa. App. filed April 2, 1917. To provide battery jars and their underlying supports that can be moved and installed as unitary structures.

1,272,279. Circuit-Interrupting Device; Alben E. Lundell, New York, N. Y. App. filed Aug. 16, 1916. Interruptions will be effective even though one or more of such interrupters should be disabled.

1,272,280. Telephone System; Alben E. Lundell, New York, N. Y. App. filed Oct. 6, 1016. A signal to an operator for indicating the designation of a calling subscriber's line.

1,272,282. Telephone-Exchange System; James L. McQuarrie, Montclair, N. J. Application filed Nov. 20, 1917. Relates to automatic switches of the type used in telephone-exchange systems.

1,272,308. Rain Signal; Victor Parker, Maberry, N. C. App. filed March 21, 1917. Device which is especially adapted to give alarm if it should begin to rain.

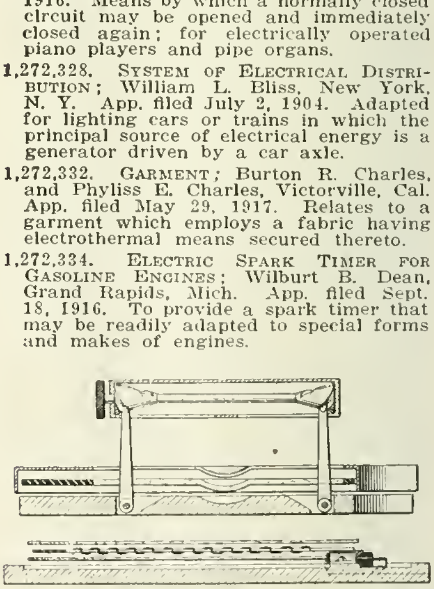
1,272,313. Arc Lamp; Edwin S. Porter, New York, N. Y. App. filed Feb. 3, 1917. Relates to projectors for moving pictures, particularly to the carbon holding and feeding means.

1,272,317. Circuit Controller; Walter C. Reed, Dalton, Mass. App. filed Oct. 25, 1916. Means by which a normally closed circuit may be opened and immediately closed again; for electrically operated piano players and pipe organs.

1,272,328. System of Electrical Distribution; William L. Bliss, New York, N. Y. App. filed July 2, 1904. Adapted for lighting cars or trains in which the principal source of electrical energy is a generator driven by a car axle.

1,272,332. Garment; Burton R. Charles, and Phyliss E. Charles, Victorville, Cal. App. filed May 29, 1917. Relates to a garment which employs a fabric having electrothermal means secured thereto.

1,272,334. Electric Spark Timer for Gasoline Engines; Wilburt B. Dean, Grand Rapids, Mich. App. filed Sept. 18, 1916. To provide a spark timer that may be readily adapted to special forms and makes of engines.



1,272,063—Electric Iron

1,272,374. Method of Preparing Vacuum Tubes; Oliver Ellsworth Buckley, East Orange, N. J. App. filed Dec. 30, 1915. Heating the anode by vigorous bombardment without endangering the cathode.

1,272,397. Apparatus for Effecting Electrolysis; Arthur Dohmen, Cologne, Germany. App. filed Dec. 1, 1914. Of the type known as "filter-press batteries."

1,272,401. Electrode for Arc Lamps; Henry R. Edgecomb, St. Marys, Pa. App. filed Dec. 7, 1916. A cored electrode which shall prevent the arc from migrating over the electrode.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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War Service Must Come First

WAR conditions have required a change in policy of many public utility companies relative to new installation work. For the present, at least in some few localities, applications from the public for new service will be indefinitely tabled in the interest of meeting the increasing demands of the United States government for facilities. How great these demands have come to be is indicated in the bill introduced this week in the House of Representatives at Washington. In addition to a shortage in coal there is a growing shortage in materials which coincides with a pressing call from the government for more service. It needs no argument to establish the fact that the needs of the military forces and of the collateral government establishments must be met first.

About the last thing a public utility desires to do is to curtail its expansion of service, and there is no question that as soon as conditions permit the present near-embargo on extensions will be withdrawn. Meanwhile, every effort will be made to provide service for emergency cases and for others whose demonstrated needs are clear. Very little objection can be raised to this forced policy of central stations, and customers as a rule have accepted the conditions, feeling no doubt that in so doing they will in a very real way be doing their bit toward helping the government secure facilities absolutely essential to the prompt carrying forward of its offensive and defensive plans. Taken by and large, central-station companies have risen finely to their responsibilities in the direction of service quality and continuity since the United States entered the war, and we believe that the public will wait cheerfully, when it understands the facts, to enable the utilities of all classes to meet governmental obligations first, so far as these are apparent.

The Use of Protective Relays

IN ELECTRIC motor service for industrial purposes it is always a nice question to determine how far the equipment shall be made automatically foolproof. Much depends on the class of work being done and on the class of help to whom the operation is to be intrusted. The time ultimately comes when automatic protective apparatus reaches a degree of complication where it causes more trouble than it averts, and the general direction of equipment, as was indicated in a recent article in these columns, points to simplicity. There are cases, however, in which protective relays may be used with very great effect. A most ingenious device, for instance, is the so-called flutter relay, adapted to take care of motors themselves automatically varied in speed. Here a field relay to prevent too sudden variations of the field strength on reversal of the motor is very useful in checking excessive armature currents.

Perhaps the chief uses of such devices are in reversible motors such as are used for planer operation. In certain cases a reversing relay to soften the shock in case the motor regenerates current may be a desirable addition. In working induction motors important use is found for protective relays to serve as a safeguard in case of failure or reversal of a single phase or extreme drop in line voltage. Almost any contingency in starting or changing the speed of motors can be watched over by a properly designed relay, of which there are many on the market. But the extent to which these should be employed is one of the fine points of industrial motor equipment to which the engineer should give most careful attention. Especially ought he to bear in mind that the means should be suited to the end, and that while at some one particular point in the plant the most thorough safeguards are needed on account of the particular functions of a certain motor, elsewhere it may be desirable to reduce the motor-operating equipment to the lowest possible terms. The cases in which automatic appliances should be used, then, depend chiefly on the nature of the service and of the motors employed, rather than on any general principles of protection which should run through all classes of motor applications.

Getting Together for Business

MUCH of the future growth of electric station loads depends on increase in the use of various electrical appliances ranging from those which fit a lamp socket to a class requiring considerable energy and special wiring. The growth of this business has been fairly rapid, but is not yet proceeding at anything like the pace which it ought to take. One of the obstacles to its progress has been the fact that in many localities the central stations and the electrical dealers have not pulled together with anything like the efficiency which is possible. To bring electrical appliances of all sorts into extensive use requires the combined efforts of those who specialize in selling electrical energy and those whose business it is to sell electrical supplies of various sorts. The dealer has often thought that the central-station man who was trying to boom his appliance department was actually robbing him of lucrative business, while, on the other hand, the central-station man has not infrequently had reason to believe that electrical dealers were very sluggish in appreciating the importance of appliance sales to themselves and have made no vigorous efforts to increase the business. Of course, there is actually no serious clash between the two. The sales of electrical energy and those things in which it is utilized inevitably must go, in one way or another, hand in hand.

Beginning with September, the Society for Electrical Development, Inc., will launch out on a "Save by Wire" campaign. This offers an excellent opportunity for manufacturer, central station, jobber and contractor to get together for the common good in a movement which, though it seeks to extend business, is nevertheless wholeheartedly patriotic. There are still wiring devices and electrical appliances available for use, besides the labor for installing them and the electrical energy necessary for their operation. Nothing connected with the campaign will in the least hamper the government or make undue inroads on an already scant coal supply. The object is to aid the general public in carrying or lightening household burdens and thereby release labor for other work. Phenomenal results are not to be expected from such a campaign at this time, for obvious reasons; but if the Society for Electrical Development only succeeds in getting the various branches of the electrical industry interested in the movement, it is enough. Coöperation is what we need first, last and all the time in the electrical business, and no effort in that direction should ever be slighted, nor is the time devoted to its attainment ever wasted.

Power Saving from Interconnection

WE HAVE so often preached the union of transmission plants into great networks that we should hesitate to inflict another sermon upon our readers save for the just cause given by a text from California, which has been the scene of so many brilliant exploits in electric power transmission. The paper by R. J. C. Wood in the current issue tells a story of economy of fuel and water which may well be taken to heart. It records the results secured by interconnection between two networks, that of the San Joaquin Light & Power Corporation and that of the Southern California Edison Company. The former has a heavy summer load due to pumping for irrigation; the latter has a normal lighting and power peak in November. Both depend for their main hydraulic supply on the mountain streams at high head, and both depend to a material extent on steam for reserve power, oil being the fuel used. The California streams are very variable in flow, and a large amount of power is lost in floods. Storage reservoirs connected with irrigation are to a certain extent used for hydraulic purposes, and some large independent reservoirs exist.

Combining irrigation and power is not always successful. It depends for success on the kind and amount of storage and the nature of the load demands of both power and irrigation. Where, however, it is possible to connect widely ramifying networks for the exchange of power it is not difficult to remedy these difficulties, since spare power anywhere can be utilized as demand arises, and with a joint territory big enough the diversity factor becomes immensely important. In the case before us the more northern system, freed in winter from its irrigation load, can help out the southern one, and in the summer a reverse exchange is practicable, so that less hydraulic power is lost and there is very much less call for the use of fuel oil by either system. The addition of power from the San Joaquin plant at critical periods of load will cut out entirely the use of power generated from fuel oil in the Santa Barbara territory and make great reductions in the use of fuel elsewhere on the combined system. By working out completely the transfer of power back and forth between these systems and connecting to the system all the hydraulic resources available, it is estimated that there will be a saving in fuel oil of more than 750,000 barrels during the current year.

This is no small showing for the results of skillful interconnection between two large adjacent networks, and it is to be noted also that the gains come directly from the varying use of power from time to time and place to place; in other words, from making the best possible use of the diversity factor. The watershed is substantially one from the hydraulic standpoint. That is to say, there is no considerable gain in the steadiness of production owing to different times of maximum flow. There are possibilities, however, in tapping different watersheds so as to give still greater conservation of the hydraulic resources than can be attained merely by working the loads to the best advantage. When both factors for gain can be combined so that hydraulic power production as well as the use of the power can be brought to a steady basis, there is still further chance for the saving of fuel and, what is equally important, the saving of the floods that now run uselessly to the sea. It takes careful planning and very skillful operation to make the most of the situation. The combination now under way, however, furnishes a striking example of the extent to which power can be economized by judicious joint operation of contiguous systems.

Factors That Govern Elevator Drive

THE electric elevator has been coming into its own within the last decade at a very surprising rate. One does not hear much about it in the sensational press, but one sees with increasing frequency signs on buildings under construction proclaiming the origin of the electric elevator system. As the demands of elevator service have increased both in speed and in lifting power, it was only natural to fall back on the general source of distributed energy for means of operation. The electric elevator is economical in operation, easy to keep up, simple and compact, and safety devices may be applied to it with the extreme facility which characterize most electrical modes of driving.

Professor Clewell's notes on this subject in the current issue neatly summarize the general methods employed. The principles of the design of the lifting gear are pretty much the same for all sorts of motive power. For most practical cases the winding drum or the traction sheave in some form or other is used, the latter more generally. So far as the motors themselves are concerned, the requirements are somewhat special, chiefly in the direction of high starting torque, and in direct-current machines sparkless operation even under extreme variation of load and overload. It is also rather necessary that the operation should be quiet, unless of course in freight service in buildings otherwise far from noiseless. The result has been the development of a somewhat highly specialized class of motors, generally now-a-days with commutating poles, designed for high overload capacity and with large mechanical factors of safety.

Non-Technical Power-Plant Descriptions

A RECENT example of first-class publicity which came to hand in connection with the building of a 100,000-kw. power plant contains a number of very suggestive points relative to the interest such an installation has from the popular standpoint. A newspaper "story" about a power station just completed can be made most helpful to the operating company's interest, or it can be couched in such dull terms as to be worth very little as a factor in developing community good will. Not every manager has the knack of writing a readable newspaper article about his new plant, and, on the other hand, very few reporters can be trusted to lead their readers of the daily press through an installation from coal pile to feeder pot-heads without getting into serious trouble technically. There is a real field, however, for non-technical articles written from the popular viewpoint, and in cases where the utility manager has an opportunity to check the "copy" from the standpoint of accuracy only, letting the "story" run on its own merits for the most part, the best results can be obtained.

To the engineer the colloquial treatment of his station in a newspaper article may appear at times amusing and provincial, but it is just by these appeals that the layman gets an idea of the progressiveness of the company. Homely, straightforward expressions, put in terms that an ordinarily intelligent person can appreciate, are what are needed. It is of no concern to an outside engineer that a particular stack is the highest in its neighborhood, but such an item is of more popular interest than questions of weight per square foot of foundations, pressure of draft and horizontal cross-section of stack construction. And constructive interest in a company's work is worth securing, even at the trouble of procuring popular articles upon its service and equipment.

Getting Economy in the Fire Room

A PAPER by Edwin A. Hunger, in this number of the ELECTRICAL WORLD, on the training of the fire-room force, deserves close consideration. We are confronted by two allied and unpleasant contingencies—first, the certainty of being somewhat short of fuel; second, the extreme difficulty of getting mechanical equipment for the boiler room in face of the restrictions due to government requirements. The time has not quite been reached when one must have a priority order to purchase a coal shovel, but things are squinting that way. Add to this the ever-increasing scarcity of labor, and the situation is evidently one which is somewhat menacing. Mr. Hunger's advice is extremely good—to pay the greatest possible attention to the efficient training of the fire-room force, so that in the very large number of cases where hand firing is necessary it can be carried out to the best possible effect.

There is no doubt that skillful hand firing can give results comparable to the best obtainable with mechanical stokers, but careless or unskillful firing falls far below this standard. The difference may easily amount to a quarter or even a half of the coal input necessary to secure the results. In one of the large plants to which Mr. Hunger refers the coal cost per kilowatt-hour was reduced during the last year by one-third. Part of this gain was due to improved turbine economy and improvement in mechanical stokers, but a considerable portion must be directly charged to better methods in dealing with the boiler-room force. For skill counts even where the actual rough work of firing is mechanical. Constant and careful training and supervision, with full recognition of the importance of the skilled fireman to successful operation, seem to be the keys to success in economizing fuel. No set program of training and encouragement can well be laid out since local conditions vary so widely. The bonus system has been tried with rather indifferent results, as has also the encouragement of competition between firing gangs. Above all, close supervision to detect and remedy bad practice and to encourage efficiency seems to be the best remedy. That it pays even when it involves material increase in the labor cost seems beyond question. It is particularly important just now because electric supply companies have to use, not the fuel which they used to like best, but that which they are lucky enough to get, and the fire-room methods in the two cases are likely to be very different. Rigorous attention to the condition of the boilers too may be counted on for large results. Persistent watchfulness to insure clean flues and freedom from scale and from leaks in the boiler settings will pay its cost many times over.

The Coming Issues

RATES are probably being altered less under war conditions than the changes in the cost of generating energy really justify. This situation gives special timeliness to an economic study of basic factors in rate making which is to be published in early issues. "If the term 'charging what the traffic will bear' is properly understood and is scientifically applied," says the writer, "there simply cannot be anything unreasonable in the rates themselves." Rate making will need most careful consideration in the changes of the war and post-war period, and these articles will be of much interest to officials of central-station companies who are responsible for the policies followed in that respect. Another article on the industrial application of electrical energy, by Professor Clewell, is to appear. A summary of various arrangements that have been proposed in the last fifteen years for high-power-factor, variable-speed induction motors, with particular reference to developments in France, will be printed.

Factors Governing Elevator Drive

Standard Safety Features Usually Embodied in Control Equipment—Power Requirements of Elevators and Types of Motors Suited to the Service—Direct-Current and Alternating-Current Elevator Motors

BY C. E. CLEWELL
Assistant Professor of Electrical Engineering, University of Pennsylvania

THE subject of electric elevator operation may conveniently be divided into a study of (a) the elevator machinery itself, (b) the driving motor, and (c) the control equipment, although, properly speaking, the coördination of these three elements of the problem is of fundamental importance to success in such applications of the motor.

The preëminent position now held by the electrical operation of elevators is due in no small measure to the following well-defined features which characterize the modern motor-driven elevator equipment—first, the convenience with which safety devices may be employed; second, the simplicity and compactness of this form of apparatus, coupled with the economy in operation and upkeep and the ease with which control may be accomplished. The fact that these features have received widespread acceptance, in spite of the highly developed state of older methods of operation, is indicated by the almost universal adoption of motor drive under the widely different conditions of high-speed passenger service, moderate speed freight and passenger equipment, and low-speed freight elevators with their more or less intermittent operation.

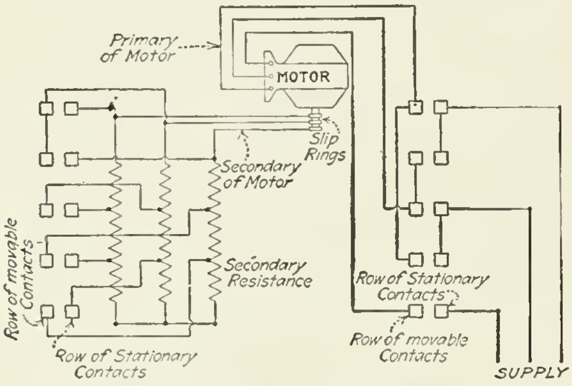


FIG. 1—CONNECTIONS FOR A THREE-PHASE SEMI-AUTOMATIC ELEVATOR CONTROLLER

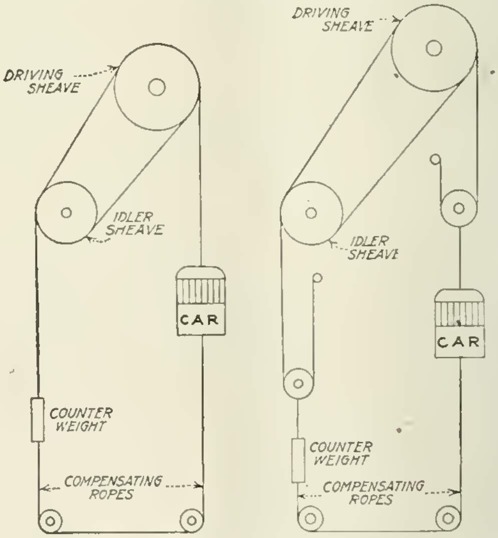
METHODS OF OPERATION

Electric elevators may be classified under two broad divisions of operation. First come those provided with so-called winding drums, which are grooved spirally and in the operation of which the cables simply wind and unwind as the car is raised and lowered. This type is employed for relatively low buildings where the lift is, say, less than 100 ft. (30.5 m.) and is adapted to speeds up to about 200 ft. (61 m.) per minute. The second class makes use of so-called sheaves which have straight grooves for holding the cables. Here the cable operates in the raising and lowering of the elevator by the friction between the cables and the sheaves, thus giving rise to the term "traction-sheave" type. This class of elevator has practically no limit to the height of the lift and may be used for speeds from about 200 ft. to, say, 700 ft. (61 m. to 213 m.) per minute.

The well-known methods of roping and counterbalancing commonly employed for the winding-drum elevators need hardly be commented on at this point other than to state that experience indicates the advantage of employing two ropes between the drum, the elevator and the counterbalance, instead of one, for the purpose of reducing the size of the rope necessary and also for the gain in the use of drums and sheaves of smaller diameter than would be possible otherwise. Counterbalancing is usually so proportioned as to meet the average conditions of load. Furthermore, for the larger distances of car travel the variations in the cable positions for different parts of the run may be compensated for by the use of a supported chain attached to the under side of the car and to the central point of the hatchway. Formulas have been worked out for the determination of the necessary weight of such a compensating chain per foot of length, the importance of which is apparent when it is considered that this feature is adopted primarily as a means for smoothing out the otherwise variable nature of the motor load.[1]

THE TRACTION-SHEAVE ELEVATOR

Simplicity of equipment for high-speed elevator service is accomplished by the use of traction sheaves, the scheme of which is illustrated in Figs. 2 and 3. The advantage of this method of driving is most apparent, of course, for the higher lifts, where the dimensions of a



FIGS. 2 AND 3—GEARLESS TRACTION ELEVATOR WITH ONE-TO-ONE ROPING USED FOR CAR SPEEDS OF 500 FT. PER MINUTE AND ABOVE AND TWO-TO-ONE ROPING FOR CAR SPEEDS UP TO 450 FT. PER MINUTE

winding drum would become unduly large. In a general way the gearless traction elevator is available in two forms, commonly known as the one-to-one roping arrangement (Fig. 2) and as the two-to-one scheme (Fig. 3), the former being used for the operation of car speeds of 500 ft. (152 m.) per minute and more, and the latter for speeds below 450 ft. (137 m.) per minute.

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[1] See "Standard Handbook for Electrical Engineers," section on "Elevators," p. 1219. Diagrams of the roping arrangement for elevators of the winding-drum type are given in this handbook section.

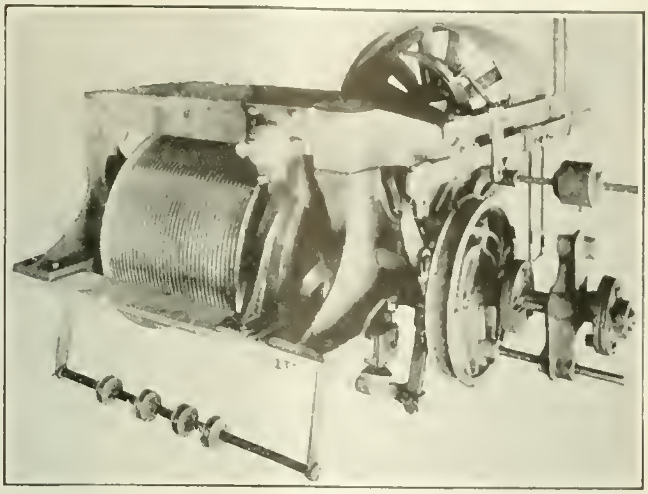

FIG. 4—HANGING TYPE OF BELT-DRIVEN ELEVATOR MACHINE FOR 1000 LB. TO 6000 LB.

The equipment for the one-to-one machine is made up of a low-speed motor and a mechanically attached driving sheave and brake wheel. The driving sheave is made as small as the wear on the ropes will allow, for the purpose of making possible a high motor speed. The traction sheave for the two-to-one equipment may be smaller than in the one-to-one machine, because of the smaller size of rope usually employed in the former, ⅝ in. (15.9 mm.) being standard for the one-to-one machines and ½ in. (1.27 m.) for the two-to-one apparatus.

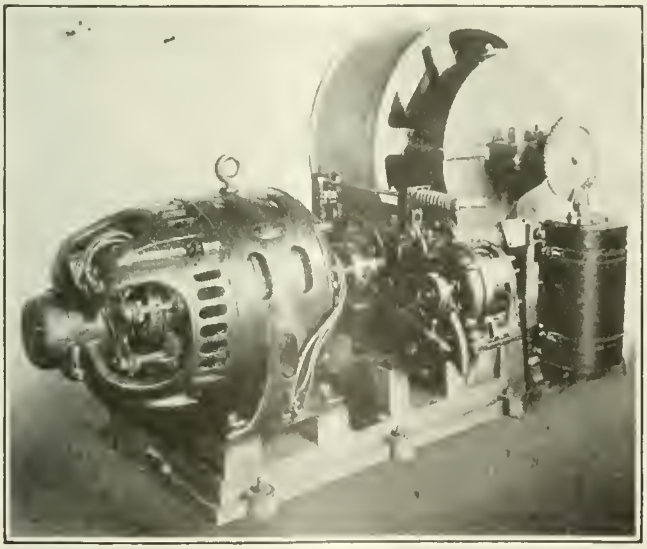

FIG. 5—DIRECT-CONNECTED ELECTRIC ELEVATOR AVAILABLE FOR BOTH DIRECT-CURRENT AND ALTERNATING-CURRENT OPERATION; CAPACITY, 2000 LB. TO 10,000 LB.

An inspection of Fig. 3 will show that the elevator speed with this roping arrangement is half that of the rope speed. The equipment of the two-to-one machine is similar to that of the one-to-one outfit, and it may be stated that the limitations to the use of the two-to-one roping scheme, even with its lower cost, are due to the excessive wear of the rope, because of the high rope speeds where the car itself operates at high lift speeds. The rope speeds, being limited to about 900 ft. (274 m.) per minute, make the car speed limit about 450 ft. (137 m.) per minute for the two-to-one arrangement.[2]

Two requirements of direct-current motors for elevator operation deserve special mention, namely, high starting torque and freedom from sparking difficulties under extreme load variations and high overloads. To these items quietness of operation may be added, this feature being important in such cases as apartment buildings, hospitals, office structures and the like.

As typical of the developments of this line of motors any one of a number of types might be mentioned. With one company's equipment ranging from 5 hp. to 50 hp. for standard voltages of 115, 230 and 550, commutating poles are employed, emphasis being placed upon such features as rolled-steel frames with forged steel feet, adequate radiation, large shafts and leakproof bearings, high efficiency, low operating temperatures and a high overload capacity.[3] These motors are available in three classes, which are mentioned here to indicate the marked coördination of the motor design with the variety of service usually encountered.

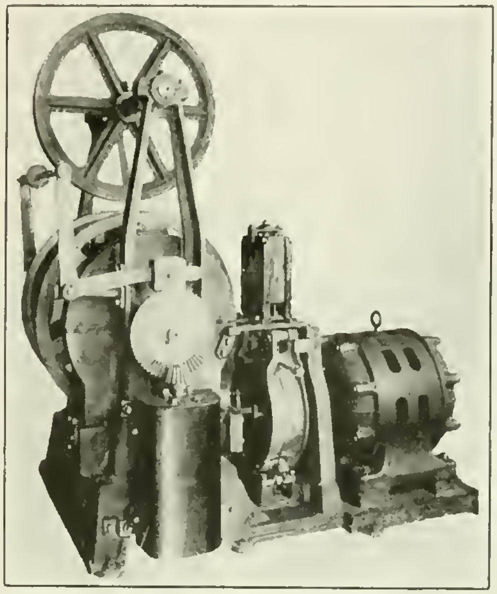

FIG. 6—DIRECT-CONNECTED MOTOR-DRIVEN ELEVATOR WITH CONTROLLER IN THE FOREGROUND

Motors of the first class apply to high-speed service (passenger) and have a speed range of two to one with field control. The fields are shunt-wound to provide uniform acceleration and are furnished with a damping winding of the short-circuited type. In class 2 the motors are of the single-speed form and apply primarily to installations where medium speeds are used. Motors for low-speed freight service constitute the third class. In both of the latter classes a compound winding is used with a short-circuiting arrangement for cutting out the series field as soon as the car is under headway. This means simply that the motor operates normally as a shunt machine except during the starting periods.

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[2] See paper by A. Brunt, *Transactions* A. I. E. E., Vol. 34, Part I, p. 196.

[3] Westinghouse practice.

Alternating-Current Motors

As usual in motor applications of this general nature, the available motors for alternating-current operation are of special interest from the central-station standpoint. Among typical standard types there may be mentioned the straight squirrel-cage motor, the two-speed alternating current motor and the induction motor of the slip-ring type.

Standard squirrel-cage elevator motors are made for two-phase and three-phase supply circuits, for 25 cycles and 60 cycles, and are operative at standard voltages of 220, 440 and 550. They are used for both passenger and freight service where the speeds are low, that is, 150 ft. (46 m.) per minute and less, and require an extremely simple form of controller, consisting merely of a reversing switch without auxiliary resistance. In connecting this motor directly across the line twice the full-load torque is obtained with two and a half times full-load current, and smooth acceleration is thus realized.

The two-speed alternating-current motor is adaptable to the operation of elevators with car speeds up to 350 ft. (107 m.) per minute, in contrast with the lower value mentioned above for the squirrel-cage type of equipment. Two separate windings are used on the stator and on the rotor. A twenty-four-pole connection is employed for starting by one company, and when the motor has reached a sufficient speed a change to an eight-pole connection brings the motor up to 850 r.p.m. from a speed of 250 r.p.m. used for starting. In slowing down the reverse sequence is used, the change from eight to twenty-four poles while the motor is running at the higher speeds making it possible to utilize the generator action of such a motor while operating above synchronous speed. This braking action brings the motor quickly down to the speed corresponding to a twenty-four-pole connection, and the final braking is then accomplished by an electrically manipulated mechanical brake in the ordinary manner.

According to current practice with slip-ring induction motors for elevator service, a common range in the sizes of one principal type is from 2 hp. to 50 hp. for 25-cycle and 60-cycle circuits, two-phase and three-phase, and for the standard voltages listed above for the other alternating-current forms. Flywheel effect is kept down by employing relatively small-diameter rotors, and a starting torque of twice the full-load value is realized.

Semi-Automatic and Semi-Magnetic Control

One standard semi-automatic elevator controller (a diagram of which is shown in Fig. 1) makes use of a quick-break butt-type form of contact protected by suitable arc shields. This form of controller is employed with a hand rope or a lever in the elevator itself and is designed for positive mechanical manipulation of the switches. It is used in conjunction with poly-phase slip-ring induction motors with full resistance in the motor secondary at starting, after which the auxiliary rotor resistance is automatically cut out at a rate best suited to the operation of any given equipment, adjustment for the accelerating rate being possible at the controller itself. When stopping the elevator the sequence is reversed in the sense that all secondary resistance is cut in before the disconnection of the motor from the line.

The operating features of this semi-automatic control equipment are interesting in that they illustrate one special form of control in contrast to the full-magnet apparatus described below. The hand rope in the elevator car operates a sprocket, which is mechanically fastened to the primary cam shaft. This action of the cam shaft closes one set of the primary switches (Fig. 1) and starts the motor, and the same action releases

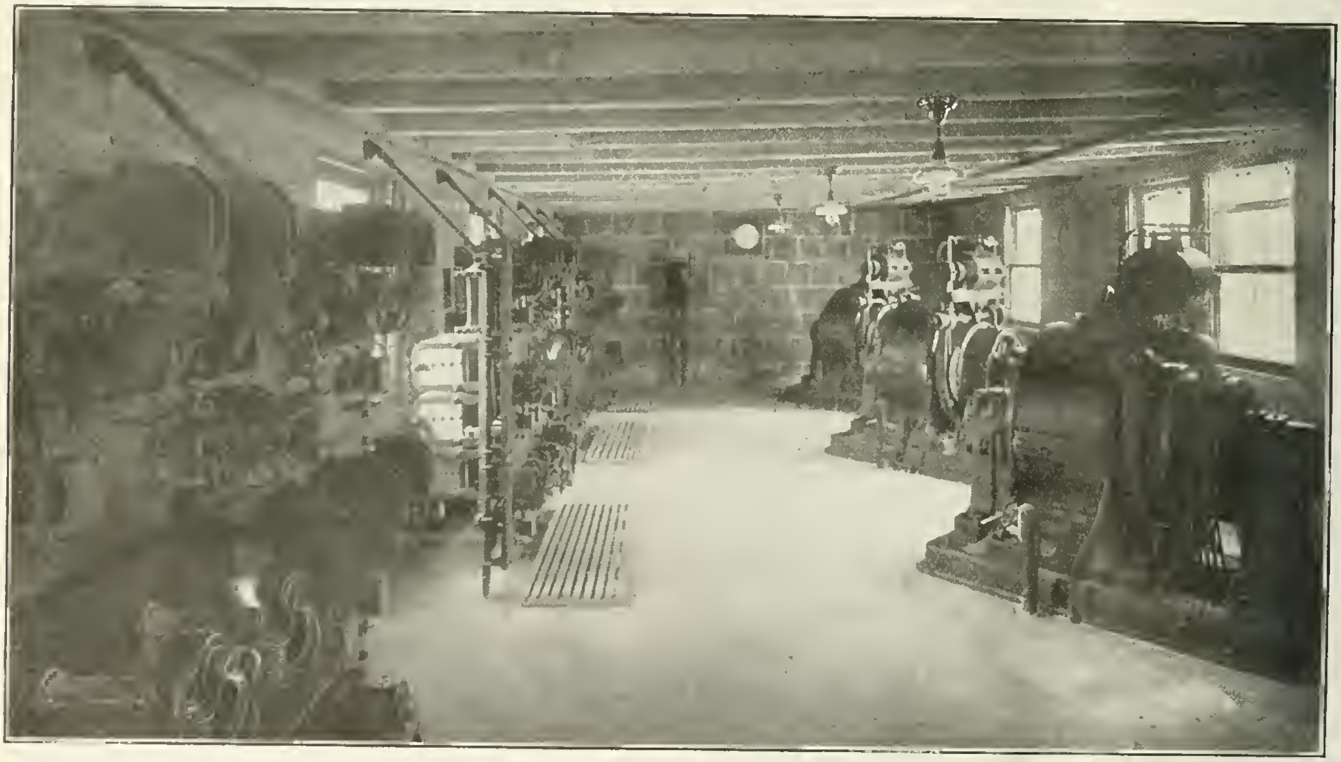

FIG. 7—DIRECT-CURRENT MOTORS AND AUTOMATIC CONTROL FOR ELEVATOR SERVICE (NOTE ARCING AT CONTACTOR SWITCHES)

a weight arm which is attached to the secondary cam shaft, closing the secondary switches in such order as to accelerate the motor properly. The motion of this weight arm is retarded by an air dash-pot. Motion of the controller to its off position opens the secondary switches, thus cutting in the auxiliary resistance, and the primary switches are then opened.

Semi-magnetic controllers, as the term implies, employ magnet switches in conjunction with a reverse switch (of the drum type) which is hand-operated from the elevator car, in one of the standard forms, by a hand rope or hand wheel for starting, stopping and reversing.

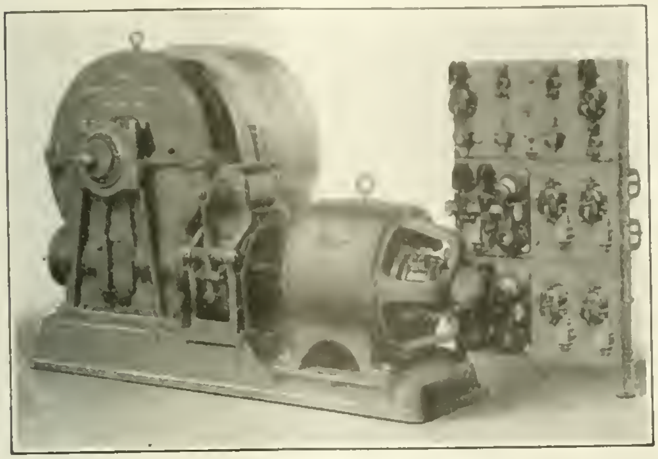
FIG. 8—DIRECT-CURRENT MOTOR AND AUTOMATIC-CONTROL PANEL FOR HIGH-SPEED ELEVATOR SERVICE

The many advantages of the completely automatic controller of the magnet type include such features as safety and prevention of improper starting, and it is used in most cases. In this form of control a switch in the elevator car merely serves to give the operator control over the elevator, but the actual operation of the magnetic contactors is not directly dependent on this master switch. In this way the rate at which the actual connections are made depends on the contactor switches themselves and not on the way in which the master switch is manipulated. Obviously such a scheme provides the elements of protection for the apparatus itself, and the accompanying safety devices, which are readily used as a part of the electrical equipment, form an added feature of importance.

SAFETY DEVICES

The use of a magnetic main switch and a magnetic brake makes it possible to employ numerous safety devices, by which the magnetic main switch is opened automatically, thus disconnecting the motor from the line and applying the brakes. This action is also caused in standard equipment by any trouble arising in the motor, the controller or the elevator apparatus itself.

The purposes for which safety devices are designed are perhaps best shown by the following list of items: The safeguarding against overtravel (hatchway limit switch); to prevent operation with any door open (door safety switch); protection in case the car or its counterweight should be jammed (slack cable switch); to offset the release of the handle by the operator (automatic return of car switch to off position); to prevent the start of the car by any one leaning against the handle (center-holding latch on main switch); failure of the regular car control features to stop the car (car safety switch); the machine limit switch for stopping the car at the top and bottom landings if the car switch becomes inoperative for stopping purposes, and relays for protecting the motor and preventing the operation of the car in case a failure or reversal of phase should take place.

The foregoing list of safety appliances needs no further comment than perhaps to point to the flexible manner in which the electric outfit lends itself to such devices and the corresponding advantages thus secured in safeguarding both the electric equipment and those served by the elevator.

Automatic push-button control makes possible the control of an elevator by means of push-button stations in the car and at the landings and thus eliminates the requirement of a special operator. Where a relatively small demand for elevator service exists, as in small family hotels, apartment buildings and the like, this particular type of control makes a special appeal. To illustrate the equipment required for such an arrangement the following list of apparatus is given as applicable to a typical two-landing push-button passenger elevator control outfit: one controller, four hatchway limit switches, one slack cable switch, one door switch for each landing, one two-landing gang push-button switch, one emergency stop button, two single push-button switches and one brake magnet.[1] With such a scheme a passenger on entering the car must first close the door before operation by the start button is possible. The button corresponding to the desired floor is then pressed, and the car automatically stops when the given floor is reached.

POWER CONSUMPTION DATA

Available figures show wide variations in the energy consumption per mile of elevator travel, depending on such factors as the average load carried and the number of stops per car mile. Obviously, therefore, the power consumption will vary in buildings of different types. For a given load and speed available figures show in one specific case a range from 1.48 kw.-hr. to 7.34 kw.-hr. per car-mile (2.37 kw.-hr. to 11.75 kw.-hr. per car.-m.) where the number of stops between the terminal landings per mile of travel ranged from zero to 380. In another case the kilowatt-hours consumed per car-mile practically doubled with approximately a 100 per cent increase in the stops per car-mile. These figures, while merely illustrative, are of considerable interest at this time owing to recent rulings affecting elevator service for the conservation of fuel.

BIBLIOGRAPHY. — Paper on "Characteristics of Direct-Current Motors for Elevator Service," by A. Brunt, *Transactions* A. I. E. E., Vol. 34, Part I, p. 196; section on "Elevators," "Standard Handbook for Electrical Engineers," by D. L. Lindquist, p. 1217; data on "Elevators," National Electric Light Association; bulletins, data and illustrations from the following concerns: Westinghouse Electric & Manufacturing Company, Salem (Mass.) Elevator Works and the Cutler-Hammer Manufacturing Company. Figs. 2 and 3 are based on diagrams found on page 207 of Mr. Brunt's paper referred to above.

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[1] Based on the practice of the Cutler-Hammer Manufacturing Company.

Education of Boiler-Room Men Necessary

Human Element Important Factor in Fuel Conservation Efforts—Means of Fostering Interest of Firemen—Notes on the Experience of Several Companies

BY EDWIN A. HUNGER
For United States Fuel Administration

AFTER all that has been proposed and done recently to increase fuel economy is properly considered, it is difficult to get away from the fact that, particularly in these war times, when means for producing mechanical coal-saving devices are not of the best, the human element looms up as the most important factor in conservation efforts. Without intelligent operation and management the best of boiler equipment cannot prevent the waste of fuel. Furthermore, it is easier now to reorganize operating methods to conserve coal than it is to obtain new equipment to do the same thing. Therefore, one of the surest methods of obtaining high fuel economy is to educate the entire boiler-room personnel in correct firing methods.

A study of fuel economy by means of the human element is of particular interest to the central-station man at this time since increased labor turnover and general scarcity of labor have added difficulties in organizing efficient boiler-room forces and in creating a spirit of economy among the men without which real fuel conservation is impossible. In many cases the shortage of labor supply has forced managers to direct attention for the first time to the education of their firemen and proper boiler-room accounting methods. In many plants this should be a blessing in disguise, for without careful supervision of the man handling the coal pile large leaks are sure to occur.

Lessons from Last Winter's Experience

Last winter a serious coal shortage existed and drastic methods were necessary to provide fuel for essential war operations. The danger of another shortage next winter is very great, and unless every plant in the country resorts to every possible economy and uses fuel when only absolutely necessary further curtailment may be required this year. If such is the case, so-called non-war and non-essential industries may have to go by the board until after the war. Of course, such action will come only as a last resort, and to forestall it as long as possible it is the patriotic duty of every consumer to save fuel. The central-station people can help much in this big project of coal conservation by getting acquainted with the men in the boiler room and exchanging ideas on saving coal.

The present is a particularly opportune time for introducing fuel-economy propaganda to the fireman. He knows full well that this is every man's war and that his efforts and those of all his neighbors and co-workers are needed to bring it to a satisfactory end. An appeal to be careful in the use of coal because "Uncle Sam needs that extra shovelful" will be painstakingly heeded. For similar reasons he is now more apt to take heed of operating directions which in other times he might pass over with disdain. He is a willing subject and can easily be made to have the desire to save coal. It is up to the management, therefore, to teach him how.

The time has also come for the introduction of Mr. Manager to Mr. Fireman. It is high time that plant managers should know more about the personnel in the firerooms. The fireman is a human being and likes to feel that he too is an important cog in the big machine. If he is made to think so by the big boss, the other bosses will quickly fall in line and treat him with proper respect. Much depends on the attitude of the "higher-ups," therefore, and if they give the right kind of encouragement and sympathy to the firemen and urge them to think fuel economy and practice it to the best of their knowledge, the possibilities of reducing the amount of coal used will be very good.

Means of Encouraging Fuel Economy

Various devices may be utilized for fostering the interest of the fireman in fuel conservation. Lectures, night classes and conferences with the chief engineer will help immensely. Placards with fuel-economy precepts printed in large letters posted in open places where they can be plainly seen by every one in the boiler room will also keep the big idea of conservation continually in the workman's mind. To prevent a lapse of interest in these placards they should be changed frequently and, if possible, printed in different colors. Such frequent change will automatically tend to revive the man's interest, and the fact that effort is made to change them will show him that interest in fuel economy in the front office is also not on the wane.

This sustenance of interest in fuel economy is important. Like all good industrial movements, it requires continual application. The idea of fuel economy must frequently be dished up to the fireman in new dresses lest his interest wane. An occasional visit by the manager or superintendent will help. Frequent talks and conferences with superiors should be introduced. Recognition for efforts in effecting savings will also encourage the fireman to keep up his interest in the saving of fuel. The plant bulletin or newspaper is another means for keeping interest in fuel economy at a keen point. In fact, every possible effort for making the fireman think everlastingly in terms of fuel economy should be introduced in order that the plant may operate with a minimum consumption of coal.

The United States Fuel Administration has been gathering data on the practice of fuel conservation in some of the power plants. Some of the information obtained on handling the boiler-room force is given herewith.

E. M. Gilbert, chief engineer of the W. S. Barstow Management Association, writes as follows on this subject: "A year ago our coal cost per kilowatt-hour in the West Reading power house of the Metropolitan Edison Company was 3.2 to 3.3 mills. Our coal costs at the present time are running from 2.1 to 2.2 mills. Part of this economy has been due to an added turbine, giving increased economy, and part to a change of mechanical stokers; but fully 25 per cent of it has been due to better methods of handling the boiler room.

"We had contemplated the trial of a bonus system, but some experiments carried on at various places led us to abandon this idea. In the first place we found that a great many of the firemen were intelligent enough to take advantage of any bonus system which could be applied on the basis of CO_2 measurements. In the plant where this was tried firemen soon ascertained that the man who did not force his boiler too hard but kept a thick fire with the damper partly shut and not too great an air pressure often obtained a better percentage of CO_2 than the fireman who pushed his fire as hard as possible. While this was in very many cases not entirely true, still the idea became fixed in the firemen's minds that this was the way to earn a bonus, and we immediately had trouble in getting the best results from our boilers and because of the contentions between the men that some were carrying all the load and doing all the work while some were doing little if any.

"In other plants we installed steam-flow meters and tried to work the two plans in conjunction, but we feared that the bonus system, from the little we had experimented with it, would cause trouble among the firemen and would disrupt our labor organization, which was difficult enough to maintain under present labor conditions, and we finally, therefore, adopted the following method:

"We installed two young power-house engineers, boys from college getting from $60 to $90 per month, who were anxious to progress and interested in our work. CO_2 recording apparatus, which could be transferred from one boiler to the other, was installed, and as our boilers are all equipped with steam-flow meters, feed-water heaters and Richardson coal scales, we were able to keep daily records for each shift in this way. The actual record of what was done by each one of the three shifts is carefully kept and is published each six weeks, showing just which shift is obtaining the best results regarding the actual coal used per kilowatt output.

STIMULATING RIVALRY BETWEEN SHIFTS

"The six-week period is adopted because the men change shifts every two weeks, and this length of time gives each shift of firemen two weeks' service on the day shift, two weeks' service on the night shift and two weeks' service on the graveyard shift. This plan stimulated the rivalry between the shifts to a great extent, and though no bonus or money offer was made to the firemen, a spirit of competition has developed between the shifts, especially between the foremen of each shift, as to who can obtain the best results. The young engineers whom we have employed not only take an analysis of the coal occasionally but analyze the ashes taken out by each one of the shifts each day to determine the amount of carbon contained in these ashes. A sample is taken by the ash men when they are cleaning out the ash pits, and the analysis is made every morning, being published for the benefit of the various shifts. By this method we have reduced the percentage of carbon found in the ashes by more than 50 per cent.

"At the present time a great deal of difficulty in obtaining coal is being encountered, and fuel of any class or description is being used, so that we are not able to make so much progress with our conservation of fuel as we had hoped, the variation in the fuel value being such that the comparison between the shifts is now often useless.

"We think the method described above is one of the best which can be used, and we still hope that we can work out a satisfactory bonus system for each shift as soon as conditions improve regarding coal supply.

"Our men show intelligence, and a great many of them show eagerness to obtain information regarding the methods of operation. We find that the employment of a high class boiler-room engineer, who knows enough about the apparatus and firing to have the entire respect of the boiler-room force, is essential and has a great deal to do with the proper application of any method which may be put into use."

PRESENT BOILER-ROOM LABOR NEEDS MORE SUPERVISION

Another interesting communication on the same subject, from E. J. Billings, mechanical engineer for Henry L. Doherty & Company, is given below:

"Just at the present time, and for several months past, we have found it necessary to devote a large part of our energies to a study of our plant organizations in an effort to keep them up to their standard of a year ago. We find that under the present labor conditions it is necessary to provide considerably more plant supervision than heretofore. This is due, of course, to the shifting and uneasiness of both skilled and unskilled labor. For example, in one of our larger plants it has been necessary to provide an assistant chief engineer to assist the chief engineer in looking after the operating details where the chief engineer was formerly able to do this alone. In several of our smaller plants which have been operating quite economically in the past without boiler-room foremen it has recently been necessary to provide such foremen, and, further, it has been desirable that these foremen be very wide-awake individuals. We have found it necessary in another plant to provide a repair foreman or master mechanic to take general supervision of maintenance work. We find that this necessity for added supervision prevails all down through the line in our power-plant organizations.

"We find it necessary also to put more emphasis than ever before on the first principles of boiler-plant operation, including such things as keeping the heating surfaces of the boilers free from scale and soot, keeping the settings, baffles, arches, grates and boiler accessories in good repair, making use of the boiler dampers, breaking up lumps for hand firing, proper methods of cleaning fires, proper methods of firing, etc. We find that where these things were formerly taken care of almost automatically we now have to keep continually fighting a callousness to them among our operating men.

"I do not believe that these conditions are peculiar to our own plants only, but that it is much the same in every boiler plant, and I also believe that these conditions are being met in a great many plants in only a half-hearted and ineffectual manner, resulting in very great wastes of fuel. If every manager or superintendent who is directly responsible for the operation of a boiler plant could have an exact diagnosis of the operating condition and its significance laid before him, he would at once take the necessary steps to relieve the undesirable conditions in so far as it lies in his power to do so. The demand for a few unusually keen operating men in the more important positions of every plant has never been felt by us so greatly as at the present time, and we believe that we will be fully compensated if we devote our efforts to finding and developing men of this class.

"Some other things along the line of fuel saving which we are doing may be mentioned very briefly. We have our plant inspectors who visit our plants at intervals and report in detail on the physical condition of the plant equipment. We also have results engineers who study and analyze the operating results, make plant tests, etc. We have a chemical laboratory for analyzing coal, ashes, oils, water and other power-plant material. We have recently been sending out a series of fuel-saving bulletins to be posted in our plants, one at a time, calling attention to some of the elementary principles of boiler-plant operation.

"We are equipping our plants as rapidly as possible with steam-flow meters on each boiler and meters for measuring the feed water. We are also giving a good deal of attention to keeping our boiler settings air-tight by the use of boiler coatings or cements which are now to be found on the market. We are also equipping our boilers as rapidly as possible with mechanical soot blowers to take the place of the old method of using a hand steam lance.

"We have tried various plant bonus schemes with more or less success, and while we are heartily in favor of the plan, we have been unable as yet to apply it generally throughout our plants, or with continued success in any one plant, owing to changes in plant conditions, to shifting labor conditions or to defects of the plan."

Dealing with the Personal Element

The following from Samuel Insull, president of the Commonwealth Edison Company, tells how the personal element is handled in the stations of the great Chicago electric company to bring about fuel economies:

"Technical, experienced men, who are in charge of the boiler-room tests which are frequently conducted, instruct and educate the boiler-room operating men in the more important positions in the importance of proper methods of firing and operating the boiler-room equipment and the effect that the proper methods have upon the actual resulting efficiency in the production of steam.

"The two things that they are taught to avoid are the running of too thin a fire and thus admitting an excess amount of air and, on the other hand, runnig too thick a fire and thus losing too much coal over the end of the grate with the ashes. Of course, with the chain-grate stokers generally used in this part of the country, in order not to have too thin a fire as the grate travels toward the back end of the furnace, a certain amount of coal, perhaps 1 or 2 per cent, with good firing, is allowed to go over the grate with the ashes; but the point is to run the fire so that not more than the necessary amount of coal is allowed to go to waste with the ashes. For best results, the fire must run as strong or as hot as possible, and the firemen are required to cut off boilers as the load decreases, rather than continue to operate all the boilers with less intense fires.

"In smaller plants, in cases where the grate area is a little larger than is necessary for the demand for steam, rather than reduce the intensity of the fire, it is our practice to reduce the grate area."

Cleanliness about the boiler room is an important factor in the maintenance of economical use of fuel. The boiler, for example, never can be too clean, both inside and outside. Soot is a poorer conductor of heat than asbestos. It pays, therefore, to clean the flues frequently. Similarly, if the interior of the boiler is coated with scale, much more coal is required. These two items, the cleaning of tubes and removal of boiler scale, are especially liable to neglect and a continual check is absolutely necessary.

Talks on fuel economy in industrial and power plants are nothing new. The United States Bureau of Mines has been preaching it for years. In fact, some of the best books in circulation on fuel conservation have been prepared by the bureau. These books are easily available on the payment of a nominal fee, and it might be well to circulate them among the boiler-room men.

The coal shortage problem is a difficult one and will remain so for the duration of the war. In some plants by means of careful firing methods and by keeping the boilers clean and in good repair the losses can be reduced 10 per cent and in some plants even 15 per cent. At least 250,000,000 tons of coal is annually used in the United States for making steam in stationary plants, so that a saving of 15 per cent would amount to 37,500,000 tons, which is considerably more than all the coal mined at present in France. In large plants, of course, some cognizance has been given to fuel conservation, and resort is made to comprehensive records, without which real fuel economy is impossible. It is in the large number of small hand-fired stations that indifference to fuel-saving methods has been so appalling. It is high time for many of these small stations to "get on the band wagon" and practice fuel economy.

Fuel Economy Precepts

The following oft-repeated fuel-economy precepts for hand firing with soft coal may be worthy of one more repetition. Technical Paper No. 80, on "Hand Firing Soft Coal Under Power Plant Boilers," published by the Bureau of Mines, Department of the Interior, contains a wealth of material on the same subject:*

1. Fire small quantities at a time at short intervals.
2. Keep the fuel bed even by placing the coal on the thin spots of the fuel bed and avoid raking and slicing the fuel bed.
3. Keep the fuel bed about 6 in. (15.2 cm.) deep.
4. Control the steam pressure by regulating the draft, and regulate the draft by the draft damper in the uptake. Have the damper nearly closed when the fire is banked.
5. Clean fires when the demand for steam is small, and while cleaning have the draft damper partly closed.
6. Look out for leaks in brick work.

In the present emergency the big drive must be made on the man in the boiler room and the man behind the shovel. Strict records on the amount of coal used and steam produced from this coal should be kept. The men in the boiler room must be made to understand that their jobs are important and not for the fly-by-night individual. Shorter hours, better pay and better working conditions—in a word, just what men in other parts of the plant are getting—will help the men to be contented with their jobs and stay at them, take a keen interest in fuel conservation and become skilled workers who will save many times the actual cost of increased wages and other innovations by the saving of many tons of coal.

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*The Fuel Administration has a limited number of these papers for free distribution. Apply to the Fuel Engineering Division, Bureau of Conservation, Fuel Administration, Washington, D. C.

LARGE OUTDOOR SUBSTATION ERECTED AT CANTON, OHIO

This Arrangement Is Made by the Central Station in That City for the Electrical Supply of Important Industrial Customer

The outdoor substation recently constructed by the Central Power Company at Canton, Ohio, to supply power to the plant of the United Alloy Steel Company is a fine example of modern practice and is one of the largest stations ever installed to supply a single consumer. It was designed for continuous service since the slightest interruption would be disastrous to stock, equipment and possibly life in the operation of open hearths, electric furnaces or rolling mills.

The present installation consists of seven 3000-kva. air-cooled transformers, connected in two banks of three each, with the seventh transformer available as a spare. Power is supplied from three 22,000-volt lines, protected by electrolytic arresters, to the incoming bus, and from this bus through automatic oil circuit breakers to the separate transformer banks. From the transformers other oil breakers make connection to the low-tension bus, which is carried inside the small building housing the distribution switchboard, relays, metering equipment, etc.

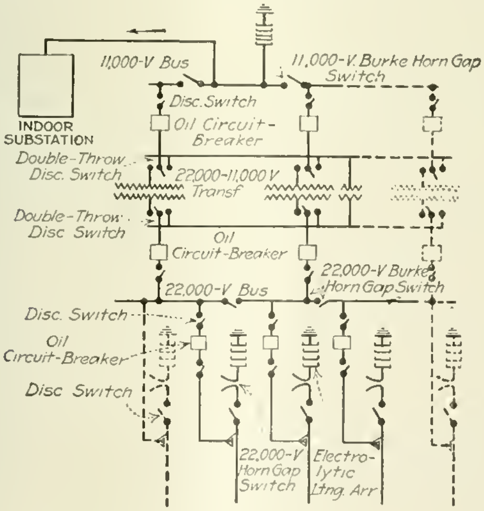


FIG. 1—ONE-LINE DIAGRAM OF SUBSTATION CONNECTIONS

Note the arrangement for replacing any transformer by the spare.

Both high-tension and low-tension busbars are sectionalized by Burke horn-gap switches. These are supplemented by disconnecting switches which give complete flexibility to the installation. Owing to the fluctuating nature of the load caused by the operation of electric furnaces, a 15,000-hp. blooming-mill motor and a 4200-hp. Morgan mill motor, it was considered advisable to dispense with overload protection of the transformer banks. Differential protection has been instituted and is operating very satisfactorily. The protection is effected by current transformers in both the high and the low sides of the transformer banks with such ratios that under normal conditions the secondaries exactly neutralize each other. In the event of the slightest ground or failure in either the primary or secondary winding of any transformer this balance is destroyed, causing the relay to operate and tripping both high-tension and low-tension oil switches, thus isolating the bank and saving it from further destruction without interrupting the service. The line feeders are equipped with reverse power relays. All protective devices are operated by alternating current.

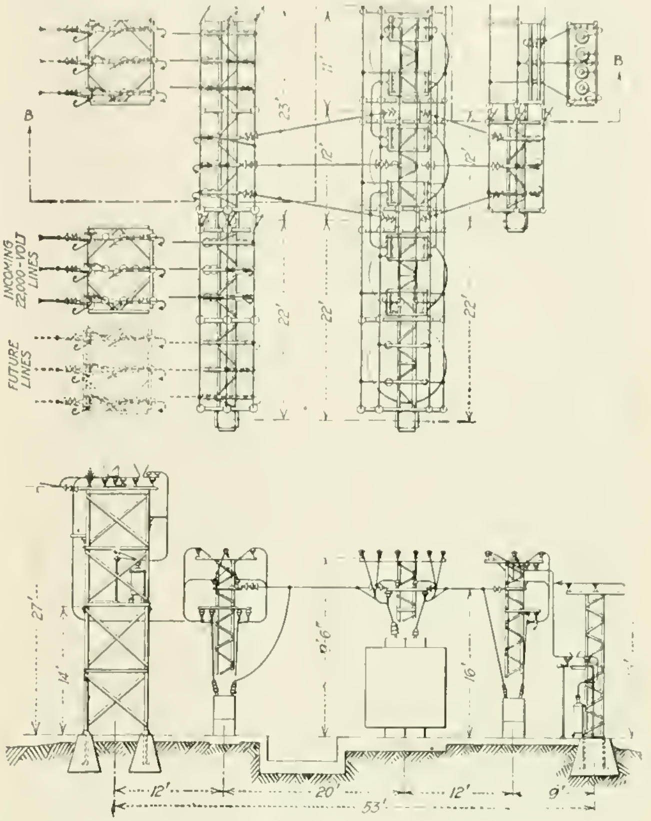


FIG. 2—PLAN AND ELEVATION OF SUBSTATION

For very important service the substation should be simple, accessible and logically arranged. These reqirements are well met in this installation.

A unique feature is the arrangement of connections for the spare transformer. High-tension and low-tension leads from the spare are carried over all the other transformers, and double-throw disconnecting switches allow the immediate use of the spare in place of any one of the other six. The station is designed on the unit principle, and as other transformers are added the spare transfer bus will be extended to protect them also.

Westinghouse transformers, oil circuit breakers and electrolytic arresters are used. The rest of the equipment was furnished by the Railway & Industrial Engineering Company, which also designed the station in conjunction with the Central Power Company. The installation was made by the Central Power Company under the supervision of William M. Hornlein, electrical engineer of this company.

Conservation of Fuel in California

By Interconnection of Systems with Different Load Characteristics One Company Alone Will Save Nearly a Million Barrels of Fuel Oil—Hydroelectric Development Must Continue to Meet Growing Demand for Energy

BY R. J. C. WOOD
Superintendent of Generation, Southern California Edison Company

FUEL once consumed is not recoverable and the supply is decreasing while its cost is increasing. On the other hand, stream flow is not depreciated by its utilization for power purposes and the supply is practically inexhaustible. Much may be accomplished toward saving fuel in California by interconnection, on account of the excellent diversity of loads between different systems. As a striking example of this difference in load characteristics the San Joaquin Light & Power Corporation and the Southern California Edison Company may be cited. The San Joaquin load is mainly due to summer pumping, while the peak load of the Edison company occurs about November. Thus the San Joaquin plants carry a considerable part of the Edison company's load in the winter time and the Edison company reciprocates in the summer. The use of steam reserve plants is thus greatly reduced, less water flows uselessly past the hydroelectric plants and fuel oil is conserved in substantial measure.

The rivers in the southern part of California are of most variable flow, and for this reason a great portion of their run-off is lost as flood water. There exist good storage sites on Big Creek, one of which has been developed to 88,000 acre-feet (10,800-hectare-m.) at Huntington Lake. Further south, reservoir locations are comparatively few, the Big Bear Valley reservoir and the reservoirs of the Los Angeles Aqueduct being the only ones serving hydroelectric plants of any magnitude. The Little Bear Valley reservoir has not as yet been put to use in connection with power development, and reservoir sites that have been proposed on the Mojave and Sespe Rivers for irrigation projects are not yet developed.

IRRIGATION AND HYDROELECTRIC COMBINED SYSTEM

The combination of an irrigation with a power project is not always so advantageous as might at first appear. In those projects where the whole run-off of the stream is stored it is apparent that power will only be available during the irrigating season. This in itself is not a serious disadvantage because the power then generated can be used for pumping purposes on lands not under gravity flow. The inherent disadvantage lies in the fact that the power plant operates under a load factor of not more than 50 per cent and to utilize the water it must have a capacity twice as large as would suffice if the water had uniform flow. Further difficulties arise in keeping together an operating organization that is idle half the year.

For immediate relief scientific operation of those storage and power sites now existing is necessary, to be followed by the building of new plants as funds become available. Each power company considered individually can do little more than it has in the past; none have wasted water in order to pay money for fuel, but many cases have existed where the water power could not all be absorbed at certain times of the day or seasons of the year, particularly where there was no adequate water storage, and great waste ensued. Combinations by the interconnection of systems of different companies and storage systems have resulted in the diversity of loads and available generating capacities being utilized to full advantage. The insurance factor has also been increased, partly offsetting the shut-down of the smaller stand-by steam plants.

Before the present urgent necessity for general conservation arose, a high standard of service had been established. In times like the present, this standard must be relaxed and the reducing of the quality of service by but a fraction of a per cent will release an amount of money for more urgent purposes which would more than offset the inconvenience due to the lowering of the standards.

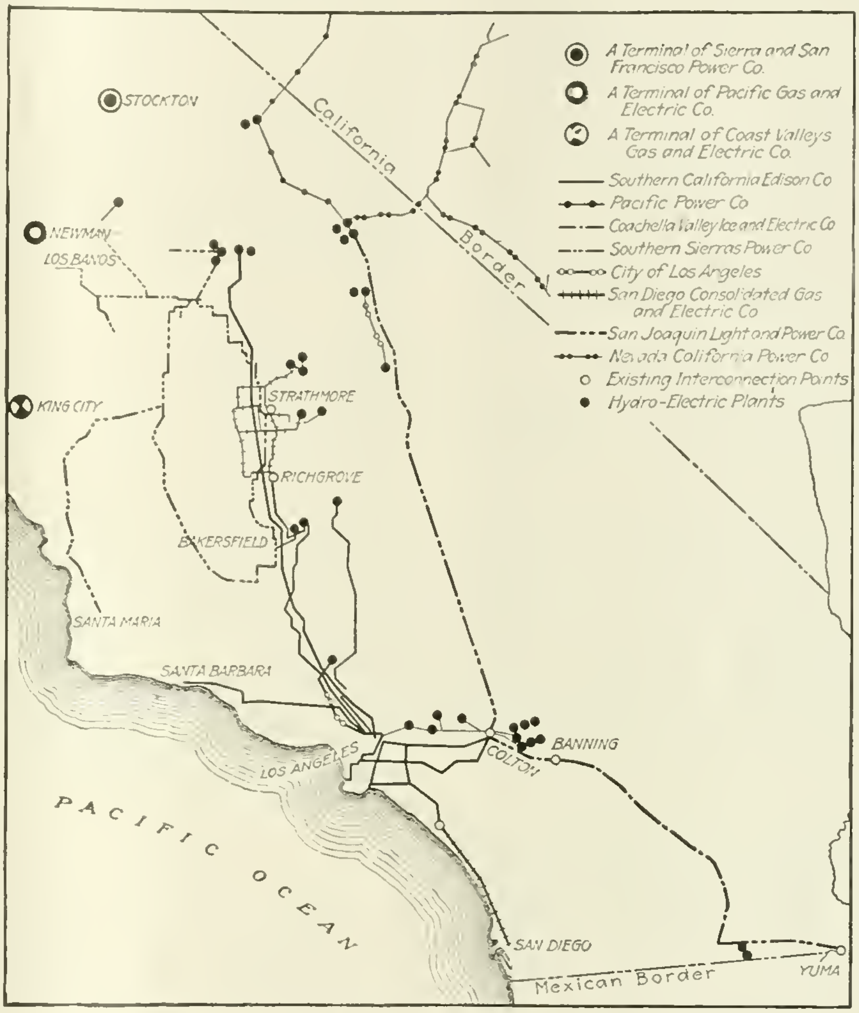
ECONOMIES MADE POSSIBLE BY INTERCONNECTION

At the present time the Southern California Edison Company, city of Los Angeles, Southern Sierras Power Company, San Joaquin Light & Power Corporation and Mount Whitney Power & Electric Company are all interconnected, and the Santa Barbara Gas & Electric Company and San Diego Consolidated Gas & Electric Company interconnections with the Southern California Edison Company are under way.

The interchange of energy between the Southern California Edison Company and the San Joaquin Light & Power Corporation well illustrates the fact that storage capacities become doubly useful when the systems are interconnected. We may conceive of the waters of Kern River that pass through the San Joaquin Company's power house being electrically transmitted to Huntington Lake, the reservoir for the Big Creek plants, 150 miles (241 km.) away, and at the same time conserving many barrels of oil per day while this condition exists. Storage on the Los Angeles Aqueduct system is also used to conserve water that would otherwise be wasted on Kern River between 1 and 6 a.m., the method of operation being to reduce the aqueduct output to a minimum during these hours and supply power from Kern River, an equivalent amount being generated by the Aqueduct plants during the remainder of the day in excess of the normal output so that the daily output remains the same, resulting in the conservation of both water power and oil fuel.

The completion of the transmission line to Santa Barbara will enable the Santa Barbara Gas & Electric Company to get its entire supply of 7,000,000 kw.-hr. over this line, saving the equivalent of at least the difference in economies between the Santa Barbara and Long Beach steam plants, and at certain times of year substituting water for steam power. This is not a clear saving to the companies involved, as maintenance and fixed charges on the transmission line and some difference in steam plant costs other than oil must be deducted before the net economic result is arrived at. Connection with the Southern Sierras Power Company through a 5000-kw. frequency changer at Colton will make possible a reduction in steam production of 20,000,000 kw.-hr. per year.

In a similar manner to the Santa Barbara case, steam load will be transferred from the San Diego Consolidated Gas & Electric Company to the Long Beach steam plant when physical interconnection is made between the two companies, delays in the shipment of frequency changers being responsible for the postponement of this operation. Probably some 25,000,000 kw.-hr. will be furnished annually in this manner, resulting in an approximate saving of 40,000 bbl. of oil annually. Here again the net results upon the companies' balance sheet must include all charges upon the line and frequency changer installation. The city of Los Angeles has some small plants at Owens River Valley which could be connected to the Southern Sierras system, utilizing 10,000,000 kw.-hr. per annum. A direct saving of flood water has been effected by raising the Big Creek dams which increased the storage by 35,000 acre-feet (4300 hectare-m.) The new River plant of the Los Angeles Aqueduct will supply 15,000,000 kw.-hr. annually, and the arrangements that will increase the output of the San Francisquito plant will add 30,000,000 kw.-hr. to the hydroelectric output of 1918.


A Terminal of Sierra and San Francisco Power Co.
A Terminal of Pacific Gas and Electric Co.
A Terminal of Coast Valleys Gas and Electric Co.
Southern California Edison Co
Pacific Power Co
Coachella Valley Ice and Electric Co
Southern Sierras Power Co
City of Los Angeles
San Diego Consolidated Gas and Electric Co
San Joaquin Light and Power Co
Nevada California Power Co
Existing Interconnection Points
Hydro-Electric Plants
STOCKTON
California Border
NEWMAN
LOS BANOS
KING CITY
STRATHMORE
RICHGROVE
BAKERSFIELD
SANTA MARIA
SANTA BARBARA
LOS ANGELES
COLTON
BANNING
PACIFIC OCEAN
SAN DIEGO
Mexican Border
YUMA

ELECTRIC-SERVICE SYSTEMS IN SOUTHERN CALIFORNIA THAT ARE INTERCONNECTED

In addition to these savings which are being effected by interconnection and intelligent load dispatching, there is a possible increase in the use of natural gas, and the San Joaquin company is preparing to utilize 600,000,000 cu.ft. (17,000,000 cu.m.) per annum, one-half of which will be available during 1918 and the whole quantity in 1919. The Southern California Edison Company is also using at Redondo 800,000 cu.ft. (22,600 cu.m.) of gas per day obtained from its own properties in the La Brea field. When all these economies and additions are totaled it is estimated that the fuel-oil consumption will fall from 1,056,000 bbl. in 1917 to 275,000 bbl. in 1918, a reduction of 781,000 bbl. despite the fact that the combined load of the southern California companies will increase from 1,146,000,000 kw.-hr. in 1917 to 1,270,000,000 kw.-hr. in 1918.

AN ECONOMICAL STEAM PLANT

Reference has been made to the transfer of load from smaller steam plants to the Long Beach steam plant. This plant was started in August, 1911, with one 12,000-kw. turbine. So urgent was its need that the main switch was erected in the turbine room supported on packing cases and temporary leads were run out of the window, and before the second unit, a 15,000-kw. machine, could be put into operation in 1913, No. 1 was carrying 14,000 kw. continuously. Not until the third unit of 20,000 kw. was installed in April, 1914, was there any margin for repairs or emergencies. The annual efficiency of this plant has been maintained satisfactorily, being as given in Table I. Probably the greatest sources of inefficiency are poor fuel consumption, low vacuum and turbine blade incrustation or corrosion. In this plant boiler-room economy is enhanced by equipping each boiler with steam flow meter, CO_2 indicator and recorder, draft gage, flue-gas thermometer and superheated-steam thermometer. Their records are carefully checked every day and the operation of the different shifts of firemen compared.

The total feed water to each set of boilers supplying steam to each turbine is separately metered by an indicating and recording Venturi meter. Fuel oil is measured by tank levels every hour, and as all switchboard meters are read every half hour, it is easy to compute the over-all plant economy for every hour of the day, which is done regularly and shown on the same chart which gives the load curve for the day.

In order to locate the cause of possible low vacuum, the circulating water is measured by a Venturi meter. Some special problems had to be met on account of the whole circulating system being under a vacuum, necessitating the placing of the indicating mechanism below the circulating pipes in the basement, and connecting it by fine cable to the recording stand which is on the turbine-room floor.

The actual condition of the turbine blading is judged by the steam rate, so weighing tanks are made a permanent part of the equipment to permit making tests on any turbine without interfering with normal operation.

TABLE I—AVERAGE ANNUAL EFFICIENCY—LONG BEACH STEAM PLANT

Year.....	1912	1913	1914	1915	1916	1917
Units in operetion	No 1	No. 1 11 mo. No. 2	Nos. 1, 2 8 mo. No. 3	Nos. 1, 2, 3	Nos. 1, 2, 3	Nos. 1, 2, 3
Kilowatt-hours generated ..	50,300,069	94,046,697	74,811,625	77,555,811	45,359,582	133,638,173
Bbl. of oil consumed	240,537	439,454	347,007	328,749	218,235	562,153
Kilowatt-hours per barrel....	219	214	215	236	208	237.5

*Kilowatt-hours generated is output of turbines less power consumed by motor-driven auxiliaries.

This equipment has proved its worth and drawn attention to conditions that might otherwise have been difficult to locate so definitely. Once a year, when load conditions permit, a turbine side is removed to permit examination of the blades.

Since the three turbines have different steam consumption characteristics a graphic chart has been prepared which shows at a glance how much load each should carry for any total station load. Each turbine and its boilers are laid out for unit operation, but on account of the greater efficiency of the No. 3 set of boilers, which are equipped with economizers, cross-over connections enable the No. 3 boilers to furnish steam to any turbine and permit of the return of the condensate.

Checks on Operating Economy

In addition to such checks upon operation as are regularly applied by the local combustion engineer, the kilowatt-hours output and fuel consumed by each unit are telephoned to the load dispatcher each night, and the superintendent has the figures early the next morning for the previous day's operation.

Output and fuel are plotted, not as kilowatt-hours per barrel, but against each other, and for normal operation fall on a straight line. Any material departure from the line is evidence that something is wrong, and the cause is immediately investigated. The expression of kilowatt-hours per barrel is worthless as a criterion of efficiency because the load factor is a determining quantity. As a matter of fact, an efficiency of 150 kw.-hr. per barrel on a Sunday might be better operation than 250 kw.-hr. per barrel on a Tuesday. This same method is applied to monthly and yearly operation, and it is remarkable how uniformly the points fall on the line, provided no changes are made in equipment and so long as no deterioration of apparatus or operation occurs.

Poor operation might increase the fuel consumption by 5 per cent and for the year 1917 this would have amounted to 28,100 barrels of oil. While this is a considerable quantity of oil, representing many dollars, yet this and the various oil savings previously enumerated are small compared to what the increases in oil consumption would amount to in the future by reason of the growth of the business, and they would probably be absorbed by 1920 unless provision were made for relief.

The estimated oil requirements for southern California power companies after making the interconnection economies are shown in Table II.

TABLE II—ESTIMATED OIL REQUIREMENTS AFTER INTERCONNECTION*

Year...	1917	1918	1919	1920
Barrels oil.	1,056,000	275,000	735,000	1,510,000

*Partial interconnection occurred between 1917 and 1918.

Relief is thus imperative, and the obvious course to pursue is to develop more water power. The projects which can be most quickly developed or extended and the kilowatt-hours obtainable are indicated in the tabulation which follows:

	Kw.-Hr.
Los Angeles Aqueduct	105,000,000
Edison Company, Kern River No. 3	180,000,000
Edison Company, Pitman Creek	32,000,000
Edison Company, new reservoir on Big Creek and one additional generating unit	96,000,000

These increases could not all be wholly obtained for the year 1919, nor is this necessary, but by a progressive development which would be largely determined by the deliveries of machinery obtainable, the fuel consumption in the years 1919 and 1920 might be reduced to a small quantity for stand-by purposes and might even be eliminated.

The expenditures necessary to provide for the hydroelectric program of the Southern California Edison Company, as detailed herein, total $11,000,000 and this development and outlay has been sanctioned by the State Railroad Commission.

If the miners will keep [weekly] production over 13,000,000 tons from this time on, we will win the fight. The week's record [13,243,000 tons of bituminous coal in the week ended July 13] was a big tribute to what America can do when faced by a crisis. It is the final blow at Germany. We are fighting to give the shipyards, the airplane plants, the munition plants and every arm of the government which is dealing Germany blow upon blow enough fuel to keep them going at top speed. And with the aid of the miners we can accomplish that task. I ask only that they keep it up and I will fight with them with everything there is in me. Germany is beaten, and nothing can drive that message home to the followers of the Kaiser more surely than the knowledge that our industries will not be balked by the lack of fuel. We will win this fight.—*Dr. H. A. Garfield, Federal Fuel Administrator.*

Analysis of Electric Cooking Situation

Central Station with Largest Number of Range Customers on Its Lines Possessed by Any Company in the United States Gets Satisfactory Results from Investigation Along These Lines

BY S. M. KENNEDY
General Agent Southern California Edison Company, Los Angeles, Cal.

THE Southern California Edison Company, which by the way has more electric ranges on its lines by over 1000 than any other central station in the United States, sold over 3000 electric ranges in the period of two and one-half years ended May 1, 1918, an average of a hundred ranges per month. Owing to the changed conditions on account of the war it became necessary to analyze closely all classes of business development and to discontinue any that might be termed experimental or unprofitable. With this in mind a canvass was made of the electric cooking situation and the value of the load.

The company's system is divided into twenty-four geographical districts, each district being a complete unit in itself in so far as local operations are concerned. The company maintains fifty district and sub-offices, so that its consumers may be conveniently and efficiently served in all parts of the country covered by distribution lines.

The electric cooking development has been carried on in each of the twenty-four districts, and the number of electric ranges installed varies from twenty as the minimum number to 333 as the maximum number in any district. In twelve districts there are fewer than 100 electric ranges in each; six districts have between 100 and 200 ranges in each. Five districts have between 200 and 300 ranges in each, and one district has in excess of 300 ranges. This indicates a large distribution of ranges over a wide territory and the supplying of service under many and varying conditions.

RESULTS OF QUESTIONNAIRE

Recently a list of questions was sent to each district agent regarding electric range installations and service, and the replies received have been considered eminently satisfactory to the company. The questions and the substance of the answers that were received are as follows:

1. "How many electric ranges are now in use in your district?" The replies varied from 20 to 333, the total amounting to 3040.

2. "What percentage of consumers using electric ranges in your district are satisfied with the service? This, of course, means the utility of the range and the size of the bills." The replies indicated that over 95 per cent of electric range consumers are satisfied.

3. "As a result of your experience, what do you consider are the strong points in the use of the electric range—that is, what commends the electric range to consumers?" Replies mentioned the following points, given in the order of importance: Cleanliness, convenience and ease of operation, absence of heat in summer, safety, saving of food and retention of flavor, automatic feature, no smoke, cost of operation, hygiene, accuracy.

4. "What do you consider are the weak points in the use of the electric range—that is, what features are a trouble or annoyance to consumers?" Replies, given in order of importance: Burn-outs of elements, burn-outs of fuses, slow top-burner heating, bricks cracking, broken switches, discoloration of oven linings, replacements too slow, unreliable thermostats, leaky oven doors.

5. "Are the electric ranges now installed in your district doing good advertising work for electric cooking, and are they influencing the sales of other ranges?" The replies clearly indicated that the ranges now installed were the best advertisers and the ablest salesmen the company had. Many range sales were made without solicitation, being entirely influenced by the praises of neighbors.

6. "Have you any suggestions to make which might tend to improve the utility of the electric range?" The suggestions were numerous, and those from different parts of the system were remarkably similar. Some of these were: More heat in at least one top burner, plenty of replacements on hand, non-rusting ovens, extra simmering burner, pilot light, units more rugged and reliable, steam vents.

Of the total number of electric ranges sold on the Edison system, only 155, or about 5 per cent, are installed in apartment houses. Experience has demonstrated that, while the apartment-house load can be satisfactorily handled, it causes the company probably four times as many troubles per range in use as do installations in private houses. Apparently the average tenant in an apartment house does not take so much interest in keeping the range in good order as does the owner of a private house. Further, the apartment-house occupants frequently come and go, and as a rule they do not study electric cooking sufficiently to get the best results. Consequently the troubleman and the demonstrator must make frequent visits to apartment-house installations.

The reports concerning the operation of 3000 electric ranges on its system have demonstrated to the Southern California Edison Company that (a) the electric cooking load is a desirable load if the rates for service are equitable; (b) the electric range is satisfactory to its consumers, and (c) electric cooking service is along the lines of conservation of both food and fuel.

The company has been slow to consider any reduction in rate for cooking service from the schedule put into effect two and one-half years ago. The schedule for private houses, a combination one, supplying lighting and cooking service through one meter, is as follows:

Primary Charge—Houses of five rooms or less, first 20 kw.-hr. per month, 7 cents per kilowatt-hour; houses of six and seven rooms, first 30 kw.-hr. per month, 7 cents per kilowatt-hour; houses of eight rooms and over, first 40 kw.-hr. per month, 7 cents per kilowatt-hour.

Secondary Charge—All energy used in excess of first block (lighting requirements), 3½ cents per kilowatt-hour.

When an electric water heater is installed along with an electric range, a rate of 2 cents per kilowatt-hour is made for all energy used in excess of 100 kw.-hr. required for cooking purposes. The company has about 700 of such combination range and water-heater installations.

While rates considerably lower than the foregoing have been put into effect by some companies having fairly large cooking loads, the Edison company has not considered any lower schedule justifiable for this service. There is an additional capital investment represented in each installation. There are additional troubles in handling the service, and expert demonstrators must be maintained to educate purchasers how to cook electrically and do it efficiently and economically. All this means extra expense, which must be fully covered by the revenue obtained from the service.

The average annual bill for electric cooking on the Edison system is around $45, and for combination cooking and water heating the average is $75. The question of cost of operation and the fear of high bills does not figure nearly as much now as when electric cooking was less known. The prospective expense is by no means overlooked by new consumers, but most of them know what it is actually costing some friend or neighbor. Then again the knowledge of the compensating advantages of electric cooking is spreading. Gas may be a cheaper means of lighting than electricity, yet in most localities the public insists on electric lighting where it is available. There are strong indications that the same preference will be developed for electric cooking.

Under normal conditions the Southern California Edison Company would have sold 2000 electric ranges in 1918 and could have accomplished this task more easily than it could sell 500 ranges two years ago. But these are abnormal times, and certain restrictions have been imposed which must keep sales down to a minimum. The difficulty in financing expenditures and the increased cost and scarcity of materials and labor must be considered as determining factors in deciding the amount of electric cooking load which may be added. Consequently, the company is not seeking additions, but rather is endeavoring to take care of only such business as may be offered. Satisfactory progress has been made in building up a cooking load on the company's system, and under more favorable conditions every reasonable effort would be made to increase the load as rapidly as possible. Until conditions change the business already connected will be nursed and cultivated so that when the right time arrives there will probably be an insistent demand for electric ranges resulting from the advertising done by present installations.

In the light of the President's proclamation appearing in the press on April 16, 1917, the work of the American power companies takes on the significance of national service. Recognized as an important part of what the President has termed "a great national, a great international service army" because of their close and necessary relationship to the industrial forces of the country, the power companies to-day stand ready to perform whatever may be required of them in the service of the nation. It is because of this that service in the power companies takes on the significance of national service.—*Joseph B. McCall, President Philadelphia Electric Company.*

ELECTRICAL DEVELOPMENTS IN THE CENTRAL EMPIRES

Concessions for Water Power Given for a Period of Sixty Years and Provision Is Made for Government Ownership

A recent issue of the British *Board of Trade Journal* contains a survey of German and Austrian plans for the reorganization of the central-station supply of electricity. Various proposals have been drawn up for an imperial monopoly or some form of central control, but the individual states have been too jealous of the imperial power to support them. So far as progress has been made it is due to the independent action of the states.

Württemberg is planning a consolidation of central stations, the state participating in the administration. In Saxony the state decided to carry out consolidation by means of state central station, the directorate to form a part of the Ministry of Finance and the work to be carried out under the supervision of a national electrical council on which technical experts and representatives of large consumers are to sit. Bavaria shows private enterprise in a more active form. The Deutsche Bank and the Allgemeine Elektrizitäts Gesellschaft have prepared plans for the development immediately after the war of Bavarian water power at a cost of about $30,000,000.

A bill was introduced toward the end of last year in Prussia enabling the government to take over the generating stations and main transmission lines, leaving the distribution lines in the hands of municipal and private enterprises. Provincial and district committees are suggested for the purpose of preparing and carrying out systematic schemes.

The Austrian government has drafted a bill for remedying the backward state of electrical enterprise, particularly with regard to the use of water power. The object aimed at is to secure a uniform and economical supply of electricity, and with this in view all future concessions will be controlled. Public and semi-public undertakings will be able to obtain concessions for a period of ninety years; companies will be limited to sixty years. Provision is made for financial aid by the state, for the supervision of rates and for state participation in the profits where state privileges are granted. Companies will be allowed to keep their profits up to 6 per cent on the capital; between 6 and 10 per cent the state will take one-third of the profits, and ov 10 per cent it will take half. Provision is also m for state purchase on the "then value" at the end twenty-five years and every five years afterward undertakings using public waters or state sources of energy.

Books Received

Above the Battle. By Captain Vivian Drake. New York: D. Appleton & Company, 322 pages. Price, $1.50 net.

1918 McGraw List of Electrical Supply Dealers, Contractors and Jobbers. New York: McGraw-Hill Company, Inc. Price, $10.

The Financing of Public Service Corporations. By Milton B. Ignatius. New York: Ronald Press Company. 508 pages. Price, $5.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

PAVING OF A STREET CAUSES CABLE TROUBLE

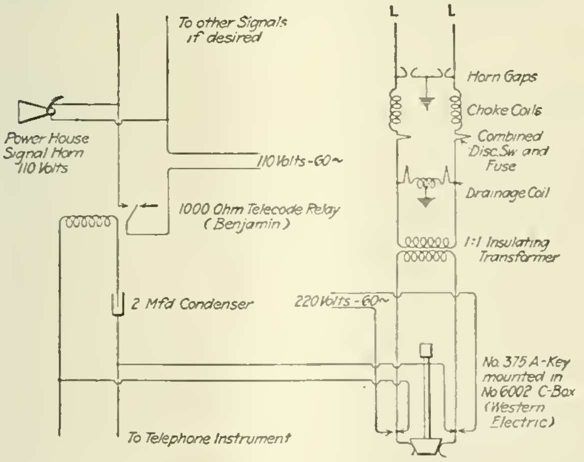
Radiation of Heat Is Reduced by Placing Pavement Over Duct Line and New Ducts Are Made Necessary

On a thirty-six-duct line from its generating station a Central States utility company had no trouble until the street under which the conduit was laid was paved. The pavement so far reduced radiation from the conduit that the circuit loading had to be appreciably reduced. On account of this enforced reduction in loading it soon became necessary to build a new duct line, this being placed under the sidewalk. This sort of construction was found to cost less and the radiation was more satisfactory because of dampness near the buildings.

MEANS FOR PREVENTING INDUCTIVE INTERFERENCE

Overcoming Inductive Interference and Signaling Troubles on Telephone Line on Same Poles with 40,000-Volt High-Tension Circuit

On its 35-mile (56-km.) private telephone line, the Otter Tail Power Company of Fergus Falls, Minn., is using the scheme of connections shown in the accompanying sketch to eliminate inductive interference from a 40,000-volt transmission circuit which is strung on the same pole line and only 5 ft. (1.5 m.) above the telephone wires.


To other Signals if desired
L
L
Horn Gaps
Choke Coils
Combined Disc.Sw. and Fuse
Drainage Coil
Power House Signal Horn 110 Volts
110 Volts-60~
1000 Ohm Telecode Relay (Benjamin)
1:1 Insulating Transformer
2 Mfd Condenser
220 Volts-60~
No. 375 A-Key mounted in No 6002 C-Box (Western Electric)
To Telephone Instrument

CONNECTIONS WHERE TELEPHONE AND 40,000-VOLT CIRCUITS ARE ON SAME POLES

The trouble was remedied to a large extent by the use of drainage coils, with telephone transpositions every four poles, but the feature of the scheme is the use of a No. 375-A Western Electric key through which the signaling current is supplied from a 220-volt, 60-cycle source. Previously the company had considerable trouble in transmitting sufficient energy over the telephone circuit from the hand generator to give distinct signals in a noisy power house at the distant end of the line. It will be observed that the signaling key now cuts out the local telephone apparatus.

To pick up the signals the company has installed at each station a 1000-ohm Benjamin "Telecode" relay with a 2-mfd. condenser in series with it. This relay in turn closes a 110-volt, 60-cycle circuit operating the 110-volt signal horns. As many signals may be connected in the 110-volt circuit as desired.

In commenting upon the success of this scheme, A. V. Taylor, electrical engineer of the company, said that "while this key is not built especially for 220-volt service, we have had only one case of trouble which has developed from the installation of these keys."

OPINION ON HIGH-TENSION SWITCHING AND PROTECTION

Methods and Practices to Be Followed and Apparatus to Be Selected for Outdoor Substations Discussed by Ohio Operating Men

Switching and overload protection on systems operating at 22,000 volts or less are generally accomplished by means of automatic oil switches and current transformers in larger installations. But in smaller ones air-break disconnecting switches are many times employed because of their lower cost. The air-break switch may be arranged for either direct or remote control, hand or motor operation. It is often employed in disconnecting oil switches and transformers from live lines and in emergencies may be used to disconnect a load from the lines. However, it is not advisable to disconnect heavy loads or long transmissions lines with heavy charging current, say a number of Ohio operating men, because of the difficulty of extinguishing the arc produced by opening the blades of the switch. The air-break switch has been used to advantage on short lines or light loads.

There are two methods of breaking the arc with this type switch, (1) horizontal break and (2) the vertical break. The vertical-break switch requires less space; it breaks the arc more naturally than the horizontal break. The horizontal break requires a wider separation. This in turn requires a larger supporting structure and therefore a greater initial expense.

The overload protection obtained by the use of automatic oil switch and current transformers is no doubt the best form of protection available, and it is essential in the larger systems. On smaller systems this expense is not permitted so the fuse has been developed. Fuse protection is not very satisfactory, however, in that most fuses already developed have some detrimental characteristics. The expulsion-type fuse, using a fiber tube, carbonizes after continued use, thus offering a path for the flow of current which in turn causes the complete destruction of the holder.

With the horn-gap fuse, which is made up of two horns bent into a "V" shape with a gap bridged by a piece of fuse wire, a surge is set up with each overload which is severe on all apparatus. This type of fuse requires large spacing to prevent jumping between phases or to ground. The principal advantage is its low initial cost and the relatively low expense of fuse renewals.

The carbon tetrachloride fuse readily destroys the arc developed by the fuse section blowing, but its ampere capacity is rather small, being about the same as that of the expulsion fuse. The disadvantage of this type of fuse is the high cost of renewal.

With these opinions and recommendations, which were presented to the Ohio Electric Light Association by the transmission and distribution committees, Fred Alsaker, of the Delta Star Electric Company, took issue in part, saying: "The carbon tetrachloride fuse will open a circuit in 0.013 second as against 0.16 second with a modern circuit-breaker. This prevents destructive energy from reaching apparatus. To get action identical with circuit-breaker protection as regards speed, a fuse rated at twelve times the full-load capacity of the circuit can be used. This will of course reduce renewal expense. When this plan is used, circuit breakers should be employed on the low-tension side of transformers. Carbon tetrachloride fuses are made in standard sizes up to 200 amp. and in special sizes to any rating."

SAFETY FOR LINEMEN

Practical Rules for Protection of Men Working with or Near High-Tension Transmission Conductors

A well-defined set of rules should be adopted by companies whose employees have to deal with circuits or apparatus operating at hazardous voltages. The load dispatcher or system operator should first see that a line to be worked on is opened, short-circuited, grounded and tagged before permitting any one to approach the work. Before climbing a pole a lineman should test it to see if it is substantial. Decay at the center of the pole may be determined by rapping it with a tool.

Great care must be exercised by workmen in getting through the wires, whether alive or not. It is advisable to assume a position from which one would fall clear of wires in case of accident. Insulated wires should be treated as bare and all conductors considered alive until they are known to be dead.

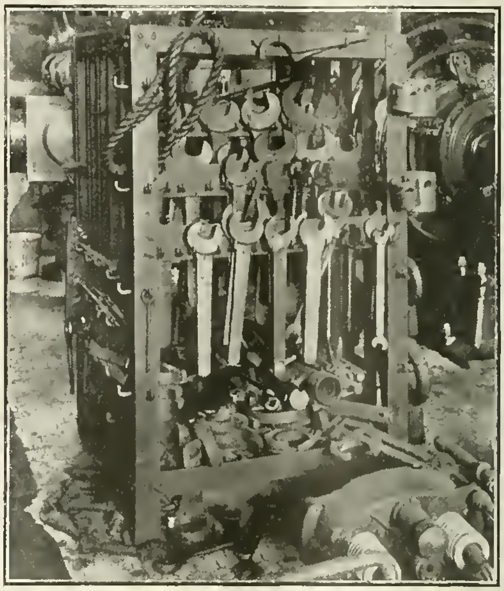
Especial attention should be given to the care and use of rubber gloves, for a very slight flaw may render them useless and consequently dangerous. Thus a lineman should never climb a pole with rubber gloves exposed to splinters. Some companies have their men wear three pairs of gloves for live work as follows: first light fabric gloves under the rubber gloves to protect the latter from finger nails, then leather gauntlet gloves over all for protection from without. This combination is said to be flexible and suitable for winter service.

These suggestions were given in a house organ published by the Consumers' Power Company of Michigan.

CONVENIENT TOOL CABINET

May Be Transferred from One Job to Another by Traveling Crane—Used by Connecticut Company

A convenient wrench cabinet in use at the Dutch Point plant of the Hartford (Conn.) Electric Light Company is illustrated herewith. The cabinet consists of a frame about 5 ft. (1.52 m.) high, 3 ft. (0.91 m.) wide and 3 ft. (0.91 m.) long, assembled from bolted angle-irons and provided with numerous hooks and cross-pieces accommodating any size of wrench desired. By installing the cross-pieces at three different heights front and back, in the step-up arrangement shown, the convenience of the cabinet is much increased. To a diagonal member across the top a hook is attached, permitting handling by the traveling crane, so that the wrenches, bolts, tools, etc., carried can be quickly concentrated at any particular job within the station. The lower part of the rack is arranged as a table for holding the lighter or more miscellaneous equipment shown. F. Wilbraham is chief engineer.



CABINET FOR POWER PLANT TOOLS

The main members are 3 in. by 3 in. by ¼ in. (7.6 cm. by 7.6 cm. by 0.63 cm.) in section and the intermediate or stiffening members are 2-in. by 2-in. (5.08-cm. by 5.08-cm.) angles of the same thickness.

RECLAIMING BOILER TUBES

Instead of Being Replaced, Leaking and Bagged Tubes Are Repaired with Oxy-Acetylene Torch

As many as fourteen welds have been made on one boiler tube before it was necessary to discard it. The method consists in slowly heating the bag to a bright cherry red with an oxy-acetylene torch and hammering the bag into shape, beginning at the outer edges and working toward the center. Sections of tubes are also welded on straight boiler tubes, thereby reclaiming the old tubes. The cost of welding is approximately 75 cents per single weld, including all labor, material and cost of setting up the apparatus. When several welds are made in one boiler the unit cost per weld is greatly reduced. It is also reported that crystallized boiler tubes are successfully annealed by heating to a bright cherry red, allowing them to cool, and rerolling. A hammer test then shows that they are as soft as new tubes. This work was reported by William Long, superintendent of production, Toledo Railways & Light Company.

ADVANTAGES OF WOOD DUCT FOR UNDERGROUND SYSTEMS

Dielectric Qualities Found Adequate for Local Distribution Systems—Does Not Break So Easily as Fiber Duct

BY R. A. PAINE, JR.
General Foreman Detail and Record, Edison Electric Illuminating Company of Brooklyn

Although the dielectric qualities of wood duct are not so good as those of fiber duct, extensive testing has shown that they are sufficient for the requirements of low-voltage 115-230 volt distribution mains and services. Low installation and maintenance costs are obtained by the use of wood duct. The cost per unit length is only slightly greater than that of fiber and tile, and it requires no concrete envelope.

In the following tabulations of tests, creosoted wood duct, which is used by the telephone company, was adopted. Its inside diameter is 3⅛ in. (7.9 cm.), and it is 4½ in. (11.4 cm.) square on the outside.

BREAKDOWN TESTS

An alternating-current breakdown voltage test was made on four pieces of wood duct and four pieces of fiber duct in order to show the comparative insulating value of wood and fiber duct. Pieces No. 1 were sealed at one end, filled with water and allowed to stand forty-eight hours. Pieces No. 2 were sealed at one end, placed in a barrel of water, keeping the inside duct dry, and allowed to stand forty-eight hours. Pieces No. 3 were placed in a barrel of water, allowing inside and outside of duct to be in contact with water for forty-eight hours. Pieces No. 4 were taken from stock.

Three test sections were taken from each piece, using tinfoil electrodes and increasing the voltage by steps of 500 volts after each minute, and the following average breakdown values were obtained:

	Piece No. 1	Piece No. 2	Piece No. 3	Piece No. 4
Fiber duct	9,300	8,700	4,300	*
Wood duct.	1,000	1,000	800	2,200

*Piece No. 4 of the fiber duct withstood 11,500 volts for five minutes.

RESISTANCE TO SHORT CIRCUIT

The resistance of wood duct to arcs as compared with fiber was determined by the following tests: To determine what the results would be if a short circuit occurred on distributing mains in the duct, three legs of 150,000-circ.mil R. & L. cable were placed in fiber duct and punctured so that they would short-circuit. A slow-burning short resulted, when they were connected to the source of energy, which burned three holes in the bottom of the duct, the fiber bursting into flame. This flame would probably have consumed the whole piece of duct, but it burned so fiercely that it had to be extinguished.

For the same experiments with wood three lengths of the duct that had been soaked in water for five days and two stock lengths were tested. Three legs of 150,000-circ.mil R. & L. cable were placed in the ducts and punctured so that they would short-circuit. A very high temperature was generated in the ducts when they were connected to the mains, and this was allowed to increase until the cables burned in half and cleared themselves. This operation was repeated four times, twice over the joint and twice in the middle of the length on both the water-soaked and the dry duct. From the water-soaked duct a relatively small amount of thick black smoke or gas was generated at each short. This smoke or gas did not seem to be combustible, and the duct was in very nearly perfect condition after the test. A very large amount of greenish white smoke was liberated at each short in the dry duct. One short burned for five minutes, destroyed two cables and filled up the bottom of the duct with molten copper and lead. After this short the duct smoldered near the joint, liberating a large amount of smoke.

It was shown that the wooden duct was better than fiber in case of a short circuit occurring in the conduit, because the latter may easily be entirely destroyed. The durability of wooden duct is apparent from the extensive use and experience which telephone companies have had with it.

ESTIMATED SAVING EFFECTED BY USE OF SOOT CLEANER

Tons of Coal Saved per Foot of Pipe Gives Basis for Soot-Cleaner Calculations—Labor Saved Is Considerable

According to a soot-cleaner manufacturer, approximately 18.3 tons of coal is saved by each foot of pipe during the lifetime of the cleaner. In addition, it is said that each foot of pipe eliminates one man's labor each day which is usually required to blow the pipes with steam. Since the average water-tube boiler requires about 200 ft. (61 m.) of pipe, it is not difficult to compute the total money saved or the money saved by the reduction of labor cost alone on the above basis. If it is assumed that boiler-room labor can be secured at $2 per day, the labor saving with the average cleaner is $400 for the lifetime of the cleaner. As for coal saving, if we assume the price of coal to be $4 per ton and 200 ft. of pipe per cleaner, the money saving for the lifetime of the cleaner will be about $14,600. This amount added to the labor saving makes the total $15,000.

Although these figures vary with labor and coal cost, they can easily be adjusted to suit any conditions. The estimates are made for boilers operated at 140 per cent rating with an average coal consumption of 4 lb. (1.8 kg.) per boiler-horsepower per hour, boilers operating twenty-four hours per day and 325 days per year. The further assumption that the life of a cleaner is seven years is verified by the experience of the United Electric Light & Power Company, New York City, which installed soot cleaners on thirty-two boilers five years ago, the cleaners having shown only slight signs of wear. Moreover, cleaners now made have a much higher safety factor than those installed five years ago because of the cast-iron-sheathed elements with which they are now equipped.

The above information is given by the Vulcan Soot Cleaner Company of Dubois, Pa.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

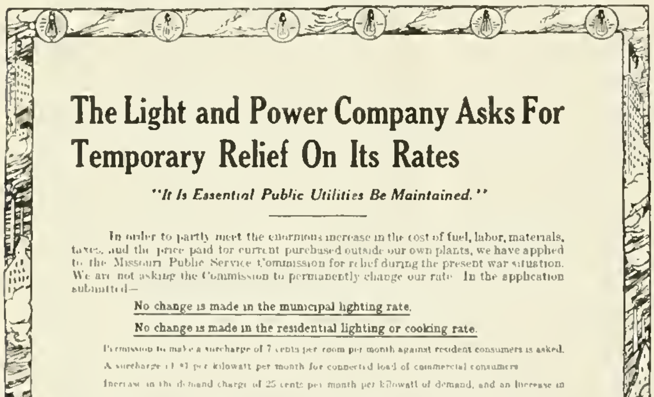
ADVERTISING TO PRECEDE ANY INCREASE IN RATES

Publicity Plan Used by Kansas City Company to Acquaint Public with Situation Which Made It Necessary to Ask for More Revenue

Even in states where rates are regulated by commissions it has been found good policy to precede applications for increased rates by publicity programs designed to set forth the company's point of view. In such a case the job of preparing the "rate-increase copy" consists briefly of planning an advertising campaign that will "sell" to the public the idea that the company must have more revenue in order to live. Therefore the medium to be used must be chosen, the topics selected concerning which the public will be addressed, and these appeals intelligently written.

How this problem was solved by A. B. Atchley, manager of publicity for the Kansas City (Mo.) Light & Power Company, is told in the following. He chose to use newspapers exclusively, but he did not use all the newspapers in town. He selected one so-called high-class paper to reach the biggest business men and one other paper to reach the great mass of the people. One was a morning and one an evening paper. He placed no advertising in one of the city's greatest papers because of its manifestly unfair criticism of the utility. The space purchased for the series of ten advertisements measured about 9 in. wide by 10 in. high for each insertion.

All of the advertisements were woven about a few fundamental ideas. These may be enumerated as follows: (1) The essential character of public utilities; (2) the increased cost of commodities entering into public utility service; (3) the inadequacy of present revenues; (4) the reasonableness of the amount of the increase asked by the company. The first advertisements (see ELECTRICAL WORLD, June 8, page 1227) told concisely why the company needed more revenue and told what it was and was not asking for. Several issues dwelt in detail on the increased cost of labor and material and the higher operating costs of utilities. Another recounted how 150 of Kansas City's industries essential to war were dependent on public utility power. Another listed by states the cities of about the same size as Kansas City where increases in rates have already been granted. Another invited investigation of its records by the engineers of the commission. Still another explained the decreased purchasing value of the dollar. A feature of each advertisement was the quoted phrase near the top of the page, "It is essential public utilities be maintained." The percentages by which common commodities like coal and copper entering into electrical production have increased were included.



The Light and Power Company Asks For Temporary Relief On Its Rates

"It Is Essential Public Utilities Be Maintained."

In order to partly meet the enormous increase in the cost of fuel, labor, materials, taxes, and the price paid for current purchased outside our own plants, we have applied to the Missouri Public Service Commission for relief during the present war situation. We are not asking the Commission to permanently change our rate. In the application submitted—

No change is made in the municipal lighting rate.

No change is made in the residential lighting or cooking rate.

Permission to make a surcharge of 7 cents per room per month against resident consumers is asked.

A surcharge of $1 per kilowatt per month for connected load of commercial consumers.

Increase in the demand charge of 25 cents per month per kilowatt of demand, and an increase in the energy charge of one-half of one cent per kilowatt hour on power consumer rates.

These are all the changes asked for in the petition for temporary relief.

Since the present rate was established the current purchased outside our own plants has been increased $400,000 annually on the present coal basis. Taxes have increased 53½ per cent, materials 30 per cent, labor 46½ per cent, fuel 57¼ per cent.

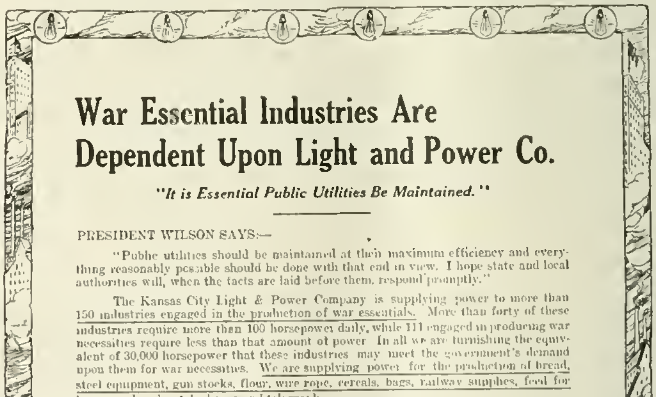
We are facing a deficit during 1918 of approximately $800,000. Unless relief is given it will be impossible to meet the operating expense during the next twelve months, there being a deficit since the present rate was established in May, 1917, of at least $300,000.

The Public Service Commission is asked to make a complete investigation into the books of the Company. We are only asking for relief to tide us over present war conditions. It is not a question of dividend paying. All the facts will be made public. Realizing that our present conditions are only temporary, we are not asking for material changes in our present rates, but only for special revenue to meet the exigencies of the situation. No good Kansas Cityan wants to see this utility or any other concern operate at a loss.

The cost of operation must be met.

The Kansas City Light & Power Co.

Percentage Increase
Copper . . . 144
Supplies 65
Fuel 57
Taxes 53½
Iron 51
Wages 45



War Essential Industries Are Dependent Upon Light and Power Co.

"It is Essential Public Utilities Be Maintained."

PRESIDENT WILSON SAYS:—

"Public utilities should be maintained at their maximum efficiency and everything reasonably possible should be done with that end in view. I hope state and local authorities will, when the facts are laid before them, respond promptly."

The Kansas City Light & Power Company is supplying power to more than 150 industries engaged in the production of war essentials. More than forty of these industries require more than 100 horsepower daily, while 111 engaged in producing war necessities require less than that amount of power. In all we are furnishing the equivalent of 30,000 horsepower that these industries may meet the government's demand upon them for war necessities. We are supplying power for the production of bread, steel equipment, gun stocks, flour, wire rope, cereals, bags, railway supplies, feed for horses and mules, telephones and telegraph.

It was of such public utilities as this one that President Wilson spoke when he said they must be maintained at their maximum efficiency.

This power is being furnished at less than cost. We are monthly piling up a deficit. In the last twelve months this deficit has reached $300,000, which, with an added current cost, based on present coal prices, of $400,000, and an additional heating loss of $100,000, will make our deficit fully $800,000 for 1918.

This condition cannot continue indefinitely. We must have immediate relief to keep going. The present costs cannot be met from the present revenues.

We have appealed to the Public Service Commission to carry out the expressed desire of President Wilson to protect essential public utilities. The relief we ask is not excessive and will only partly relieve our situation. It is temporary—not permanent.

The Kansas City Light & Power Co.

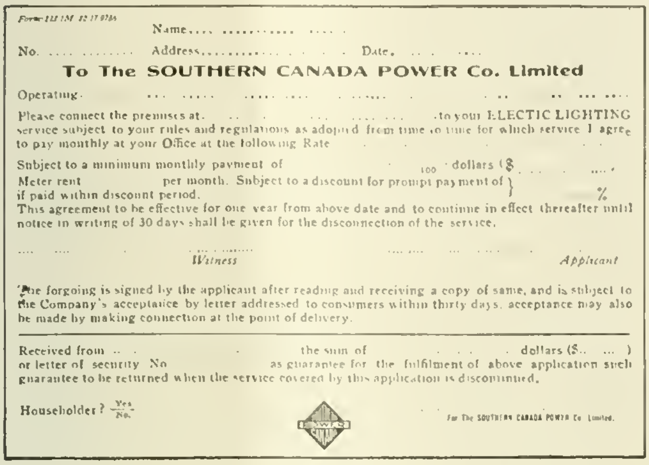
ENLIGHTENING THE PUBLIC IN ADVANCE WHEN RATE INCREASES ARE NECESSARY

CARD CONTRACT COVERING LIGHT AND POWER SERVICE

Canadian Company Uses Form Containing No Regulations, Thereby Simplifying Filing and Attracting the Customer

A simple form of card contract is being used by the Southern Canada Power Company, Ltd., Montreal, Que. The card measures 8 in. by 5 in., and on the reverse side it has the same contract except that it is in the French language, because of the large French population.

The average contract used by light and power companies is crowded with numerous regulations legally phrased and which not infrequently serve to frighten the prospective customer, especially if he be a householder. In addition, as has frequently been shown, such contracts do not lend themselves readily to convenient filing. With this Canadian company the regulations are kept on file and are available whenever required, while the card, satisfying all practical purposes, is filed with others of its kind.


Form [illegible]

Name.......

No. .... Address.......... Date. ....

To The SOUTHERN CANADA POWER Co. Limited

Operating ....

Please connect the premises at .... to your ELECTIC LIGHTING service subject to your rules and regulations as adopted from time to time for which service I agree to pay monthly at your Office at the following Rate

Subject to a minimum monthly payment of .... 100 dollars ($........)
Meter rent .... per month. Subject to a discount for prompt payment of } .... %
if paid within discount period.
This agreement to be effective for one year from above date and to continue in effect thereafter until notice in writing of 30 days shall be given for the disconnection of the service.

.... *Witness* .... *Applicant*

The forgoing is signed by the applicant after reading and receiving a copy of same, and is subject to the Company's acceptance by letter addressed to consumers within thirty days, acceptance may also be made by making connection at the point of delivery.

Received from .... the sum of .... dollars ($........) or letter of security No .... as guarantee for the fulfilment of above application such guarantee to be returned when the service covered by this application is discontinued.

Householder? Yes / No.

For The SOUTHERN CANADA POWER Co. Limited.

CARD CONTRACT USED BY MONTREAL COMPANY

The card when filed constitutes an option on the customer's business for a period of thirty days. Besides, it acts as a deposit form. A copy is retained by the customer.

IDEAS ON THE TRAINING OF ILLUMINATION SALESMEN

Individual Company Courses Recommended in Which Employees Shall Be Given Instruction in the Principles of Illumination

After outlining his ideas on the essential qualifications that lighting salesmen should have, Charles A. Luther of the People's Gas, Light & Coke Company, Chicago, speaking before a recent meeting of the Chicago Section, Illuminating Engineering Society, gave a summary of the assistance which companies can render men who are in training to sell illumination. Mr. Luther's program of training follows:

The employer can very materially help his salesmen in becoming proficient in their specializing on lighting by holding regular classes or meetings at least once a week where the men can be shown by actual experiments and demonstrations just what effects and results can be secured from the various types of units and diffusing equipments, including not only the ones they are handling but also those handled by their competitors. At these meetings everything new pertaining to illumination, whether it be in the nature of a type of unit or a description of some installation published in a house organ or trade periodical, can be discussed, and the relative merits or disadvantages can be brought out in such a logical way that they will be stamped indelibly upon the minds of the salesmen and can be brought out forcibly at the opportune moment when required to turn an order in his favor.

The employer can compile a course in illumination, covering the fundamental principles of artificial illumination, which can be divided into sections, and each section can have from ten to twenty questions covering the most important features of each section. The salesmen should be required to answer these questions, after which their answers can be checked.

A large blackboard should be used to lay out in detail various plans of stores, factories, etc., on which the men should be required to plan the lighting equipment, specifying the type of units to be used, as well as their spacing, their height above the working plane or floors, the cost of installation, the rental per month and the cost of operation after they are installed.

At one of the meetings the men can be notified that at a future meeting the manager will call on two men to hold a debate on the relative merits of their equipment and their competitors'. The rest of the men should be required to criticise any blunders or omissions that either of the men makes, and as the men should not know till the meeting night who will be called on they will naturally keep themselves primed.

COAL CHARGE BRINGS HIGHER UNIT REVENUE

Nevertheless, Central Station in New England Found that It Had to Bear Part of the Additional Burden of Coal Cost

An instance of increased unit revenue resulting from the application of a coal charge is afforded by a street railway's transactions with a central station situated on tidewater in eastern New England. The power contract between the two concerns is based upon a price of coal not exceeding on an average $4 per ton delivered at the wharf. Should the average price be in excess of $4 per ton, then the railway company pays the power company at the end of each year an amount equal to that obtained by multiplying such excess per gross ton by the number of gross tons of coal actually burned in generating electricity for the railway company. The amount of coal so burned is taken as bearing the same proportion to the total coal burned in the station as the electrical energy used by the railway company, as measured, bears to the total energy generated in the station and distribution from it. This contract was made when the price of coal was about $3.37 per ton, so that the power company was obliged to stand the loss between $3.37 and $4 per ton before any adjustment was made. For the year 1917 the cost of power to the railway company was $223,593, an increase of about $55,000 over the amount paid in the year ended June 30, 1916. The average price of coal for 1917 was $7.51 per ton against $3.65 for 1916. The average price of coal for 1917 was $7.51 per ton against $3.65 for 1916.

The unit selling price of energy to the railway by the central station at the alternating-current terminals of the railway substations was 1.77 cents for the year 1917 per kilowatt-hour, compared with a base price of 1.4 cents per kilowatt-hour made for coal at $4 per ton. In 1917 the central station received 0.37 cent more per kilowatt-hour of alternating-current energy delivered at the substation terminals than in 1916. The total energy generated at the plant in 1916 cost 0.42 cent per kilowatt-hour for fuel and 0.84 cent in 1917, or an increase of 0.42 cent. As the cost of generation per kilowatt-hour delivered at the substations as alternating-current energy exceeds the cost of production per kilowatt-hour at the plant itself on account of the reduced number of kilowatt-hours delivered at the substations compared with the energy produced at the main plant, it is apparent that the additional price paid by the railway in this case did not fully compensate for the increased cost of coal at the main plant. The central-station company bore part of the added burden, and in support of this practice it is contended that if a company shares a part of the burden of increased costs it will find its applications for rate advances more favorably regarded by the public and by the public utility commissioners having jurisdiction over it in rate matters.

SPEEDING UP COLLECTIONS OF CUSTOMERS' ACCOUNTS

Methods and Policies Used by More than Thirty Indiana Companies to Shorten Interval Between Meter Reading and Payment of Bills

BY O. M. BOOHER
Chairman Commercial Section Indiana Electric Light Association

It appears to the writer that the question of collections looms large, particularly at this time, when every dollar must be worked and worked to the limit. The usual custom of having the local central station serve its community in the capacity of a bank, without proper banking rules and regulations, is poor business, even when money is easy. The tightening up of money naturally should lead the central station to think of means to hasten collections. The practice of time payments on merchandise and miscellaneous sales accounts should be either entirely eliminated or greatly reduced unless a fair rate of interest is collected or unless the sales profits are amply sufficient to warrant time payments.

It is hard to avoid the conclusion that the time has arrived when the problem of collections should be vested in a department separate and distinct from all other departments. Especially is this true with the larger properties. There should be employed a department with a competent head who has been trained thoroughly in the matters of aggressive and effective collection systems.

Reconnection Charge Should Be Enforced

All companies should establish and enforce without discrimination certain penalties for non-payment. In extreme cases, where disconnections are necessary, a charge for reconnection is not out of place if the "chronics" are to be eliminated. We have enforced in Kokomo the reconnection charge of $1 and find that it adds materially to our collections as a whole, helping to reduce our non-collectibles to less than 0.5 per cent. We do not find much adverse public comment caused by this practice.

The public is learning very rapidly how to adapt itself to new conditions without complaining, and the utility should grasp the opportunity so far as is possible to ask of the public all things reasonable and necessary, especially those things which the public will not complain about and which are of much help to the utility.

Another feasible plan which is working out successfully, especially with the larger companies, is the establishment of authorized agencies in each small community center where all bills save those in dispute or in arrears may be paid. Such a system adds much to the convenience of the customer and speeds up collections considerably. At the same time it creates public good will.

REPLIES TO QUESTIONS ASKED OF FORTY-EIGHT ELECTRIC COMPANIES

	Number Answering	Yes	No	Average of Answers
Do you allow cash discount	37	28	9	.
Do you send out delinquent notices....	36	30	6	. .
Do you discount for non-payment after a certain date ...	36	34	2	....
Do you charge for reconnection	38	17	21	...
Per cent. of bills collected during discount period	31	.		78.5
Per cent receiving delinquent notices ...	30			11.2
Per cent of total monthly receipts considered non-collectible.....	24			0.87

The question of collections is closely affiliated with public policy. Labor is scarce and its scarcity is increasing, consequently labor is growing much more independent. A man can be loyal to his company or disloyal as he chooses. He can get a job just as good, or maybe a little better, somewhere else. Therefore great care should be exercised in the selection of a man to place in charge of collections, so as to be sure that the company's interest will be carefully looked after. The customer should not be antagonized or insulted because he is a little late paying his bills. In other words, proper discretion should be exercised, and this will not be done unless a man of acquaintance and one who is in touch with the public pulse be employed.

How Thirty Indiana Companies Do It

In order to summarize the collection practice of a number of companies the writer sent letters to forty-eight members of the Indiana Electric Light Association. The replies received are reviewed in the table herewith. These replies show that a majority of companies favor allowing cash discount, sending out delinquent notices and disconnecting promptly for non-payment. Opinion seems to be about equally divided for and against a charge for reconnection. The replies also show that 78.5 per cent of the customers take advantage of cash discounts and 11.2 per cent wait to reecive delinquent notices. The average of accounts considered non-collectible amounts to the surprisingly high figure of 0.87 per cent.

The letters also brought out that in thirty-one companies the collections are looked after as follows: Two companies by manager of collections, five companies by chief clerk, eight companies by cashier, two companies by auditor, seven companies by office force, six companies by general manager, and one company by treasurer. In most cases the same individual looks after collections of accounts for merchandise, motors and signs as well as customers' monthly accounts for energy consumed.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Empirical Equations for Speed and Torque Curves of the Series Motor.—A. S. LANGSDORF.—While it is generally most convenient to represent by graphs the relations between speed, torque and current of series motors, occasionally it may be desirable to summarize these relations in the form of equations. To illustrate the method generally applicable in such a problem the author worked out the equations of a Westinghouse railway motor from curves published by the manufacturer.—*Washington University Studies*, July, 1918.

Standardized Motors for the Steel Industry.—W. T. SNYDER.—Steel-plant operators have two alternatives in the choice of electric drive: (a) To adopt a certain motor and get the benefits of standardization, as far as possible, or (b) to buy motors in open competition based on price and reliability and be content with a conglomeration of motors of different makes. The standardization committee of the Association of Iron and Steel Electrical Engineers is now studying the advisability and possibility of a joint committee of engineers, representing makers and users, designing a line of standard motors which all manufacturers would be asked to build.—*Proceedings Association of Iron and Steel Electric Engineers*, March, 1918.

Generation, Transmission and Distribution

The Essentials of Transformer Practice—XII.—E. G. REED.—Deals with the effect of load factor on operating cost and fixed charge, yearly cost of transformer losses, cost of transformer exciting current, cost of transformer regulation, and total cost of operating a transformer.—*Electric Journal*, July, 1918.

Fuel Oil as a Substitute for Coal.—This article deals with oil available for fuel purposes, care required to prevent waste of oil, comparative maintenance expenses with oil and coal, selection of type of burners, oil pressure and temperature, importance of air regulation, boiler furnace for oil fuel, oil-fuel shortage, automatic regulation of fire, fuel-oil demand for ships, interconnection of hydroelectric plants, and available deposits of oil shale.—*Journal A. S. M. E.*, July, 1918.

Ground Connections for Electrical Systems.—O. S. PETERS.—Information available up to this time has been supplemented by new experimental data to form a comprehensive report on the subject of "grounds." The matter is taken up in the following order: (1) Resistance of ground connections; (2) their uses and service conditions; (3) different forms of ground connections and the electrical characteristics of each; (4) mechanical construction; (5) inspection and testing; (6) fire hazard and interference with service; (7) costs; (8) bases for specifications, and (9) field measurements of the resistance of ground connections. It has been found that the contact resistance between clean metal and earth is negligibly small when the earth is properly tamped and is moist. Rusting, contrary to the general belief, does not appreciably affect the contact resistance of an electrode in the ground, but care should be taken to eliminate grease, paint or any non-conducting scale which may seriously impede the flow of current. Salt improves the conductance of the soil and it is of particular importance that the ground remain moist. The author lays considerable stress on the idea that grounds should not be specified by mechanical construction but should meet certain electrical tests. In particular, the ground resistance should be such that when a certain heavy current flows through it the potential rise at the copper connection above the surface should not be more than 150 volts above the earth. This heavy current is fixed at the rating of the nearest circuit breaker which will operate to disconnect the equipment or circuit concerned from the source of the dangerous voltage. Thus a ground is satisfactory when human life, as well as low-tension apparatus, is safe in its vicinity. Water pipes are especially recommended for ground circuits, but it is suggested that gas mains should be used sparingly on account of the danger of explosions. Periodic tests should be made to insure low resistance. —*Bulletin No. 108, Bureau of Standards*, June 20, 1918.

Installations, Systems and Appliances

Electrical Labor-Saving Devices in Coal Mining.—GRAHAM BRIGHT.—Every effort must be made to speed up coal production, even with a decreased supply of workmen. It is evident, then, that labor-saving devices must be used to the utmost in the coal-mining operations. The writer prefers central-station energy for mine service on account of the fact that more reliable service may be obtained than from local plants. The pumping of water is best done electrically, and motors without starting devices may be used. Ventilating fan units are most reliable and efficient when electrically operated. A considerable saving in drivers may be made if locomotives instead of mule teams are used for gathering, and for main haulage there is no comparison between animal and electric traction. Direct-current motors with flywheels serve admirably for hoisting, and the greatest economy (especially in man power) results from the use of cutting and loading machines. Especially from the superintendent's point of view telephones are useful as time savers.—*Coal Age*, July 10, 1918.

Opportunities for Central-Station Power in Oil Fields.—L. E. MOHRHARDT.—The author points out the fact that motor drive is especially applicable to the pumping of both shallow and deep wells. Alternating-current supply is preferred on account of the distance of the oil fields from central stations. Alternating-current motors should be of the two-speed type, so that one speed may be used for pumping and another for operations such as pulling the rods and cleaning. Electric drive may also be used for drilling and for maintaining the proper head in pipe lines. This load is especially desirable since the operation is practically continuous for twenty-four hours per day.—*Electrical Review*, July 6, 1918.

Electricity in Coal Mining.—FRANK HUSKINSON.—A general discussion is given concerning the application of electricity to coal-mining operations. The writer points out the fact that central-station service is far more desirable for coal-mining operations than the use of special plants located at the mines, for the reason that these isolated plants are commonly not well cared for. He recommends the use of alternating-current supply, as far as possible, on account of the greater flexibilities of this system for various voltages in use. He also states that although direct-current is constantly used for mine locomotives, the three-phase induction motor may be well adapted to this service.—*Electrical Review*, July 6, 1918.

A Rocking Electric Brass Furnace.—H. W. GILLETT and A. E. RHOADS.—On account of the increasing difficulty of obtaining crucible materials and on account of the deterioration of the quality, the authors suggest that the use of crucibles in brass making should be superseded by electric furnaecs. One item of especial importance in the operation of brass furnaces is the fact that the zinc boils at comparatively low temperature. For this reason fuel-fired furnaces of the reverberatory type may only be applied to brass at the expense of a high loss of zinc. The same consideration prevents the use of the direct-arc type of electric furnace such as the Heroult furnace for this purpose. The authors review the various types of furnaces which have been developed for brass melting, giving their disadvantages and the reasons why they are not commercially more practical. In a study of electric brass melting during the past five years, the Bureau of Mines has tried out a rocking-type furnace which may perhaps help to fill this gap. In the ordinary indirect-arc type of furnace the heat is applied above the melt, and as hot metal is lighter than colder metal there is little circulation in the bath. If the rate of heat input is at all rapid, as is necessary for thermal efficiency, heat conduction from the top of the melt downward does not keep pace with the heat supply. Before the melt as a whole reaches the proper pouring temperature the surface is much superheated. In the case of an alloy high in zinc the surface will reach the boiling point of the zinc in that particular alloy while the bottom is scarcely melted. The obvious way to overcome this difficulty is to stir the melt so vigorously as to make the temperature practically uniform and thus prevent the superheating of the surface. Instead of rotating the furnace through a complete revolution which would involve difficulties in keeping the metal out of the joint between the door and the door opening and in making bus contacts to the electrodes, it appears simpler to rock the furnace back and forth so that the molten charge just fails to reach the door at either end of the rocking angle. In the development of a furnace of this type, the Detroit Edison Company had long been interested and offered to co-operate by constructing a rocking furnace for commercial test. Sketches of the furnace design were given the Detroit Edison Company, which refined the design, made the working drawings, constructed and erected the furnace. The authors present a considerable amount of data, such as the energy required per ton of metal poured, the electrode consumption and total cost of operating the furnace. Accurate temperature control is very easy in the rocking furnace, since the walls are no hotter than the metals and there is no heating up of the sides from hotter roof and walls. After cutting off the arc the temperature falls very slowly, about 2 or 3 deg. C. per minute. By running the arc a minute or so every ten or fifteen minutes, the charge can be held at pouring temperature for an indefinite period. Where automatic electrode control is used one man can probably attend to two furnaces. The output per man-hour was greater from the rocking furnace than from the coke fires, and the working conditions are much less severe and more healthful with electric furnaces than is the case with coke fires. A more detailed account of the test of the rocking furnace will soon be published in bulletin 171 of the Bureau of Mines.—*Chemical and Metallurgical Engineering*, June 1, 1918.

Electrophysics and Magnetism

Some Characteristics of the Marvin Pyrheliometer.—PAUL D. FOOTE.—For the first time, it is believed, a pyrheliometer has been calibrated by two methods, the usual electrical method and a radiometric method. The calibrations by the two methods agreed within limits of experimental error. A lag, part of which is due to the galvanometer of the bridge, has been found to exist, and with a silver disk No. 3 it was experimentally shown to be less than two seconds. Both theoretically and experimentally it was shown that the effect of this lag is negligible after five to ten seconds. The cooling and heating of the receiver follows Newton's law of cooling. In order to eliminate completely errors due to a lag effect, readings should be made at ten seconds and sixty seconds following the beginning of a heating or cooling. The factor for converting readings of temperature or resistance change over this fifty-second interval to corresponding changes over a complete sixty-second period is 1.217. This factor is the same for both electrical and radiometric heating and was determined with an accuracy of 0.1 per cent. The Marvin pyrheliometer was found to give 2 per cent lower values of the solar radiation than the Smithsonian pyrheliometer. This difference is within the errors of observation of the present calibration.—*Scientific Paper No. 323*, Bureau of Standards, June 28, 1918.

Grating Space of Calcite and X-Ray Spectrum of Gallium.—ARTHUR H. COMPTON.—It is claimed by the author that the wave lengths of characteristic X-rays from gallium given by Uhler and Cooksey require revision because of error in their determination of the grating space of calcite.—*Physical Review*, June, 1918.

X-Ray Emissions as Function of Applied Voltage.—It is shown how the emission depends upon the voltage from a consideration of well-established physical facts.—*Physical Review*, June, 1918.

Formation of Negatively Electrified Raindrops.—The author shows how negatively electrified drops may be blown from positively electrified drops by a wind giving off positive charges to water.—*Physical Review*, June, 1918.

Electrochemistry and Batteries

Electric Storage Batteries—IV.— Attention is given to the characteristics of the Edison storage battery with special reference to care and upkeep. There also appears a general discussion on the application of storage batteries to central-station service, in which some methods of voltage control are given.—*Power Plant Engineering*, July 15, 1918.

Units, Measurements and Instruments

Boiler-Room Instruments.—Instruments which are useful and desirable in the boiler room as aids in saving coal are named, and the essential ones are indicated. Among other subjects considered are controllable losses in boiler operation, results which should be known promptly on relation of steam flow and air flow to coal feed, advantages of recording meters, and what a CO_2 recorder shows.—*Journal of American Society of Mechanical Engineers*, July, 1918.

Magnetic Observations.—Compilation of a series of highly successful magnetic observations which were undertaken by the Carnegie department of industrial magnetism and the United States Coast and Geodetic Survey.—*Science*, July 5, 1918.

The Engineering Evolution of Electrical Apparatus—XXX.—Charles R. Riker.—A history of indicating meters, dealing with D'Arsonval instruments, hot-wire instruments, electrostatic voltmeters, electrodynamometer instruments, etc.—*Electric Journal*, July, 1918.

Telegraphy, Telephony and Signals

Motor Vehicles in Telephone Work.—A general discussion is given concerning the applications of motor trucks to line construction. It is pointed out that they may be used for moving large quantities of material and for the distribution of supplies from storerooms to the men on the job. These trucks may be equipped for pulling wires in the case of overhead construction and also for drawing in cables in case of underground construction. The workmen are moved to and from a job with much less loss of time than formerly, and work may be undertaken at a much greater radius from headquarters than would be possible without the services of motor vehicles. It is pointed out that the White company has designed trucks especially for service in connection with line work.—*Telephony*, July 20, 1918.

Theoretical Calibration of Condenser Transmitter.—I. B. Crandall.—A study is made of the mechanics of the condenser transmitter with reference to air damping and elasticity, from which may be constructed a theoretical calibration curve.—*Physical Review*, June, 1918.

Miscellaneous

The Structure of Metals.—The penetrating power of the X-ray tube has been greatly increased as developed by Mr. Coolidge, who devised a cathode of a spiral of tungsten surrounded by a sleeve of molybdenum. For example, the rays can penetrate 4 in. (10.2 cm.) of hard steel if a sufficiently high voltage is used. This apparatus is very useful in examining welds for air holes and flaws, but great care must be exercised to protect the operator from "burning." The process of examining metals is a photographic one, and it is said that a hole 1/50 in. (0.5 mm.) in depth can be detected in 2 in. (5.1 cm.) of hard-steel casting. Also that 1/1000 in. (0.025 mm.) variation in thin mica insulation can be detected.—London *Times Engineering Supplement*, June, 1918.

Electrical Power for Oil Fields.—Attention is called to the advantages of employing electrical machinery in oil fields in place of the notoriously inefficient steam plants commonly used in most cases and to the indiscriminate selection of gas and oil engines for power purposes. Figures bearing on the cost of installing and working electric motors are given, and it is pointed out that British electrical manufacturers will find a large market for their products if they will carefully study the requirements of the petroleum industry.—London *Times Engineering Supplement*, June, 1918.

Electric Arc Welding.—E. Wanamaker.—Great economy has been effected in the Rock Island Railway system by means of electric welding devices which perform a variety of services, such as cutting plates and holes, the welding together of sheets, welding of tubes to the back flue sheets and repairing holes in fire boxes of locomotives. The "metal electrode" method of welding is employed, using a soft steel wire or other metal as the negative. Direct-current energy at 20 volts is furnished by a number of portable motor-generator sets which are applicable to the considerable varieties of work. The detailed results of six months' operation are given, based on the expenditure of $40,000 for electrical welding outfits. It is shown that 85.7 per cent of the cost of welding by older methods was saved by the new system and that the electrical system shows a saving of 28.5 per cent over the gas method. On the basis of results obtained thus far, the author calculates the rate of saving to be $200,000 per year. Of this, $136,000 is a direct saving in the performance of the work and $64,000 represents increased service of engines due to shorter time for repairs. By extending the use of the electric welding operation over the whole Rock Island system the author estimates a possible yearly saving of $1,000,000.—*Journal Cleveland Engineering Society*, May, 1918.

German Trade Methods in Spain.—It is shown that German trade with Spain in engineering equipment, while not large, grew rapidly in antebellum years, on account of the elaborate and systematic propaganda of agents representing German houses. The newer group of technical men in Spain were thus growing up to believe that German apparatus was far superior to other makes.—London *Electrical Review*, July 5, 1918.

Internal-Combustion Engine Lubrication and Lubricants.—P. H. Conradson.—The selection of the proper grade of oil for each class of service depends upon a number of factors, such as the type and condition of the machine, the lubricating system, the method of applying the lubricant and the method of cooling, as well as climatic conditions. One of the essential points in the selection of lubricants is that they should have sufficient body not only to make a proper seal at the start, when the clearance between the piston rings and cylinders may be great, but also, when the engine becomes highly heated, to prevent the gaseous vapors from leaking past the piston rings and condensing in the oil in the system, thereby reducing the efficiency of the lubricant.—Extracted from paper presented before the American Society for Testing Materials, June 25-28, 1918.

Readers' Views and Comments

Improved Power Factor Is Urgent

To the Editor of Electrical World:

Sir: Central stations and industrial plants of the country are struggling to keep pace with the tremendous demands made upon them for electrical energy. Conservation of our resources demands that present equipment be made to serve to the limit of its capacity. To do this, equipment having to do with alternating current should operate at the highest possible power factor. A poor or low power factor carries a pure economic loss and, in general, goes hand in hand with poor efficiency. It therefore follows that if the power factor of the alternating-current installations can be improved, there will result greater output from this equipment, relieving the burden on the electrical manufacturers, labor, transportation—ultimately fuel.

Power factor might be defined as the ratio between useful work and the apparent work of any piece of alternating-current apparatus. Inasmuch as the apparent work limits the capacity of this apparatus, the useful work should be made to approach the apparent work as closely as possible. A concrete illustration may better explain. A central station was asked to supply a manufacturer with 100 kw. of power. A power feeder passing his premises was fully loaded with apparent amperes, but not with useful amperes, due to its supplying entirely induction motor load. However, this manufacturer agreed to install apparatus—a synchronous motor—which would cause the useful amperes on the feeder to approach more closely the apparent amperes. This was done and the load put on without any noticeable increase in apparent amperes, yet this same apparatus was delivering 100 kw. more of useful power. Consider what was saved: A new feeder from the manufacturer's premises to the substation, substation equipment, feeder capacity from substation to generating plant and probably 133 kva. in generator capacity. Consider further what this ultimately means in labor, material, transportation and fuel.

A further illustration of a manufacturer purchasing energy for the operation of 600 hp. of induction motors, varying in size from 2 to 100 hp., might be noted. Transformers and necessary apparatus were installed of estimated capacity to carry the load, as had been shown by steam engine indicator cards. Electrical operation with motor drive was started. Upon inspection it was found that transformers and portions of the wiring were apparently overloaded. A careful investigation of the motor installation was then made. As a result, when carefully rearranged, over 100 hp. in motors was on the floor available for other uses, and also approximately 1500 kw.-hr. per month was saved. Also the apparent amperes were reduced or brought more closely to the useful amperes, so that the transformers and wiring were working under conditions free from danger of burn-out. This improvement of power factor meant a real economic gain.

The important point to the engineer in charge of a plant operated by alternating-current equipment is that if the load imposed has a low power factor this may result in an overload on supply lines, local transformers, generating equipment, etc., with a consequent low voltage and a reduction in plant output. This condition subjects the equipment to the danger of burn-outs, which are to-day more serious than ever, as the time involved in making repairs is greater because of the shortage of spare parts as well as the shortage of men to do repair work. A shutdown due to a burn-out to-day is likely to result in considerable loss in plant production. Under present conditions this should be avoided, and may be avoided in many cases by a careful engineering study of power-factor conditions. Never before in our history has the position of plant engineer been vested with such important responsibility.

The importance of power factor is felt more and more by engineers, but there is still need for more organized co-operative effort toward the general betterment of power-factor condition in alternating-current installations.

G. E. Miller.

Cleveland Electric Illuminating Company, Cleveland, Ohio.

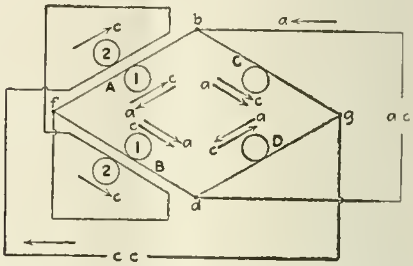
The Precise Measurement of Alternating Currents

To the Editor of Electrical World:

Sir: As pointed out by C. O. Gibbon in his article on the "Precise Measurement of Alternating Currents" (Electrical World, May 11, 1918, page 979), the values of alternating currents and continuous currents are the same, and his instrument is limited to this condition. By using the *b* and *d* terminals for the alternating currents, however, the two field or stationary coils (1) can be made for heavy currents, while the moving coils can be made for lighter currents. Two auxiliary field coils (2) can then be used to reinforce the field for the continuous-current element, these auxiliary coils being outside of the bridge circuit.

To adjust the placing of the extra field coils, the whole instrument is calibrated on constant current, two different sources being used and both easily measured. For example, moving coils on 0.1 amp., one set of field coils (1) on 99.9 amp. and the other set (2) on 0.1 amp., a current of 100 amp. is then sent through the bridge from *b* to *d*, this current dividing into 99.9 amp. through the field coils and 0.1 amp. through the moving coil. A current of 0.1 amp. is then sent through the bridge by way of the auxiliary field coils and the points *f* and *g* of the bridge. This current is from a separate battery. With both currents flowing—that is, 100 amp. from one battery and 0.1 amp. from another—the auxiliary coils are moved laterally until the instrument reads zero. The instrument is now ready for alternating current use as originally designed and 100 amp. alternating current will be balanced by 0.1 amp. continuous current.

To have 100 amp. divide in the ratio of 99.9/0.1 for alternating currents, it is necessary that the resistances of 99.9/0.1 of the bridge arms and the inductances shall be in the inverse ratio. To calibrate the bridge so that the fixed coil and stationary coil have the proper ratio, use alternating current and a telephone in the well-known bridge method for measuring inductances. This can be done after the instrument is built by adding inductance and resistance to either arm of the bridge as needed.



New York City. T. W. Varley.

To the Editor of Electrical World:

Sir: So far as I can see, the use of the auxiliary field coils forms an excellent means for extending the range of the instrument. Such an instrument, however, would require very exact adjustment before leaving the laboratory. Assuming a ratio of 10:1, the following conditions must be satisfied: $R_a = R_b$; $R_c = R_d$. The alternating current divides in the ratio of 10:1, and the currents through the two paths *bfd* and *bgd* must be in phase. Hence the following relations must exist: $R_c = 10R_a$; $R_d = 10R_b$; $X_c = 10X_a$; $X_d = 10X_b$. By means of calibrated variable inductances and resistances inserted in the arms *bg* and *dg* and suitable switches for varying the number of turns in the auxiliary field, a multiple-range instrument of very high precision may be obtained. Since the coils in the arms *B* and *D* are used only as balancing inductances it is unnecessary to place an auxiliary field on the arm *B* except to neutralize the effect of mutual inductance between the main and auxiliary field in the arm *A*.

It is my intention to bring the single-element, differential dynamometer to a much higher degree of precision than that attained in its first crude form. I therefore greatly appreciate Mr. Varley's suggestions.

Charles O. Gibbon.

Millville, N. J.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

INSTITUTE DIRECTORS BEGIN THE NEW YEAR

First Session for the Administrative Year of 1918-19 President Adams Announces Appointment of the Committees

The first meeting of the board of directors of the American Institute of Electrical Engineers for the administrative year beginning on Aug. 1 was held at Institute headquarters, New York, on Aug. 13.

There were present President C. A. Adams of Cambridge, Mass.; Vice-presidents William B. Jackson of Chicago, F. B. Jewett of New York and John H. Taylor of Schenectady; Managers N. A. Carle of Newark, N. J., Charles Robbins, Wilfred Sykes and Frank E. Newbury of Pittsburgh, Walter A. Hall of Lynn, Mass., William A. Del Mar and Walter I. Slichter of New York, and G. Faccioli of Pittsfield, Mass.; Treasurer George A. Hamilton of Elizabeth, N. J., and Secretary F. L. Hutchinson of New York.

President Adams announced the appointment of the committees for the administrative year. The chairmen of the committees appointed are as follows:

Finance—N. A. Carle, Newark, N. J.
Meetings and Papers—W. I. Slichter, New York.
Editing—Henry H. Norris, New York.
Safety Codes—Farley Osgood, Newark, N. J.
Board of Examiners—F. L. Rhodes, New York.
Sections—W. A. Hall, Lynn, Mass.
Student Branches—C. Francis Harding, Lafayette, Ind.
Membership—H. A. Pratt, New York.
Public Policy—Calvert Townley, New York.
Headquarters—N. A. Carle, Newark, N. J.
Electrical Engineering Service—William A. Del Mar, New York.
Code of Principles of Professional Conduct—George F. Sever, Washington, D. C.
Standards—L. T. Robinson, Schenectady, N. Y.
Power Stations—Philip Torchio, New York.
Transmission and Distribution—L. E. Imlay, Niagara Falls, N. Y.
Traction and Transportation—C. F. Uebelacker, New York.
Industrial and Domestic Power—A. G. Pierce, Pittsburgh, Pa.
Lighting and Illumination—C. E. Clewell, Philadelphia, Pa.
Economics of Electric Service—W. B. Jackson, Chicago, Ill.
Protective Devices—D. W. Roper, Chicago, Ill.
Electrochemistry and Electrometallurgy—Carl Hering, Philadelphia, Pa.
Electrophysics—F. W. Peek, Jr., Pittsfield, Mass.
Telegraphy and Telephony—Donald McNicol, New York.
Marine—H. A. Hornor, Philadelphia, Pa.
Use of Electricity in Mines—K. A. Pauly, Schenectady, N. Y.
Electrical Machinery—Alexander M. Gray, Ithaca, N. Y.
Instruments and Measurements—S. G. Rhodes, New York.
Iron and Steel Industry—Eugene Friedlaender, Braddock, Pa.
Educational—V. Karapetoff, Ithaca, N. Y.

In accordance with the by-laws of the Edison medal committee, the board elected from its own membership Charles Robbins, C. E. Skinner and Walter I. Slichter to serve on the committee for the term of two years. F. B. Jewett, John B. Taylor and Harold Pender were elected by the board to serve on the committee for one year ending July 31, 1919, to fill the unexpired terms of three retiring members of the board of directors.

Local honorary secretaries were reappointed for the two years ending July 31, 1920, as follows: Robert Julian Scott, New Zealand; T. P. Strickland, New South Wales; W. G. T. Goodman, South Australia; James S. Fitzmaurice, West Australia; L. A. Herdt, Province of Quebec; Henry Graftio, Russia; A. S. Garfield, France; Harry P. Gibbs, India; J. W. Kirkland, South Africa.

Upon the recommendation of the board of examiners, thirty-two students were ordered enrolled, 129 applicants were elected to the grade of associate, five applicants were re-elected to the grade of associate, fifteen applicants were elected to the grade of member, two applicants were transferred to the grade of fellow, and ten applicants were transferred to the grade of member.

WAR SERVICE ACTION BY THE MANUFACTURERS

General Committee Urges Thorough Co-ordination of Effort in the Interest of Maximum Service by the Whole Industry

A letter sent by W. W. Nichols, secretary of the General War Service Committee of the Electrical Manufacturing Industry, to the chairmen of the group committees calls attention to the following action taken at its meeting on Aug. 15 by the general committee:

To insure proper coördination of effort it was:

Resolved, (1) that constructive programs developed by group war service committees for conservation be subject to the approval of the General War Service Committee; (2) that future conferences of group war service committees with the Priorities Division or the Conservation Section of the War Industries Board be first either approved by or arranged by the General War Service Committee.

"The General Committee," Mr. Nichols writes, "is energetically collaborating with both the Priorities Division and the Conservation Section in the development of plans applicable to the industry as a whole, and it is important at this critical stage to avoid uncoördinated action anywhere within our organization. Your general committee does not wish in the slighest degree to hinder the development of any plan which will of service to your particular group. It only requests that, before attempting to put into effect such a plan, it first be submitted to the consideration of the general committee in order that our entire industry may render maximum service to the government."

CONSERVATION PROGRAM FOR THE SUPPLY MANUFACTURERS

A. W. Berresford Asks Group War Service Committees to Take Immediate Action for Comprehensive Report on Possibilities

A. W. Berresford, chairman of the War Service Committee of the Manufacturers of Electrical Supplies, has written to the chairmen of the various group committees in the electrical supply industry asking immediate action on a program for conservation to meet the views of the War Industries Board.

In urging that immediate and careful attention be given to this important subject, Mr. Berresford says that the group committees should not overlook the possibilities for ultimate good to the industry in following out the policy laid down by the Priorities Division of the War Industries Board. It has been stated that the manufacturer who did not take advantage of the present plans for conservation, and the relation of the War Industries Board thereto, to clear his lines by coöperation with his competitors under the instructions of the board, was missing an opportunity that could hardly present itself in normal times and which would be of exceeding value in the world-wide competition following the war.

"Nothing must be done in private interest, but much that is done now in the public interest must be of private value ultimately," Mr. Berresford says. "The dates set are reasonable in view of the public need and have already been advanced beyond what was originally contemplated. They should be met or anticipated."

The letter of Mr. Berresford reviews the conferences at Washington with the representatives of the War Industries Board in the effort to establish some means of insuring material supply for electrical manufacturers, the nature of whose business requires manufacture for stock. Mr. Berresford continues:

The final agreement reached was as follows, but was based entirely on an agreement to immediately develop a constructive program for conservation in coöperation with the Conservation Division:

1. Automatic inclusion in Class B2 will be approved only when all products have been brought to the basis of what is absolutely essential during the period of the war.
2. Favorable consideration will be given to extending automatic B2 rating to include manufacturers of essential supplies, a list of which is to be submitted by the manufacturers for approval.
3. Individual manufacturers will be given individual plant rating where justified by the information filed in report forms PC 20 and 21. (The assumption is that these will not be so favorable as B2.)

It is immediately obvious that there can be no delay in starting the work. It seems equally obvious that it can only be done through the group committees.

Your committee desires to be able to place before the Conservation Division not later than Sept. 21 a comprehensive and, so far as possible, accurate statement of the possibilities in each group of the industry, together with the pledge of each group that it will actively promote the plan which it suggests. This would require the holding of group meetings as soon as they can be organized, but certainly so that reports may be received by your committee not later than Sept. 14.

The following possibilities should be carefully considered and report and recommendation made thereon in as definite form as practicable:

1. Reduction in stock of raw material.
2. Reduction in stock of finished products.
3. Elimination of sizes, types and styles of apparatus and results possible thereby.
4. Elimination of wasteful competition.
5. Elimination of sales campaigns.
6. Reduction of consumption by elimination of replacements of material which, while possibly less desirable than present product, or even obsolete, may well survive the period of the war.

The desire and intent of the Priorities Division is that only such material shall be used as is necessary to be used. In the words of Judge Parker, it is not a question of applying a remedy which will in the end effect a cure, but of applying the surgeon's knife now.

In the opinion of your committee, however, it is vital that the course suggested be taken and it is every man's duty to coöperate to the exclusion of his personal interest.

Will you therefore make immediate arrangements for the meeting of your group, notifying the writer of the time and place thereof, and, as soon thereafter as possible, the date at which you will make report?

PORTLAND (ORE.) COMPANY ASKS FOR HIGHER RATES

Petition to Commission Says that Operating Expenses for Year 1918 Will Be 63.9 per Cent Greater than in 1916

The Portland (Ore.) Railway, Light & Power Company has filed with the Oregon Public Service Commission an application for an advance in light and power rates in the city of Portland and Willamette divisions of the company over the rates fixed by the commission in May, 1917. At that time the commission ordered the company to discontinue the commercial power rates then in force.

These rates were placed in two divisions. The first provided that all electrical energy used by the consumers under 73 kw.-hr. a month be charged at a primary rate of 5 cents for the first 500 kw.-hr., 4 cents for the next 500 kw.-hr., 3 cents for the next 4000 kw.-hr. and 2 cents a kilowatt-hour for all in excess of 5000 kw.-hr. The secondary rate was made for users of a great amount of energy and was lower than the primary rates.

In its petition the company states that these rates were based upon operating conditions prevailing during the year and a half ended Dec. 31, 1916, and that the commission assumed that the conditions then existing would be fairly indicative of those to be encountered in the near future.

While the aggregate revenue from the electric properties for 1917 was 4.9 per cent greater than for 1916, the revenue per kilowatt-hour for 1917 was less than for 1916 by 12 per cent, and while the 1918 revenue will be 16.1 per cent greater than for 1916 the 1918 revenue per kilowatt-hour will be 22 per cent less than for 1916.

Operating expenses of the electric properties, including taxes, depreciation and fixed charges, have increased so that while revenues under present rates for 1918 will be 16.1 per cent greater than for 1916, operating expenses will be 63.9 per cent higher and operating expenses for each kilowatt-hour produced and utilized for 1918 will be greater by 10 per cent than in 1916. Operating expenses in 1918 will be increased because of the necessity of more continued operation of the steam-power plants, due to heavy loads on the system as a result of increased activities in war industries and low water conditions.

NATIONAL CONTROL OF THE POWER RESOURCES

Terms of Bill to Give President the Authority to Build or Use Stations or Energy in the Paramount National Interest

T. W. Sims, chairman of the House committee on interstate and foreign commerce, has introduced in the House of Representatives a bill to provide further for the national security and defense and for the more effective prosecution of the war by furnishing means for the better utilization of the existing sources of electrical and mechanical power and for the development of new sources of such power. The bill provides the sum of $150,000 for administrative expenses and provides the sum of $200,000,000 for the purchase and building of power plants.

The proposed legislation is to be known as the emergency power act. It is not to be confused with the water-power bill now pending in the House of Representatives and will not be considered in connection with that bill, which is all ready on the floor of the House, while the emergency power act has but just been referred to the committee. Hearings on the emergency power act were begun before the House interstate and foreign commerce committee on Aug. 23.

In making the bill public, Representative Sims issued a statement in part as follows:

> We are facing a power shortage which is and for some time past has been acute and is hampering our progress on war production. So this measure authorizes the President to erect power stations near the coal mines and at other points where he may deem them necessary, or to extend financial aid to persons or corporations about to do so, and therefore desiring to secure results of tremendous, immediate and inestimable value to America. It is considered necessary by representatives of the administration, by representatives of the great power companies and by economists who attacked the problem from various viewpoints, and is indorsed by all of them.
>
> This bill must not be misunderstood as in any wise taking the place of the water-power bill now before the House. That is in its nature a peace-time measure, and the provisions of the two do not conflict. The plans are to confer upon the President all necessary power to deal with the urgent power situation properly and effectively and to place at his disposal sufficient funds with which to assure adequate operation. The bill concerns:
>
> 1. Increased production of power available for war industries and shipyards.
> 2. Economy in the use of fuel.
> 3. Reduction in the railroad freight load, especially in the fuel load.
> 4. Increased production of metallurgical coke, toluol, ammoniacal liquor, all recovered from coal.
>
> The greatest immediate need is perhaps that of the munition factories and shipyards for additional power, which cannot be supplied by the existing supply companies, by the most economical and efficient means of producing power, and to decrease the amount of fuel to be transported by the railroads and in turn make possible an early electrification of congested railway lines, which Director General McAdoo prepared for only a few days ago. So the development of the proposed super-power station for directing the production of explosives, as the proper utilization of coal, will yield by-products.
>
> Nearly every department of the government is in some way interested either in power itself or in one or more of the commodities which, under present circumstances, may be secured as by-products in the economical development of power or which in their manufacture give as by-products the requisites of power production.
>
> In addition to our war needs there is a widespread demand for increased production and adequate distribution of fuel, light, heat and power for city and rural communities and industries, which will continue to increase after the war when the country will return to normal conditions and can and will compete for the trade of the world.
>
> The plan adopted to solve any one of those problems should primarily include conservation of transportation and increased production of coal products and power. The appropriation required for all these is provided in the bill just introduced.

The bill grants sweeping authority to the President and includes penalties of imprisonment or fine or both for any who knowingly neglect or refuse to comply with any order or requisition made by the President or any officer, agent or agency designated or created under the act.

Among the clauses of the bill are those empowering the President:

1. To construct at any place or places within the boundaries of the United States such power plant or power plants as he may deem necessary, and in connection therewith to construct within such boundaries plants for the production of gas, coke, toluol, benzol, coal-tar products, and any other useful products that may be produced through or in connection with the coking of coal or lignite, or through or in connection with the combustion of any fuel.
2. For the purpose of increasing the capacity or productivity of any private power plant within the boundaries of the United States, to install in any such plant any structure, machinery or appliances that he may deem useful to that end, either through agents or contractors employed by him, or by providing the owner or operator of such plant with funds to be applied to that purpose; to lease the machinery, appliances and structures thus installed or any parts thereof to the owner or operator of such plant for a term of not to exceed the war period and such reasonable time thereafter as he may deem expedient in the interest of the United State, upon such terms as he may deem reasonable, and to enter into contracts requiring or permitting the lessee to purchase such appliances, machinery and structures, or parts thereof, at or before the termination of such lease at their then value or upon such other terms as he may deem equitable for the protection of the interests of the United States and of the community served by such lessee. Whenever any such structures, machinery or appliances shall have been installed, and until the sale or other disposition thereof, the title thereto shall remain in the United States and shall be free and exempt from any liens, mortgages, judgments or other incumbrances, whether created by act of the owner or operator of such plant or by operation of law. And upon and during any default in any payment of any sums due the United States under such lease or contract the President shall be empowered at all times to enter upon the premises upon which such machinery, structures or appliances shall be installed and there to maintain and to operate them or any of them for the use of the United States free from any rent or other charge, or to take possession of and remove them or any of them from the premises.
3. To aid in equipping any private power plant or in expanding any such plant to such extent as he may direct by making advances, upon such terms and conditions as he may determine, to the person operating or authorized to operate it, and in connection with such advances to agree with such person that, if the actual reasonable cost of equipping or expanding such plant shall be in excess of its value at the termination of the war period, or at such later time not more than five years after the expiration of the war period as he may deem reasonable for such valuation, and the machinery, structures or appliances constituting such extension or expansion, or their equivalent, shall have been maintained and operated in accordance with his directions until such time, repayment of the whole or any part of such excess will be waived, and to provide by agreement for the manner of determining such costs and values

by arbitration or otherwise and for the terms and time of such repayment; provided, that the powers conferred by this subdivision shall be exercised only if the President shall deem that the emergency is such as to render it impracticable or undesirable to act with respect to such plant under any of the other powers conferred by this act.

4. To acquire any private power plant within the boundaries of the United States.

5. To construct any pipe or other transmission lines, or other structures, facilities or appliances that he may deem necessary or useful for the purpose of better utilizing or of increasing the facilities of any power plant, or of combining the facilities or power of two or more such plants, or of better utilizing the gas, power or products generated by them.

6 To maintain, operate and extend any plant, pipe or other transmission line, or other structure, facility or appliance which he shall have constructed or acquired pursuant to the provisions of this act, and to deliver the power generated and the products produced in any such plant to such persons and in such proportions and at such times and at such rates as he may deem proper.

7. To require the operator of any private power plant within the boundaries of the United States to place at the disposal of the United States or to acquire from such operator during the war period the whole or any part of the power generated by such plant and during such period to transmit or distribute, or to require such operator to transmit or distribute, such power to any other power plant or to any other persons for such periods in such manner and quantities and upon such terms as he may direct.

8. To lease for the war period, or for such period thereafter not exceeding five years, or for any shorter period, and upon such terms as he may deem reasonable, to any person or body politic, for use in operation by such person or body politic, any plant, transmission line or other property or part thereof constructed or acquired pursuant to the provisions of this act.

9. In furtherance of any of the foregoing purposes, to modify, cancel or suspend any existing or future contracts for the delivery of power to any person not engaged in the production of war material, or to the extent to which he shall deem the power contracted for to be in excess of the requirements for the manufacture of war material by such persons or to which, in his opinion, it shall prevent the delivery of power which he shall deem necessary for the production of war material of greater or more immediate utility.

10. In furtherance of any of the foregoing purposes, to acquire any property or property rights, including any public or private rights, or any interest in any such rights; or any material, machinery, appliances or processes, patented or otherwise, which he may deem necessary or useful for the construction, development, expansion or operation of any such plant or transmission lines.

11. If in his judgment such action shall be necessary or useful for the purpose of this act, to form one or more corporations under the laws of any state, territory, district or possession of the United States for the purchase, construction, extension, lease, maintenance or operation of any such power plants or facilities, or for the merger or consolidation of any private power plants, or for the purchase of the whole or any part of the capital stock thereof or of the property thereof; provided, that not less than the majority of the capital stock of any corporation thus formed shall be subscribed and during the war period shall be retained by the United States, and that at no time shall it be a minority stockholder therein.

12. To sell or exchange any plants or structures constructed by him and any property to which he shall have taken title, and any rights acquired by him, whenever in his opinion the interests of the United States will be furthered by such sale; provided, that no public right acquired by him shall be alienated for any term in excess of five years after the war period, upon any terms or conditions other than those prescribed by the sovereignty from which such public rights shall have been acquired; provided further, that whenever, in the opinion of the President, any structure or appliance which he shall have installed in any private power plant, or any structure or appliance in any such plant to which he shall have taken title, or any property or right which he shall have acquired from the owner of such plant, shall constitute an integral portion of such private plant, or shall be of such character that it would be uneconomical to separate it therefrom, the owner of such private power plant shall be accorded an option to purchase the same at the then reasonable value thereof, to be ascertained either by agreement or by arbitration, wherein the President shall select one arbitrator, the operator a second and the two thus selected a third, before the same shall be otherwise offered for sale or exchange. . . .

That whenever any act done pursuant to the provisions of this act shall constitute a taking of private property within the meaning of the Constitution, just compensation shall be made therefor in an amount to be determined by the President; and if the amount so determined by the President is unsatisfactory to the person entitled to receive the same, such person shall be paid 75 per cent of the amount so determined by the President and shall be entitled to sue the United States to recover such further sum as added to said 75 per cent will make up such amount as will be just compensation therefor, in the manner provided for by Section 24, paragraph 20, and Section 145 of the Judicial Code.

HEARINGS ON THE BILL

The War Industries Board, the Treasury Department and the Shipping Board served notice on the committee that it was desired that representatives of these governmental agencies should testify at the hearings which began Friday, Aug. 23. The hearings are open, and if public utility men desire to be present the committee will be glad to hear them. It is not known how much time the government officials will require for their testimony, but it is understood that members of the National Committee on Public Utilities, including P. H. Gadsden and E. K. Hall, will be present at the hearings and possibly testify.

The proposed emergency power act has the backing of the administration. The bill was drawn three months ago by the War Industries Board after consultation with J. B. McCall of Philadelphia, Mr. Gadsden and Mr. Hall. It was submitted to several public utility companies at the instance of different departments of the federal government which find themselves in need of additional power for war production with no appropriations or means of meeting their difficulties along that line. There has been much discussion in Washington of the difficulties of the public utilities, which in many cases the Capital Issues Committee has not been able to meet in the way public utilities have desired them to be met. There is in the bill a provision which allows the government to advance money to the companies. This would solve some of the difficulties encountered.

E. K. Hall, a member of the National Committee on Public Utility Conditions, informs the Washington correspondent of the ELECTRICAL WORLD that, if a suitable bill along the lines of the measure as it is now before the committee is finally drafted, the public utilities of the country ought to be in favor of it.

"It is hoped," Mr. Hall said, "that when the bill is reported from the committee it will be suitably safeguarded to protect the legitimate interests of the public utilities, and I am of the opinion that the War Industries Board has had that in mind and that the committee will have it in mind."

OPERATIONS OF BROKERS IN SUPPLIES FOR ARMY

Covenant in Contracts Not to Be So Used as to Harm Long-Established Business Customs or Curtail Industry

The War Department authorizes the statement that the President has agreed with the Secretary of War that the covenant to be inserted in all war supply contracts against the operation of contract brokers and other illegitimate business agents shall not be used in such a way as to be harmful to long-established business customs or to curtail industry.

In accordance with this agreement the General Staff has ruled that exceptions to the covenant will be allowed only in classes of cases first authorized by the Superior Board of Contract Review after finding that the best interests of the government require such exceptions.

The first ruling of the board covers manufacturers of cotton, woolen and worsted and silk-textile industries. The board has decided that there shall be added to the covenant a clause which shall exempt the manufacturer who handles his products through a selling agency or agencies which have handled such products prior to and since April 1, 1917.

Manufacturers and dealers who have the required supplies in stock may make contracts with the supply bureaus. Exceptions to this rule will be allowed only in cases first authorized by the Superior Board of Contract Review of the supply bureau affected after finding that the best interests of the government require such exceptions. The rulings of these boards are subject to the authority of the superior board.

LABOR SHORTAGE IN THE WAR INDUSTRIES

Shortage of One Million Men in War Industries Must Be Met by Drafts on Non-Essential Industries

Faced with a labor shortage in war industries of approximately a million unskilled laborers, and with a tremendous additional shortage coming as soon as the new army draft expansion increases the need for supplies, the United States Employment Service of the Department of Labor puts the problem of supplying these laborers up to the states. An early solution of the present difficulties is imperative for the reason that corresponding shortage in skilled labor is becoming apparent.

Reports from Pennsylvania show that the Midvale Steel plant at Coatesville has been forced to shut down certain units for lack of labor. As a result of shortage and of the placing of the burden upon the states, Georgia was notified that unless that state could at once furnish the eight-million-dollar picric acid plant at Brunswick with 5000 laborers, the entire construction force will be necessarily laid off and the plant moved out of Georgia.

Nathan A. Smyth, assistant director-general of the United States Employment Service, immediately notified all state directors of the service that the shortage of 1,000,000 men in war industries can and must be met by drafts upon non-essential industries, but that men cannot be taken from farms, railroads, mines or other war industries. It is pointed out that unless this labor demand can be met, the new army, which is to be raised by increasing the present age limit from eighteen to forty-five, may be faced with lack of equipment.

MUSCLE SHOALS POWER PROJECT IS SUSPENDED

Statement of the Reasons Given to the "Electrical World," by Assistant Secretary of War Crowell

The War Department, after consultation with the War Industries Board, has ordered the suspension of work on the dam and other construction for the hydroelectric power project at Muscle Shoals, Ala. This statement has been made to the Washington correspondent of the ELECTRICAL WORLD by Benedict Crowell, Assistant Secretary of War, with an explanation of this decision which is in effect as follows:

Mr. Crowell pointed out that no stoppage of work on the building of the nitrate plant at Muscle Shoals is in contemplation, nor is there any contemplation of stoppage of work at the Cincinnati, Toledo and other plants. There are estimates obtainable in Washington, in fact, that the nitrate plant at Muscle Shoals will be placed in production this year.

While the work on the hydroelectric development at Muscle Shoals is announced as being suspended temporarily, it is nevertheless the belief in Washington that this work has been suspended for the period of the war. Three years' time would be required to complete this work, and it is plainly stated at the War Department that in view of this fact the work is of a non-essential character. In other words, the belief is entertained in Washington that the war will be over before this particular power plant could be placed in production.

The decision to abandon the Muscle Shoals hydroelectric plant came as the result of a request to the War Industries Board that this project be placed on the list for priority as an essential undertaking, but the board held that the labor and material being used there and in contemplation are urgently required to meet more immediate war demands. In this view the War Department has concurred.

SAVING THE FUEL IN OFFICES AND STORES

The Bulletin of Massachusetts Fuel Administration Points Out Ways of Lessening the Waste of Coal and Energy

Bulletin No. 2 of the Massachusetts Fuel Administration, just issued, contains many valuable suggestions as to methods of saving fuel in office buildings, stores and isolated power plants. The bulletin was prepared under the direction of the advisory committee of engineers which is assisting James J. Storrow, Fuel Administrator of New England, in his drive to secure more economical plant operation, President Ira N. Hollis of the Worcester Polytechnic Institute being chairman.

Besides pointing out the necessity for reducing the demand for coal by all users, the bulletin discusses general principles in coal saving, details the practices best adapted to economical use of fuel in the boiler room, engine room, lighting and heating systems, and outlines a fuel-saving staff organization for office buildings and stores, with a tabulation of the fuel-saving duties of each member.

Among the suggestions included are shutting off every unnecessary lamp and reducing the size of lamps where possible without the loss of good service, placing the watchman in charge of heating system operations in control of lighting and of lamps, modification of switching systems to give better subdivision, so as to light only parts of rooms in use, and the general use of tungsten lamps for less efficient units.

WORK IS PROGRESSING ON THE SKAGIT RIVER PROJECT

Plants of the City of Seattle and the Puget Sound Traction, Light & Power Company to Be Interconnected

Mayor Hanson, who returned recently to Seattle from Washington, D. C., where he, with other members of the Seattle committee, secured permission of the Capital Issues Committee to issue $5,500,000 bonds for development of the Skagit River power project, states that the city's victory is clean-cut and complete and that no conditions were placed upon the issue that cannot be met readily.

The Capital Issues Committee demanded that the plants of the city and the Puget Sound Traction, Light & Power Company be interconnected so that surplus power of either plant could be used, and both city and traction officials agreed to this.

The City Council of Seattle has taken immediate steps to make funds available for the preliminary work. An ordinance introduced by Councilman Fitzgerald provides for a loan of $100,000 from the general fund to the Skagit River project fund for beginning and prosecuting work pending the sale of bonds.

A report of City Engineer A. H. Dimock of the progress of the work to date shows that a survey has been completed for one-half of the road which the city must build between the end of the present wagon road and the power site, that good progress has been made on the topographic surveys at the site, and that other preliminary matters are going ahead promptly.

SEPTEMBER SERVICE OUTLET CAMPAIGN NEAR

Plans of Society for Electrical Development Fully Completed and Movement Will Increase Economical Use of Existing Appliances

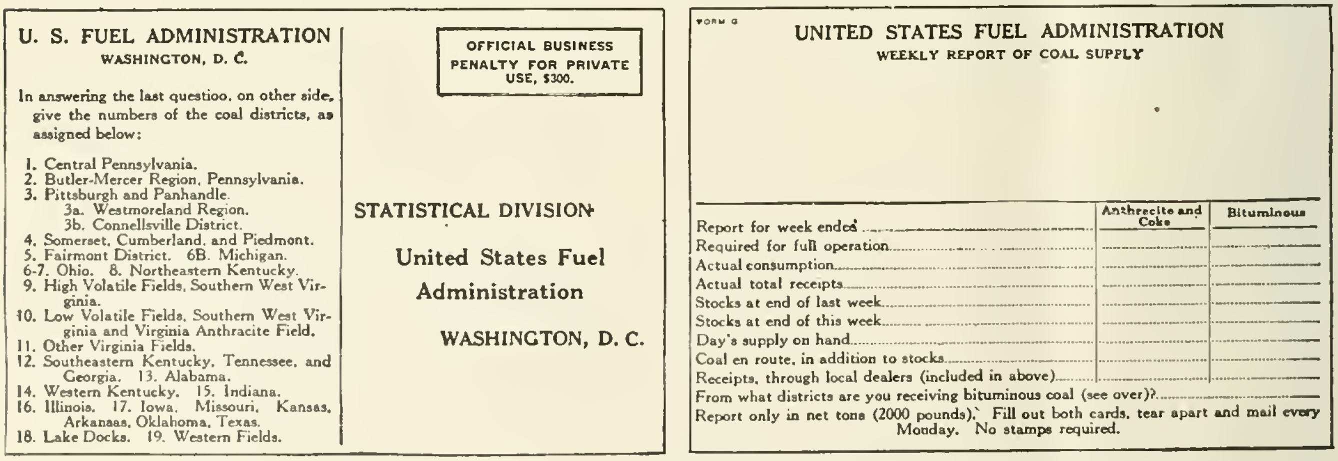
Plans of the Society for Electrical Development, Inc., for the September service outlet campaign are fully completed. The society is sending from its office in New York detailed information which is of much help to the branches of the industry immediately affected by the movement. The direct purpose of the effort is to make more useful the appliances already owned by householders and to show them how to use labor-saving and coal-saving appliances to the best advantage. In doing this the society is emphasizing its desire to conserve existing materials in accord with the spirit of the rulings of the War Industries Board. By providing service outlets the society believes that the off-peak business of the central stations will be stimulated.

GOVERNMENT LOANS $2,000,000 TO UNION GAS & ELECTRIC COMPANY

Third Unit of 30,000 Kw. to Be Provided So that New Generating Station at Cincinnati May Supply Nitrate Plant

A loan of about $2,000,000 will be made by the federal government to the Union Gas & Electric Company, Cincinnati, for the construction of a third unit of 30,000 kw. at the new generating station. The loan will be for five years, but payable at option of the company at any earlier date. As agent for the government the company will build a transmission line from the station to the new government nitrate plant at Broadwell. This line, it is estimated, will cost $1,000,000. The company will deliver energy to the plant on or before July 1, 1919, with a minimum of 30,000 kw. and a maximum of 40,000 kw. for the first year.

Form of Weekly Report on Coal Adopted by the United States Fuel Administration



U. S. FUEL ADMINISTRATION
WASHINGTON, D. C.

In answering the last questioo, on other side, give the numbers of the coal districts, as assigned below:

1. Central Pennsylvania.
2. Butler-Mercer Region, Pennsylvania.
3. Pittsburgh and Panhandle.
    3a. Westmoreland Region.
    3b. Connellsville District.
4. Somerset, Cumberland, and Piedmont.
5. Fairmont District. 6B. Michigan.
6-7. Ohio. 8. Northeastern Kentucky.
9. High Volatile Fields, Southern West Virginia.
10. Low Volatile Fields, Southern West Virginia and Virginia Anthracite Field.
11. Other Virginia Fields.
12. Southeastern Kentucky, Tennessee, and Georgia. 13. Alabama.
14. Western Kentucky. 15. Indiana.
16. Illinois. 17. Iowa. Missouri. Kansas, Arkansas, Oklahoma, Texas.
18. Lake Docks. 19. Western Fields.

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, $300.

STATISTICAL DIVISION

United States Fuel Administration

WASHINGTON, D. C.

FORM G

UNITED STATES FUEL ADMINISTRATION
WEEKLY REPORT OF COAL SUPPLY

	Anthracite and Coke	Bituminous
Report for week ended		
Required for full operation		
Actual consumption		
Actual total receipts		
Stocks at end of last week		
Stocks at end of this week		
Day's supply on hand		
Coal en route, in addition to stocks		
Receipts, through local dealers (included in above)		

From what districts are you receiving bituminous coal (see over)?

Report only in net tons (2000 pounds). Fill out both cards, tear apart and mail every Monday. No stamps required.

This is the postal-card form provided by the United States Fuel Administration for the weekly report on coal supply for industries and public utilities. Identical postal cards, attached together, are to be mailed to the statistical division of the United States Fuel Administration and the office of the district fuel administration.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Maximum Price for Service.—The Maine Public Utilities Commission, in a case affecting the Cumberland County Railway & Light Company and the city of Portland, decided that it would not approve a provision in a contract between a public utility and a municipality which attempts to fix a maximum price for service.

Competing Company.—The Oregon Public Service Commission has decided, in the case of California-Oregon Power Company vs. Keno Power Company that the question of public convenience and necessity cannot be raised under the Oregon statutes by a company seeking to exclude another utility from the field, but can be presented only upon the application of the utility desiring to invade the field.

Discontinuance of Operation.—The Illinois Public Utilities Commission, in case No. 7631, compelled a utility to cease operating where it was shown that the property was in the hands of an unincorporated control which had acquired possession by an unauthorized sale, that standards of service were not complied with, and that the transmission line was in a condition which would render its use dangerous to the public.

Upholding Meters.—A decision of the Illinois Public Utilities Commission, affecting the Jacksonville Railway & Light Company, says: "This commission, in harmony with the rule of public utility commissions of other states, has held in favor of meters as against all other comparative tests as a basis of settlement of disputed claims. To set aside this determining agency for inferential reasons or personal opinions would open the way to endless controversy and question the accepted means provided for measuring the service rendered by a utility. The commission therefore finds that the complainant has failed to establish his claim for rebate for the alleged overcharge in this behalf."

Coal Cost in Electric Rates.—In allowing the DeKalb-Sycamore Electric Company to increase rates the Illinois Public Utilities Commission said in part in its decision: "It appears that in 1914 the company paid for coal delivered at De Kalb $1.99½ per ton, whereas under present conditions it is paying for a similar grade of coal $2.00½ per ton, and after the expiration of the coal contract April 1, 1918, this coal will cost $3.52 per ton delivered in De Kalb. Other operating costs have largely increased. It appears from testimony that after April 1, 1918, the cost of producing electric energy will be approximately 2.15 cents per kilowatt-hour, which is exclusive of any cost of distribution, general expense, meter reading, bill collecting, taxes, depreciation and interest upon the money invested. It appears from the statements of consumption which are submitted that under the existing rate some power consumers are securing energy at a cost of between 2 and 2½ cents per kilowatt-hour, which it is apparent will little more than pay for the actual production cost, to say nothing of meeting the other expenses properly chargeable to power service. Attention should be drawn to the fact that the power business of the company has increased remarkably during recent years. The revenue from commercial power service in 1914 was $19,909, and in 1917 this power revenue had increased to $30,330. . . . The property of the De Kalb-Sycamore Electric Company appears to be well managed and its operations appear to be efficiently conducted. Under these conditions the consumers are securing the benefit of reliable service and efficient, economical operation. It is no more than reasonable that under such circumstances the utility should be entitled to share in the benefits which arise from good business judgment and good management."

Value of Water Power.—The Angelica Water & Ice Company, which the Pennsylvania Public Service Commission has authorized to increase water rates, included in its valuation testimony an estimate on a water power. In the course of its decision the commission says: "Respondent claims a potential power value for the Angelica Creek at the two lower dams of $26,856 in its reproduction cost new valuation, which appears to be based upon measurements of stream flow. In connection with its table of measurements it is stated that 50 boiler-hp. is available for seven months of the year for twelve hours per day, and intermittently for one month more, or substantially for eight months per year, and further that this amount of theoretical water power when converted into kilowatt-hours is worth, at 3 cents per kilowatt-hour, $3,222.72. Under the assumption that this situation relieves the company of 6 per cent interest on construction and 6 per cent for operation and maintenance, the capitalized value of this water power is estimated to be $26,856. The first error in this calculation is to omit a charge for interest, depreciation, taxes and insurance upon the necessary hydraulic development for a theoretical water power to utilize the 50 boiler-hp. The second error is the assumption that respondent would purchase electricity when it owns a steam plant and probably holds it in operation at all times to drive its pumps. The additional coal needed could be purchased cheaper than electricity in a normal market. The basis of any valuation of this potential horsepower therefore should be measured by the amount saved in buying coal instead of electricity. Upon this basis, accepting respondent's calculation as to the amount of potential horsepower, the value of the water rights should be placed at about $6,100 under the conditions that are normally existent."

Rate Increases and Financing.—In approving temporary electric rate increases for the war emergency by the Empire Gas & Electric Company, the New York Public Service Commission, Second District, said in part: "All parties to the controversy are to be congratulated and commended for taking such action as will enable the commission to fix emergency rates without a prolonged investigation involving perhaps a valuation of the company's properties in each community, and which would be conducted at a time when costs are shifting so rapidly that, whatever time might be taken as the basis of the calculation, the situation would probably be materially changed while the investigation was in progress. In fixing these rates the commission has not been unmindful, and, agreeing to submit the matter in this peculiar form to the commission's determination, the municipalities have not been unmindful, of the warning given by the Comptroller of the Currency in his report for 1917, and by the Secretary of the Treasury in his letter to the President of Feb. 15, 1918, that the existing conditions have thrown upon many of the public utility corporations strains which they are unable to endure without prompt help. . . . It is evident that if the public service corporations are to be permitted to make the most necessary extensions and improvements, or even refund outstanding capital obligations, the commission must insure to them such rates as will yield a revenue meeting the requirements of the War Finance Corporation. It is not proposed to permit those which are unnecessarily high in the present emergency, nor is it proposed to pursue a starvation policy, which, if the war should long continue, would inevitably deprive the public of all its utilities. The rates now fixed are emergency rates and are made effective only for a period of six months from the effective date of the new tariffs, and thereafter until the commission shall upon its own motion or upon complaint fix higher or lower rates. . . . It is estimated that these rates will afford such an increase in revenue as should insure the payment of interest on the funded debt and dividends upon the preferred stock. They should also provide a moderate surplus available for dividends on the common stock. They certainly will not yield so large a return as might reasonably be expected in normal times. We think, however, that the public service corporations must and do expect to submit to their share of the common sacrifice, and that neither the appeal of President Wilson nor the ruling of the War Finance Corporation had in view the maintenance in all cases of normal profits."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Arsenal Power-Plant Appropriations.—The War Department has been authorized to spend the following sums of money for improvement, maintenance and construction of arsenal power plants: Frankford Arsenal, Philadelphia, for improving the power plant, including necessary buildings, $205,000; Rock Island (Ill.) Arsenal, additional for improving water-power plant, $100,000, and for maintenance and operation of power plant, $20,000; Watertown (Mass.) Arsenal, for a power tunnel between power plant and shops, including piping, electrical distribution, mains, switchboards, etc., $70,000, and the appropriation of $20,000 for a power tunnel between power plant and shops made in the sundry civil appropriation act for the fiscal year 1918 is appropriated and made available as an additional to the foregoing sum; for repairing and electrifying five large planers and boring mills, $32,000. The total appropriation for this work reaches $447,000.

The Recruiting of Labor.—The Department of Labor authorizes the announcement that at the close of a three days' conference of employment managers, state employment agents and officials of the United States Employment Service instructions were sent out to war industrial plants concerning methods by which the central recruiting of labor will be put into effect. The conference, in which both state and federal agents as well as industrial management were represented, devoted itself to a consideration of methods by which the national system may be made most useful. The instructions which were sent out authorize under certain conditions war industries with field forces for recruiting labor to continue their use after Aug. 1, when recruiting and distributing unskilled labor will in accordance with the President's statement be unified in the national service. The labor recruiting organizations of private industry will, however, after that date operate only under the supervision of the United States Employment Service.

Hydroelectric Power Distribution in Sweden.—United States Consul-General Albert Halstead writes from Stockholm that the capacity of the water plants constructed in Sweden is about 4,000,000 turbine horsepower, of which 1,000,000 turbine horsepower was completed during 1917, one-fourth by the government and three-fourths by municipalities and private corporations, generally large industrial enterprises. The greater part of the energy produced, or say 92 per cent, is being utilized by the larger industries and 8 per cent by the so-called civil requirements, such as for illumination and for the lesser industries. Electrical power is obtainable in all the cities and larger communities of Sweden and to a considerable extent even out in the country. Extensive wiring out in the country is now taking place, the principal reason being the scarcity of illuminating oil as a result of the war. At the same time lively interest is being manifested to prevent the rural population from moving to the cities, and it is thought that power distribution may exert a certain amount of influence.

Electricity Increases Food Production.—That the production of foodstuffs has been increased $21,000,000 a year as a result of bringing 75,000 acres of land in southern California and the San Joaquin valley under production by electric irrigation in the past year is a feature of a statement made by President W. A. Brackenridge of the Southern California Edison Company recently. "The maintenance of continuous and reliable service and the extensions to serve essential industries and electric power for irrigation of agricultural lands are of such paramount importance that we believe that whatever rate adjustments may be necessary to maintain the company in a strong financial position to provide these services can be safely left to the Railroad Commission of the state," said Mr. Brackenridge. "We have received considerable assistance from consumers, who have purchased stock in our company in amounts necessary to finance extensions of our system for their requirements, thus adding to our already large number of stockholders throughout the vast territory which we serve in southern California."

Production and Shipments of Bituminous Coal.—The production of bituminous coal during the week of Aug. 10 decreased 278,000 net tons, or 2.2 per cent, and recorded the fourth successive week of decreased output. The decrease in production during this period was equivalent to 1,000,000 net tons, or 7.6 per cent below the record week of July 13, when production reached 13,286,000 net tons, and makes necessary an output of 14,500,000 net tons during the rest of the summer months to make up the deficit for the coal year to date. The output during the week of Aug. 10 (including lignite and coal coked) is estimated at 12,274,000 net tons, as against 12,552,000 net tons during the week of Aug. 3 and 10,636,000 net tons during the current week of 1917. The average production per working day during the week of Aug. 10 is estimated at 2,046,000 net tons, as compared with 2,092,000 net tons during the week preceding and 1,773,000 net tons during the week of Aug. 10, 1917. The daily average during the current week fell 54,000 net tons, or 2.6 per cent behind the daily summer requirements established by the United States Fuel Administration.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Unprofitable Extension No Ground for Refusing to Comply with Commission's Order.—That a project of extending gas mains, considered as an independent entity, will be unprofitable is no ground for refusing to comply with an order of the Public Service Commission for such extension, the Supreme Court of New York held (170 N. Y. S., 1009).

Power of Commission.—The Common Pleas Court at Hamilton, Ohio, in the case of King Powder Company vs. Thrasher & Leslie, receivers, held that the act creating the Ohio Public Utilities Commission is valid and enforcible in so far as it vests in the commission control over railway rates. It also held that the power of the Public Utilities Commission is not restricted by contracts affecting private interests, and an agreement whereby a right-of-way was granted by a corporation to an interurban railway company in consideration of the employees of the corporation being carried for certain fixed rates of fare is not enforcible against the railway or its receivers, notwithstanding that the contract antedates the passage of the public utilities act.

Reliance on Assurances of Foreman.—Where the assistant foreman's testimony showed that he was the vice-principal, the employer had the right to rely on his statement that electricity in a transmission wire was turned off when he ordered the employee to cut the wire; hence it was immaterial whether rubber gloves or other instrumentalities should have been used, the Supreme Court of Appeals of Virginia held in Lynchburg Traction & Light Company vs. Gordon (96 S.E. 195). If the assistant foreman ordered employee to ascend pole and cut wire, and assured him that there was no current in the wire, and plaintiff, relying on such assurance, took hold of the wire and was injured, he could recover. An employee injured by touching a live wire which the foreman has assured him was dead had the burden of proving that the foreman ordered him to cut the wire and assured him it was dead. If the employee who was an experienced lineman, working about highly charged wires daily and knowing how to handle them, obeyed an instruction, given without assurances, to cut a wire, he could not recover when burned by the current in the wire. If the foreman, in the discharge of a non-assignable duty, assured the plaintiff that the wire was dead, there was nothing upon which the doctrine of assumed risk could rest.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Harry Ridgeway has been appointed to succeed Wallace Foster as manager of the Marin district of the Pacific Gas & Electric Company.

Warren T. Bulkley, former plant supervisor of the Danbury & Bethel Gas & Electric Light Company, Danbury, Conn., is now general superintendent. He has been in this company's service for a number of years.

L. G. Scott, formerly head of the underground department of the Cumberland County Power & Light Company, Portland, Me., has joined the staff of the Cumberland Shipbuilding Company as electrical engineer, with headquarters at Portland.

Frank C. Kidder, business manager of the Newburyport (Mass.) Gas & Electric Company, has been appointed a personnel officer in the bureau of production and engineering of the War Department. He is under orders to report in Washington, Sept. 3.

Stanley N. Abbott, assistant sales manager and office manager of the Hygrade Lamp Company, Salem, Mass., has entered the Officers' Training School for the Ordnance and Quartermasters' Departments, at Camp J. E. Johnston, Jacksonville, Fla.

Carl Allenbach, commercial manager of the Spokane (Wash.) Gas & Electric Company, left that city recently for New York, where he will be in the purchasing department of the Henry L. Doherty Company. He will be succeeded by Luther Gaston of Knoxville, Tenn.

John W. Brooks, general manager for Pass & Seymour, Solvay, N. Y., manufacturer of electrical specialties, has been appointed a member of the new Community Labor Board for the Tenth District, now being formed for the purpose of conferring on labor problems which may arise during the period of the war.

J. Kappeyne, formerly chief engineer of the Public Utilities Commission of the District of Columbia, has recently been appointed transportation engineer to the United States Fuel Administration for the State of Illinois, with headquarters in Chicago. Means for promoting the conservation of fuel by the various electric railway companies of the state will be worked out by Mr. Kappeyne.

Howard M. Turner, assistant to the president Turners Falls Power & Electric Company, with headquarters at Boston, has received a commission as first lieutenant in the Engineering Corps, U. S. A., and has been stationed at Camp Lee, Petersburg, Va. Lieutenant Turner has been prominently identified with the hydraulic engineering development of the Turners Falls system for some years, and the recently completed hydroelectric plant at Montague City, Mass., was designed and built largely under his engineering supervision. He has made numerous investigations of water-power problems and had a part in important commission work at Boston, where he has been assistant to Philip Cabot, head of the Turners Falls system, for about two years.

Monro Grier of Toronto, the new president of the Canadian Electrical Association, is vice-president and solicitor of the Canadian Niagara Power Company, Niagara Falls, Ont. Mr. Grier was born and educated in England, was enrolled as solicitor there in 1882, was called to the Ontario bar in 1884 and created King's Counsel in 1902. He has had an extensive legal practice in the Dominion. He was engaged as junior counsel for the Canadian Pacific Railway in its arbitration proceedings with the Dominion government, and later in arbitration and litigation with the railroad contractors on the Lake Superior section. He engaged later principally in parliamentary practice, until 1901, in which year he was appointed secretary and solicitor for the Canadian Niagara Power Company, of which in 1905 he became vice-president.

Obituary

Willis L. Brownell, Manchester, Conn., ex-treasurer of the Crocker-Wheeler Company, Ampere, N. J., manufacturer of generators, motors, etc., died on Aug. 11, at his home, aged seventy-two.

N. Bruce MacKelvie, vice-president of the Nassau Light & Power Company, Mineola, N. Y., and a director in a number of other corporations, suffered a stroke of apoplexy while bathing off the shore of his estate at Sands Point, Port Washington, L. I., Aug 17, and was drowned.

Sergeant Richard H. Stewart, for the last two years treasurer of the New York Electric Installation Company, New York City, and for many years previously associated with the Dale Lighting Fixture Company and the Acme Gas & Electric Fixture Company, is reported by the government as having been killed in action on July 17. Sergeant Stewart went to France early in the spring with the 308th Infantry.

V. A. Henderson, secretary of the Memphis Gas & Electric Company, Memphis, Tenn., died suddenly Aug. 19. Mr. Henderson was for a number of years secretary and commercial manager of the Merchants' Power Company of Memphis, which was recently consolidated to form the present Memphis company. He was one of the most popular central-station commercial men in the country and was well known not only in the South but throughout the entire United States.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Pennsylvania Electric Association.—The annual convention of the Pennsylvania Electric Association will be held on Sept. 6 and 7 at Bedford Springs. The program of the meeting will be given in a later issue.

Kansas Public Service Association.—On Sept. 17 to 19 the Kansas Public Service Association will hold its annual meeting at Kansas City, Kan. The secretary-treasurer of this association is W. W. Austin, Cottonwood Falls, Kan.

Engineers' Club of Northern Minnesota.—W. J. Downing, chief engineer of the Shenango Furnace Company, has been elected by the Engineers' Club of Northern Minnesota as its representative on the Minnesota Joint Engineering Board.

American Electrochemical Society.—The fall meeting of the American Electrochemical Society will be held at Princeton, N. J., from Sept. 29 to Oct. 1. The secretary of this association is Prof. J. C. Richards, Lehigh University, Bethlehem, Pa.

Smoke Prevention Association.—The annual convention of the Smoke Prevention Association is being held at Newark, N. J. The program, arranged by David J. Maloney, smoke inspector of Newark, vice-president of the association, includes a paper on "Boiler-Room Efficiency."

Electric Club-Jovian League of Chicago.—The annual outing of the Electric Club-Jovian League of Chicago was held at Ravinia Park on Aug. 22. C. W. Pendell was chairman of this outing. It is announced that the first meeting of the fall season will be held Sept. 5 at the Hotel Sherman.

Pacific Division Electrical Supply Jobbers' Association.—It has been announced that the Pacific Division of the Electrical Supply Jobbers' Association has postponed its meeting from Aug. 13 and 14 to Sept. 9, 10 and 11. This meeting will be held in Portland, Ore. This change was made because the Northwestern Electric Light and Power Association will hold its meeting on Sept. 13 in the same place.

Minnesota Joint Engineering Board.—This association called a meeting for Wednesday evening, Aug. 7, at St. Paul to meet Alfred D. Flinn, secretary of the Engineering Council. Mr. Flinn explained the work of the United Engineering Societies, the Engineering Foundation and the Engineering Council and asked for suggestions from the engineers of Minnesota and adjacent territory as to how these three organizations can serve them best.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

ELECTRICAL EXPORTS LARGER FOR THE MONTH OF MAY

Figures for First Five Months of Current Year Reach Total of $22,837,665; for Eleven Months, $49,507,951

Exports of electrical merchandise during May last were larger than for many months previous, excepting March. The value of the electrical commodities exported in May was $5,013,379. This brings the total for the first five months of the current year up to $22,837,665.

May, 1918, exports compare favorably with May, 1917, exports in every way except insulated wire and cable, which showed a falling off of roughly 50 per cent.

For the eleven months ended May last the exports amounted to $49,507,951, compared with $46,323,381 and $27,103,876 for the corresponding periods of 1917 and 1916.

The accompanying figures were compiled by the Bureau of Foreign Commerce:

	May		Eleven Months Ended May	
Articles	1917	1918	1917	1918
Batteries	$204,526	$308,895	$2,566,830	$3,079,522
Carbons	......	112,903	....	1,407,133
Dynamos or generators	235,768	443,331	2,276,929	2,554,620
Fans	66,604	120,930	403,072	653,852
Heating and cooking apparatus	....	48,492	...	484,803
Insulated wire and cables	628,384	344,186	6,558,969	5,376,137
Interior wiring supplies, including fixtures	121,928	140,050	1,020,933	1,393,504
Arc lamps	1,643	1,085	14,691	13,218
Carbon-filament lamps	15,356	10,459	136,464	140,776
Metal-filament lamps	346,037	309,413	1,786,527	2,707,253
Magnetos, spark plugs, etc	......	160,395	....	2,999,615
Meters and measuring instruments	84,294	161,431	955,077	1,383,901
Motors	427,224	574,437	5,245,908	6,077,222
Rheostats and controllers	....	28,516	....	187,889
Switches and accessories	....	148,359	....	2,040,615
Telegraph apparatus, including wireless	101,940	32,339	519,474	282,638
Telephones	156,917	251,785	1,670,352	2,292,120
Transformers	151,766	214,958	1,103,279	1,771,652
All others	2,047,888	1,601,415	22,064,876	14,661,481
Total	$4,590,275	$5,013,379	$46,323,381	$49,507,951

NON-ACCEPTANCE OF BILL ON PART SHIPMENT A HARDSHIP

Government Departments, by Holding up Payment Until Complete Delivery, Make It Difficult to Check up Materials

Electrical jobbers would find it much easier to supply the government if the various departments for which the equipment is ordered would accept a bill covering partial shipments. With deliveries so uncertain partial deliveries are unavoidable in many cases unless the jobber wishes to hold up the shipment until he is able to ship every part of the order. To do this, however, would not be rendering the best service to the government, which as a rule wants and needs the goods just as soon as they can be shipped.

By refusing to accept partial shipment bills the government forces the jobber to hold all charge tickets until the last item is shipped. When, as in an order to a jobber, a hundred or so different items are required, it is frequently found that the stock of a particular item has been exhausted and the manufacturer can make no delivery for many weeks, sometimes months. In such cases the jobber must wait for his money until the last item is shipped.

That the jobber must wait so long for his money is not the only objection to this practice. By neglecting to accept billing for each shipment as it goes forward considerable difficulty must arise to the government when it does check the bills. If a period of three months should elapse between initial and final shipments it is easily conceivable that the checking at the end might disclose many items missing or, what is more frequently the case, damaged. A number of such instances have occurred, in one of which the government claimed not to have received a certain switchboard. A few months later it was found hidden under a pile of other stuff that had been received later. The board was in no condition to be used.

ENGLAND LOOKING TO TRADE AFTER THE WAR

Roughly 50 per Cent of United States Electrical Exports Go to British Home and Colonial Markets

For some months the English electrical interests have been making a study of conditions in order to make some plan for trade after the war. The Board of Trade departmental committee, in its report on electrical manufacturing, laid considerable emphasis on the unfavorable comparison between German and English electrical foreign trade. The report indicated clearly that the English manufacturers intended to compete with Germany for markets that Germany enjoyed prior to the war.

At the end of its report the committee drew the following conclusions:

"1. That the earnings of electrical manufacturing concerns have been insufficient, in most instances, to attract capital for development.

"2. That electricity has not been used in this country to the same proportionate extent as in Germany or America.

"3. That the necessity of retaining the home markets as a basis of overseas trade has never been properly recognized in this country.

"4. That our fiscal system has in the past operated adversely to our manufacturers.

"5. That the dependence of manufacturing upon finance has not been generally appreciated, and, in contrast with German practice, British financiers, when providing funds for enterprises, have not been accustomed to impose conditions insuring the use of British-made goods for original equipment, extensions and renewals.

"6. That the government and public of this country have been unduly influenced by the fear that combination or association might result in enhanced prices, and have lost sight of the advantages attending combination or association—such as reduced cost by producing in large quantity in standard patterns, and the united front which can be presented in competing abroad against foreign manufacturers.

"7. That in Great Britain the facilities for cargo handling and transport, including carriage by canals and waterways, compare unfavorably with those of Germany and America.

"8. That a better understanding between employers and employed, and better working and housing conditions, are essential.

"9. That after the war a large increase in every branch of electrical industry at home and abroad may confidently be expected, and that measures along the lines indicated in this report should be taken to secure the business for British manufacturers."

It thus is evident that English manufacturers intend to make a vigorous fight for domestic and colonial markets.

In this connection, therefore, it would be interesting to see to what extent England and her possessions have purchased goods manufactured in the United States. The total for the fiscal years which ended June 30, 1913, 1914, 1915, 1916 and 1917 are respectively as follows: $12,608,295, $11,074,828, $11,390,786, $14,219,559 and $21,620,266. Incidentally these figures represent large percentages of the total electrical foreign trade of the United States as shown in the following: 1913, 47 per cent; 1914, 44 per cent; 1915, 57 per cent; 1916, 47 per cent, and 1917, 41 per cent.

The accompanying table shows how American manufacturers have been segregated in the foreign British markets. Particular interest attaches to the trade with Canada, the biggest foreign customer of American electrical goods, which roughly takes 25 per cent of the exports annually.

	1913	1914	1915	1916	1917
1 United Kingdom......	$1,483,981	$1,791,835	$4,113,412	$5,815,371	$7,200,634
2 Bermuda.	21,157	15,365	17,468	14,294	16,880
2 Br. Honduras.	5,448	10,008	10,549	8,489	16,600
4 Canada....	8,695,473	6,667,277	4,253,557	5,196,874	9,928,311
5 Newfoundland and Lab....	82,062	79,762	49,258	84,531	183,140
6 Br. West Indies......	60,195	69,711	56,237	57,110	111,465
7 Br. Guiana...	17,888	19,382	20,502	12,640	36,494
8 Br. East Indies	480,462	397,757	352,888	416,754	849,419
9 Hongkong....	50,363	59,155	47,514	115,147	75,485
10 Br. Oceania...	1,330,969	1,583,085	2,131,504	2,011,758	2,692,094
11 Br. Africa....	377,314	379,633	333,945	479,913	479,969
12 Egypt........	2,983	1,858	3,952	6,678	29,775
Total.........	$12,608,295	$11,074,828	$11,390,786	$14,219,559	$21,620,266

METAL MARKET SITUATION

Increased Activity in Copper Due to Price Remaining Fixed Until Nov. 1—Tin Continues Lower

Consumers who have been hanging back on the theory that the price of copper might be reduced are now placing their orders because of the government announcement that the price will continue at 26 cents until Nov. 1. Producers are booking sales up to the limit of their assumed ability to make delivery through September and October.

The price-fixing committee's plan was to have the maximum price of 26 cents a pound remain in effect until Dec. 15. On the protest of the producers, however, this time was shortened to Nov. 1. It would seem that what has happened gives assurance that there will be no overproduction during the remainder of the war and that the return of peace will find reviving industry dependent wholly upon the then current volume of output. Therefore there is a great likelihood of higher prices for copper after the war.

There has been no real market in tin for some days, owing to the lack of demand, but prices may be said to be 1 cent per pound lower than the general market of last week.

The price of spelter is advancing, owing to the reduction of surplus stocks. It is said that if the present reduction continues for another month, half of the surplus of prime Western spelter will be wiped out.

NEW YORK METAL MARKET PRICES

	Aug. 13	Aug. 21
Copper:	£ s d	£ s d
London, standard spot....	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake..........	Govt. price 26 00	Govt. price 26.00
Electrolytic..........	Govt. price 26 00	Govt. price 26 00
Casting..........	Govt. price 26 00	Govt. price 26.00
Wire base..........	29 25	29 25
Lead, trust price..........	8 05	8.05
Antimony..........	13 50 to 13 75	14 25 to 14 37½
Nickel, ingot..........	40 00	40 00
Sheet zinc, f.o.b. smelter..........	Govt. price 15 00	Govt. price 15 00
Spelter, spot..........	8 80 to 8 90	9 35 to 9.47½
Tin, Chinese *..........	91 00	90 00
Aluminum, 98 to 99 per cent.....	Govt. price †33 10	Govt. price †33.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire.......	23 50 to 24 50	23.50 to 24 50
Brass, heavy..........	14 50 to 15.00	14 50 to 15 00
Brass, light..........	11 50 to 12.25	11 50 to 12 25
Lead, heavy..........	7 12½ to 7.50	7.50 to 7.75
Zinc, old scrap..........	5 50 to 5.75	6 25 to 6 50

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* No Straits offering. † In 50-ton lots or more; carload, 33 10 cents per lb.; 1-ton to 14-ton lots, 33.20 cents per lb.

THE WEEK

IN TRADE

HEAVY government construction is maintaining an active market in all lines which can supply the demand. There is some talk of supplying material only on government order on account of the difficulty of replacement. Considerable construction of essential plants is in progress in the West. A central station on the Pacific Coast has bought land for building a new power plant, and efforts are being made for tying the companies together and diverting the power for war work.

The labor situation everywhere is unsettled on account of the pending draft regulations. This is probably a temporary flurry and will be cleared up when the new bill is on the statute books. New wage decisions are also noted on the Pacific Coast, the skilled workers seeming to take advantage of the limited supply of trained men.

In general, the idea seems to prevail that the demand for material will always be greater than the supply. Chicago is bidding for large war contracts on the ground that it is the center of railroads and an ideal place to secure raw materials. Moreover, the apparent decrease in population leaves adequate accommodation for housing war workers. This is shown by a recent survey of vacant apartments and houses in one district of the city.

As was noted last week, material is being sold at the current prices at the time of sale—that is, the prevailing price at the time when the order is placed is disregarded if any advance has been made by the time of delivery.

Electrical welding of ships, instead of riveting, is attracting considerable attention in the Northwest. An aggressive campaign in this section for government contracts has greatly stimulated business in all lines. Some industrial plants are building or enlarging their factories to take care of this increased work.

No summer let-up is noted in the East, and from all indications there will be no reduction in demand for materials.

As the length of time since the United States has been at war increases, the need of eliminating non-essentials seems to become more fully realized and voluntary efforts are apparent for directing our total efforts and materials toward the task of winning the war.

NEW YORK

Staples are becoming difficult to obtain on account of the shortage of materials and the drain of man power for work in government plants. This entails a hardship on the jobbing industry, especially taking into consideration the uncertainty concerning the government's final course. Sales are not the question at this time; it is merely a question of supplying the demand. Any product that uses steel, copper, rubber or brass is bound to be restricted in manufacture, and the amount of these materials that can be obtained will depend entirely upon the necessity of the device.

CONDUIT.—Not much conduit is to be had because of the large demand by the government for industrial plants.

WIRE.—The wire shortage is due to the need of the government for certain sizes of wire for use in the field. It is predicted by one jobber that there will be an extreme shortage in B. & S., gage Nos. 14, 16 and 18. The prices remain unchanged for copper wire.

LAMPS.—Lamps can be had in some quantities to supply the heavy demand from industrial plants.

FANS.—Practically all fans of the larger size were sold during the hot weather of the last few weeks. One jobber states that he has a stock of fans under 12 in., there being very little sale in the smaller sizes. It is believed that this is due to the short, intensive hot-weather period this year, which led to the purchase of fans large enough to give material relief. Moreover, the popularity of small-size fans several years ago contracted the future market.

FARM-LIGHTING SETS.—An increasing demand for farm-lighting sets seems large enough to insure heavy sales until the advent of winter, when it will not be so easy to get into communication with farmers.

POLE-LINE HARDWARE.—The fact that there is no new line construction in this vicinity reduces the demand for pole-line hardware and line material.

CHICAGO

Chicago is being depopulated by the increasing drain of men to work in Eastern and Southern war industries. It has been estimated that as many as 125,000 men have left the city in the last six months. New drafts of unskilled laborers already made or announced by the United States Employment Service will take perhaps 50,000 more men out of Chicago and neighboring territory by Oct. 1. These figures count only the workmen. To them must be added a certain percentage of the wives and children of these men, who will gradually move away to join the head of the family.

There has just been made a survey of the territory in Chicago south of Thirty-first Street and east of Halsted Street as far south as the city limits. The figures show that there are in this comparatively small part of the city nearly 5000 vacant flats, something like 800 vacant houses and about 12,000 vacant rooms. To a considerable extent the same conditions prevail in other parts of the city. Chicago is close to the coal mines, to iron and steel and all the raw materials needed in the manufacture of munitions. It is the greatest railroad center in the world and also has the additional advantage of lake transportation. It stands in the center of a great food-producing country. Most important of all, Chicago and the territory about it are not already congested by more freight and people than can be easily handled.

There is every reason why practically all the new and tremendous war orders of the government should be placed in Chicago or nearby territory. Looked at, not from a sectional and profit standpoint, but solely from a national and patriotic angle, the Middle West is the proper location for new government plants, as well as for the placing of government orders in plants already established and not now engaged in war work. A suggestion has recently been made that a conference on this subject be held in Chicago in the near future, and steps are being taken to carry out this suggestion

FANS.—Despite the recent hot spell, fans are reported to be in fair condition.

WIRE.—Deliveries on various sizes of wire from one large Chicago factory range anywhere from six weeks to six months. It is stated that 70 per cent of the work turned out by this factory is for government purposes.

INDUSTRIAL LIGHTING FIXTURES.—The demand for fixtures for use in industrial plants, especially the adjustable type, is great. Deliveries are good.

WASHING MACHINES.—One large manufacturing concern that builds about forty-five machines a day states that its entire output for the year 1918 was sold by the middle of February. The recent ruling of the government placing this industry in class B and allowing it 75 per cent of the material that it used during 1917 will cut the production of this manufacturer and many others to a great extent. Many of the washing-machine manufacturers have increased their output and enlarged their plants in the last six months, but they will be allowed material only on the 1917 basis.

FARM PLANTS.—The fall selling season is well under way, and the demand for farm plants is exceedingly great. Most manufacturers, however, say they are in a position to make good deliveries.

BOSTON

A very busy summer is being experienced by the trade, and as the country's great war machine accelerates its relentless advance little is heard of any prospective recession below present levels of sales. Collections continue fairly satisfactory, although in some quarters difficulties are being experienced in obtaining prompt remuneration for shipments forwarded for government use on the receipt of oral orders from army officers Stocks are rather uneven at the moment. In some lines jobbers are husbanding their material in view of the difficulties of replacing it except for specific war orders. This is particularly the case with conduit, which now goes forward only on the strength of bona-fide war industry work. There is much uncertainty in the trade as to the scope of the new draft law and its consequent effect upon the supply of trained men. Labor conditions in the electrical field are steadier this week than for some time, barring a threatened strike on certain suburban trolley lines at Boston. Deliveries are still greatly handicapped by insufficient railroad service In general, the trend of prices is still upward.

WIRE AND CABLE.—Government orders hold the center of the stage. Prices are running higher than a month ago, by and large. The demand for cable for war plants continues most active, and rush motor-truck deliveries are being called for even in some cases where the regular railroad facilities might meet the situation.

LAMPS.—Stocks are in better shape than for some time, especially in the ordinary sizes of tungsten unit. The activities of the Fuel Administration are influential in reducing consumption sufficiently to permit the accumulation of stocks to proceed more rapidly than is normal for this time of year. Dealers look for heavy fall trade in sizes below 40 watts.

IRONS.—Trade is remarkably good, considering the small amount of advertising at present being displayed. There is a scarcity in New England of one of the most prominent makes of irons, due probably to the commandeering of steel en route to the factory. Other competing makes are consequently being heavily drawn upon.

FANS.—Jobbers wh have pushed good lines and followed up sales opportunities consistently report an excellent fan business this summer, despite the protracted cool weather of last month. In such cases few fans will be carried over until spring. There is some discussion in the trade as to whether fans are essential products or not, but the feeling is widely prevalent that any electrical device which increases the comfort of the war worker under adverse weather conditions and thus tends to yield increased output cannot be regarded as a non-essential. Not long since the government commandeered a carload or two of fans for its own uses, and those in the trade who hear of this action find it hard to believe that the electric fan will go into the limbo of things not needed in the industrial war program.

MOTORS.—Sizes up to and including 10 hp. can now be had freely for immediate delivery. One Boston jobber reports a stock of 700 motors not exceeding 10 hp. rating. These have been gradually accumulated as the result of far-sighted buying, and as the revamping of industrial motor installations becomes more general in the interests of fuel and energy saving the trade is expected to become brisker in these smaller units. Large motors are less readily obtainable in comparison with the smaller ones. Prices hold firm and the war plants are still buying liberally.

ELECTRIC RANGES.—The quiet but none the less insistent demand for electric ranges continues. The total volume of business is, of course, far below that of normal times, and the central stations are not as actively interested as in the days when "priority number" was an unknown term. The outlook for material is too uncertain at this time to justify any widespread campaigning of the house-to-house order, in the opinion of central-station men. The jobber, too, looks upon the electric range as an uncertain quantity from the standpoint of supply. Close observers believe, however, that it will be impossible to hold back the development of this class of business so long as a fair supply of material can be applied to this use, and that the close of the war will find many more ranges in service than were in operation in 1914.

POLE-LINE MATERIAL.—The New England market is fairly dull in this branch of the supply business. Central stations are doing little beyond piecemeal construction in connection with war industry plants, and the electric railway market is below par though some additional revenue is being derived from higher rates.

SEATTLE—PORTLAND

Both wholesalers and retailers report the volume of sales in the past week as excellent and showing a slight increase over the last two weeks. The increase was not along any special line, but consisted of heavier buying along general lines. Recent contracts for steel ships let in Seattle presage still heavier buying in the immediate future. Industrial sales to both steel and wooden yards and to foundries and machinery manufacturing plants operated in conjunction, keeping up remarkably well. Portland territory reports proposed immediate electrical installations in industrial plants in that city. The Pacific Coast Steel Company, Portland, is proceeding with the installation of a plant consisting of two 40-ton open-hearth steel furnaces and rolling mills, all equipped with electric drive.

The starting of operations in the new steel yard with five ways, which has contracts for ten 9500-ton ships; the enlargement of the wooden shipyard from two to four ways, with the receipt of additional government contracts, and the enlargement of other industrial plants are the features of the news from Portland.

The city of Seattle lighting department recently awarded contracts for eight 1000-kva. transformers to be used in shipyards where the city is furnishing a large amount of energy.

Northwest shipyard owners are deeply interested in experiments being conducted in the electric welding of steel ships in place of riveting. The experiments are authorized by and under the supervision of the Shipping Board. Experiments so far conducted have included welding of beveled joints, lap joints and butt joints. The reaming done under this process is asserted to have been excellent, and electric welding is said to be faster and cheaper than riveting and a great labor saver.

Spokane reports that state industrial plants throughout the Inland Empire reflect progress and healthful manufacturing conditions. Coupled with the building of new factories is the enlargement of older concerns, adding of extra shifts and taking on of heavier contracts. More war orders are being placed since the adaptability of plants in this section has been proved and since an aggressive campaign to secure government business has been waged.

Jobbers and manufacturers in Spokane report business brisk in most lines. Building conditions in the Northwest along residence lines specifically continue to attract attention. This is especially true in Seattle, where building permits issued this year up to date exceed in valuation permits issued for the entire year of 1917. In response to the call for new homes, 5000 in all, it is of interest to note that 1109 residences are now building in Seattle.

Labor shortage continues to harass business. In the steel shipyards in Portland, Tacoma and Seattle the situation is acute. Seattle has appealed to professional and business men to give their services for sixty days, and Portland expects to make a like appeal. The power apparatus demand is good and increasing, but stocks are low and hard to replenish. Equipment moves almost as fast as it is secured. Portland territory reports low stocks, and the consequent difficulty in securing motors and transformers of high rating is having a tendency to slow down the establishment of new industries and enlargement of existing ones.

Domestic appliances are moving well, with washing machines an easy leader. Stocks are becoming depleted, and shipments are coming through very slowly. Range sales show but little fluctuation. Wire is becoming exceedingly difficult to obtain. It is anticipated that dealers will soon be unable to obtain stocks except for war work. Shortages still exist in rubber-covered and stocks of the larger sizes. In industrial plants, whenever possible, substitution is resorted to. The demand for residence wire, including devices, is steadily increasing. Collections are very good.

SAN FRANCISCO

An unusual amount of construction work, actual and contemplated, was announced during the past week. There are unmistakable signs that private and non-essential building will be limited to the vanishing point, not alone from shortage of material but from sentiment; for several municipalities, when asked to revise wiring regulations in accordance with the present rate of demand and supply, answered that they would not do so unless such action was necessary for the government and its allied industries. The city of San Francisco, for instance, made such a decision. Government building contemplated includes fourteen permanent buildings for the Marine Brigade barracks at Dutch Flats, near San Diego, the construction totaling $1,500,000 of a permanent character and $500,000 more for temporary structures.

The sea-plane station at North Island, near San Diego, will be immediately enlarged by the construction of hangars, landing places and quarters for men and officers.

The Universal Gas & Electric Company of San Francisco has signed a new wage agreement granting a minimum wage to journeymen electricians of $5.80 per day and to cable splicers of $6.80 per day. Workmen employed by the San Francisco Board of Electricity have requested that their wages be increased to $6.50 per day. Other construction announced consists of $100,000 for Visalia hospital, a forty-thousand-dollar addition to the Stanford hospital of San Francisco, a number of buildings for miscellaneous purposes by the Southwestern Building Company of San Pedro, a hundred-thousand-dollar hotel at Woodland, a hundred-and-fifty-thousand-dollar cyanide plant at Azusa and a calcium-carbide plant at the National Carbon Company's factory in San Francisco. The San Joaquin Light & Power Company has purchased a five-acre tract in the outskirts of Fresno for a new power plant. A large number of New Power Company installations all over the state, are reported, along with the tying together of systems and the diverting of power to war-plant areas. The Pacific Gas & Electric Company has constructed a new substation (E) in the Mission section of San Francisco to handle power for part of the Ocean Shore Railroad and the municipal railways in San Francisco and eventually to transmit it to the new territory opened by the construction of the Twin Peaks tunnel.

STREET LIGHTING.—Santa Barbara and Salinas report consideration of street-lighting projects, but it is very probable that, as was the case with Fresno, the State Council of Defense will recommend that they take a patriotic view of these enterprises if they are non-essential.

RAILROADS.—The Northern Electric Railway is considering the construction of a new freight terminal at West Sacramento. The San Francisco municipal railroad will be extended into the Parkside district to Twentieth Avenue. The subject of an extension of the municipal railroad to serve the Union Iron Works was reported by the city engineer, to cost more than $400,000 with a period of construction so indefinite that it would not serve the present urgent need. Another plan of serving the Union Iron Works from Potrero Avenue over Seventeenth Street, at an estimated cost of $180,000, was recommended.

BELLS.—The reported big advances by Eastern factories in the price of bells, including skeleton weatherproof, watertight and iron-box, have sent dealers scurrying for government priority orders on which they may base their own protection stock orders. These advances, it is reported, will average from 33⅓ to 50 per cent over previous prices.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List Per 1000 Ft.
No. 14 solid	$61 00
No. 12 solid	71 00
No. 10 solid	90 00
No. 8 solid	106 00
No. 6 solid	145 00
No. 10 stranded	95 00
No. 3 stranded	115 00
No. 6 stranded	160 00
No. 4 stranded	205 00
No. 2 stranded	266 00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104 00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575 00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	12½%—57 25
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	12½%—66 75

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	12½%—97 75
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	12½%—126.80

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20% to List
Coil to 1000 ft	5% to 15%
	No. 12 Solid
Less than coil	+20% to List
Coil to 1000 ft	5% to 15%

Twin-Conductor

	No. 14 Solid
Less than coil	$115 00 to $80 00
Coil to 1000 ft	98 80 to 75 00
	No. 12 Solid
Less than coil	+20% to +5%
Coil to 1000 ft	5%

ATTACHMENT PLUGS

List ranges from $0 22 to $0 30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1 5 std. pkg	12%
1/5 to std. pkg	20%
Std pkg	44%

DISCOUNT—CHICAGO

Less than 1 5 std pkg	+20% to 12%
1/5 to std. pkg	List to 20%
Std. pkg	25% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 40	$0 40
12 to 50	.35—.36	.35—.36
50 to barrel	31—.32	32—.33
Barrel lots	.28—.289	.29—.299

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Igoitor
Less than 12	$0.40	$0 40
12 to 50	35	.35
50 to barrel	.319 to .322	329 to .332
Barrel lots	.289 to .292	.299 to .302

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5 00
⅜	250	7 50
½	100	10 00
¾	50	13 00
1	50	21.00
1¼	50	26 00
1½	25–50	35 00
2	25–50	45 00
2½	25–50	52 00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00— 82 50	$69 75— 75 00
⅜-in. double strip	75.00— 82 50	72.00— 75.00
½-in single strip	100 00—110.00	93.00—100 00
½-in. double strip	100 00—110 00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75 00 to $78 75	$63 75 to $71 25
⅜-in. double strip	78 75	71 25
½-in. single strip	100 00 to 105 00	75 00 to 95 00
½-in. double strip	105 00	93 00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0 05½	1	$0.25
¼	0′	1¼	.33
⅜	.09	1½	.40
½	12	1¾	47
⅝	15	2	.55
¾	18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	25.00–55 00	24 00–24 45	21 50–23 00
¼-in.—	30 00–60 00	27 00–27 28	23 50–26 00

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$60 00	$30.00	$26.50
¼-in.—	65 00	32 50	29 00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
¼	$0 08½
⅜	08½
½	.08½
¾	11½
1	17
1¼	.23
1½	.27½
2	37½
2½	.58½
3	76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0 05	$0 19
⅜	06	.19
½	.07	.19
¾	.10	25
1	.13	.37
1¼	.17	45
1½	.21	50
2	.28	1 10
2½	.40	1 80
3	.60	4 80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	7% to 12%	10% to 15%
2500 to 5000 lb.	9% to 14%	12% to 17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+5% to 6 8%	+3% to 8 8%
2500 to 5000 lb.	9 8 to + 20%	11 8% to list

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5 00 to $6 00
Discount	30%

CHICAGO

List price	$5 50 to $6 00
Disconot	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg	List
3-amp. to 30-amp	100	$0 25
35-amp. to 60-amp	100	.35
65-amp. to 100-amp	50	90
110-amp. to 200-amp	25	2 00
225-amp. to 400-amp	25	3 60
450-amp. to 600-amp	10	5 50
600-Volt		
3-amp. to 30-amp	100	$0 40
35-amp. to 60-amp	100	60
65-amp. to 100-amp	50	1 50
110-amp. to 200-amp	25	2 50
225-amp. to 400-amp	25	5 50
450-amp. to 600-amp	10	8 00

DISCOUNT—NEW YORK

Less than 1/5 std pkg	30%
1 5 to std pkg	41%

DISCOUNT—CHICAGO

Less than 1 5 std pkg	30%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$5 00 to $5.50
1/5 to std. pkg	4 50 to 4 75

Standard packages, 500. List, each $0 07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$7.00
1/5 to std. pkg	$5.15 to 5.75

Standard packages, 500. List, each, $0.07

LAMPS, MAZDA

105 *to* 125 *Volts*

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0 30
60-watt—B	100	35
100-watt—B	24	70
75-watt—C	50	.70
100-watt—C	24	1 10
200-watt—C	24	2.20
300-watt—C	24	3 25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25.	50	53
25-watt—G 25.	50	.55
40-watt—G 25.	50	.55
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30	24	77
Round Bulbs, 4⅜-in., Frosted:		
100-watt—G 35.	24	1 10

DISCOUNT—NEW YORK

Less than std. pkg	List
Std pkg	10%

DISCOUNT—CHICAGO

Less than std pkg.	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C. No 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30 20—$35 90
Coil to 1000 ft	26.95— 27 18

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$35.00
Coil to 1000 ft	26 00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24 00

CHICAGO

Net per 100	$21 75 to $30 00

OUTLET BOXES

Nos.	List, Per 100
101—A, A 1½, 4 S.C., 6200, 320	$30 00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30 00
103—C.A., 9, 4R, B 1½	25 00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25% to 33%	20% to 27%
$10 00 to $50 00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Glavanized
Less than $10 00 list	40%	35%
$10 00 to $50 00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std pkg.	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std pkg.	10%
1/5 to std. pkg	20%
Std pkg	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$21 00 to $38 00
1/5 to std. pkg.	17 85 to 19 00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$16.80 to $24 15
1/5 to std. pkg.	15 80 to 21.00

Standard package, 2200. List per 1000, $20.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500 5½ N.C.—Solid	Std. Pkg 4000 Nail-it—N.C.
Less than 1/5 std. pkg.	$16 00 to $20 50	$32 00
1/5 to std. pkg.	13.60 to 15 60	27 20

CHICAGO

Per 1000 Net	Std. Pkg 3500. 5½ N C.—Solid	Std. Pkg 4000 Nail-it—N.C.
Less than 1/5 std pkg.	$11 70 to $18 40	$33 35 to $36 80
1/5 to std. pkg.	10 15 to 16 00	26 60 to 32.00

SOCKETS AND RECEPTACLES

	Std Pkg.	List
¼-in. cap key and push sockets.	500	$0 33
¼-in. cap keyless socket	500	.30
¼-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10% to + 10%
1/5 to std pkg.	5% to 8%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List to 10%
1/5 std. pkg.	16⅔%

SWITCHES, KNIFE

250-*Volt, Front Connections, No Fuse*

High Grade:	
30-amp. S. P. S. T.	$0 80
60-amp. S. P. S. T.	1 20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3 48
300-amp. S. P. S. T.	5 34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1 80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5 08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	$0.42
60-amp. S. P. S. T.	.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3 76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+5% to Net
$10 to $25 list	11% to 15%
$25 to $50 list	14% to 20%
	Low Grade
Less tban $10 list	5% to 10%
$10 to $25 list	16% to 25%
$15 to $50 list	24% to 28%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+15% to +5%
$10 to $25 list	11% to List
$25 to $50 list	5% to 14%
	Low Grade
Less than $10 list	+5% to 5%
$10 to $25 list	8% to 16%
$25 to $50 list	24% to 28%

SWITCHES, SNAP AND FLUSH

5-*Amp. and* 10-*Amp.,* 125-*Volt Snap Switches*

	Std. Pkg.	List
5-amp. single-pole	250	$0 28
5-amp. single-pole, ind	250	32
10-amp. single-pole	100	.48
10-amp. single-pole, ind	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-*Amp.,* 250-*Volt Push-Button Switches*

	Std. Pkg.	List
10-amp. single-pole	100	$0 45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+10%
1/5 to std. pkg	5% to 8%
Std. pkg	23% to 25%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	10% to 20%
1/5 to std. pkg.	List to 16⅔%
Std. pkg.	25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0 34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	40% to net	30% to net
$2.00 to $10.00 list	10% to 40%	5% to 40%
$10.00 to $50.00 list	20% to 60%	10% to 52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25% to 40%	15% to 30%
$2.00 to $10 00 list	25% to 50%	15% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6 00
Discount	30%

CHICAGO

List price	$6 00 to $6 50
Discount	25% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0 434—$0 4625
No. 18, full spools	384— 4425

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0 65 to $0 69
No. 18, full spools	55 to .575

WIRE, RUBBER-COVERED, N. C

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15 00–$20 00	$12 50–$15 00	$11 00–$11 25
12.	21 29– 27 10	19 35– 23 20	17 05– 17 42
10.	29.70– 37 80	27 00– 32 40	23 75– 24 30
8.	41 90– 53 35	38 10– 45 70	33 45– 34 29
6.	60.30– 84 40	54 27– 72 35	51 55– 53 05

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft	500 to 2500 Ft.	2500 to 5000 Ft
14.	$19.00–$21 00	$14 00–$16 00	$12 50–$13 25
12.	27.53– 28 70	23 86– 28 70	22 02– 24 50
10	33 02– 40 10	30 48– 40.10	27 44– 34 23
8.	46.09– 56 50	42 54– 48.23	38 99– 41 34
6.	91 18– 91 30	61 76– 77 84	52 18– 66.72

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 *to* 3 *Inc.*

NEW YORK

	Per 100 Lb. Net	
Less than 25 lb	$37 75	$38.40
25 to 50 lb	36 40	37.75
50 to 100 lb	32 40	36.75

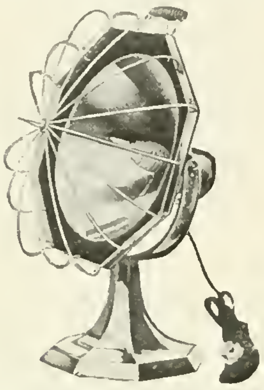
CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$37 00 to $39.72
25 to 50 lb	36 00 to 38.7
50 to 100 lb	35 00 to 37 72

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Deep Parabolic Reflector Heating Stove



SWIVEL ALLOWS HEAT TO BE DIRECTED TO ANY ANGLE

Full reflection of the heat rays is claimed for a reflector-type radiator that is being manufactured by the Rutenber Electric Company, Marion, Ind. This is accomplished, the maker says, by the extra deep parabolic reflector which concentrates the heat rays and the fact that the heating element is placed vertically in the focal plane. This type of radiator has a swivel base so that it can be turned at any angle. Also a hole in the base allows the device to be placed on the side wall where the heat may be reflected in any angle required.

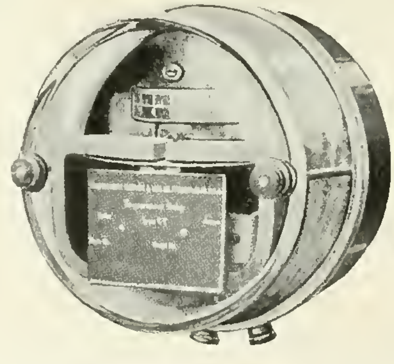
This device is furnished complete with 8 ft. (2.4 m.) of heater cord, feed-through switch and attachment plug which can be used on any lamp socket. The wattage is 615 and the shipping weight is 10⅛ lb. (4.6 kg.)

Temperature Relay for Overload

A relay known as type CT, built by the Westinghouse Electric & Manufacturing Company, is designed so that it will automatically trip the circuit breaker of a power circuit when the temperature reaches a danger point under excessive current. This device may be used to protect any alternating-current apparatus from excessive heating, if the apparatus is so arranged that an exploring coil can be installed.

The relay is intended to protect apparatus against overheating from sustained overloads. To afford this protection with the least interruption of service, the breaker should be tipped through the direct effect of the temperature of the apparatus. The relay should be so arranged that it prevents the breaker from tripping if the overload is of such short duration that the temperature does not rise to a dangerous value, while, if the overload persists, the breaker must be tripped out as soon as the temperature rises beyond the critical value. This is accomplished by an operation similar to the Wheatstone-bridge principle. Two arms of the bridge are copper exploring coils arranged to be placed in the oil or embedded in the windings of the apparatus to be protected. The other two arms are unchanging resistances, mounted in the relay.

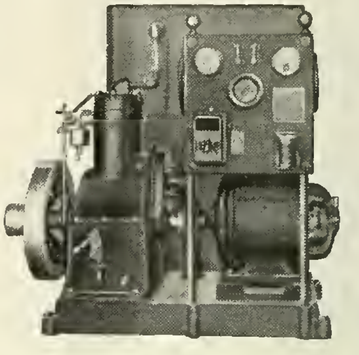
The current for the bridge is supplied by the current transformer connected in the circuit of the apparatus to be protected. The relay has two windings, corresponding with and co-operating to produce a torque in a manner similar to the current and voltage coils of a wattmeter. The main winding is a coil operated directly by the current transformer. The auxiliary coils are connected to the Wheatstone-bridge arms as in a galvanometer connection and thus receive current the magnitude and direction of which depend upon the resistance of the search coils. Above a certain temperature the torque of the relay is in the contact direction and below in the opposite direction. It will thus be noted that in order to close the contact two predetermined conditions must co-exist—excess current and excess temperature. Neither one will separately trip the relay.



PROTECTS APPARATUS AGAINST OVERHEATING FROM SUSTAINED OVERLOADS

Farm-Lighting Plant

Longer battery life and the elimination of engine trouble are the two features claimed for an electric lighting plant for farm and country-home use that is being maunfactured by the Mayhew Company of Milwaukee, Wis. Other features are said to be simplicity of engine design and effectual control of the charging rate while the batteries are being charged. The engine is of the four-cycle water-cooled type and is rated so that it has considerable surplus power over that required for driving a generator. Therefore a pulley has been provided so that the outfit can be used for power purposes as well as lighting.



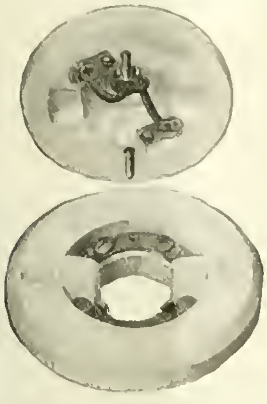
CHARGING RATE CONTROLLED WHILE BATTERIES ARE BEING CHARGED

If desired, the outfit may be equipped with a device for automatically shutting down the engine when the batteries are fully charged. The switchboard is provided with a voltmeter, an ammeter and a rheostat for controlling the rate at which the batteries are charged. The generator has been rated at 800 watts, and batteries of various sizes are furnished to meet any conditions encountered in farm and country-home lighting.

Interchangeable Connecting Block and Rosette

It is unnecessary to remove the fitting or splice and solder wires when using a connecting block that has been placed upon the market by the Bryant Electric Company of Bridgeport, Conn. This block, as shown in the accompanying illustration consists of two pieces of porcelain fastened together by means of two screws. These screws are retained by fiber washers in their holes in the top piece even when the two blocks are separated, which eliminates the possible loss of the screws when the block is unassembled. They also form the current-carrying contacts between the top and base.

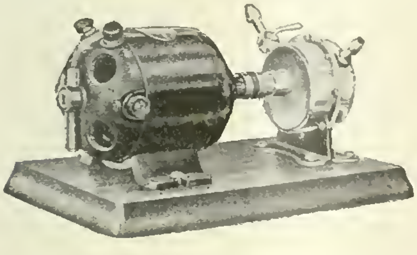
The base of the block has a substantial recess for the two firmly fixed biinding plates, each of which has four binding screws to permit of ready connection of wires for additional circuits as may be needed. This connecting block can easily be transformed into a rosette by means of a small film or "knock-out" of porcelain in the center of the cap. A light blow will serve to knock this out, transforming the block into a rosette. Wires can be passed through this opening and fastened at the binding screws, as shown in the upper view of the figure, so that a drop light or switch fixture can be attached.


SUBSTANTIAL INTERCHANGEABLE CONNECTING BLOCK

Another interchangeable feature of this block is that to this same style of base a porcelain lamp receptacle can be attached. The heavy lugs shown in the base fit into the recesses molded into both the top piece of the block or rosette and the lamp receptacle base and insure the correct relative position of the parts so that the fastening screws, which also serve as current connections, can be easily and properly fastened. These devices, designated as List No. 566 for the rosette connecting block and No. 4122 for the receptacle, are designed for attachment to standard 3¼-in. outlet boxes and to No. 700 Adapti boxes. All of these devices are National Electrical Code approved.

Motor-Driven Rotary Blower

A complete motor-driven rotary blower mounted as a unit on one base is being manufactured by the Anderson Electric Specialty Company, 118 South Clinton Street, Chicago. The device consists of a rotary blower direct-connected to the motor. The energy consumption is said to be only that of a 40-watt lamp, although the blower is driven at a rate of 1500 r.p.m. The driving motor is made in various voltages for either direct or alternating current.

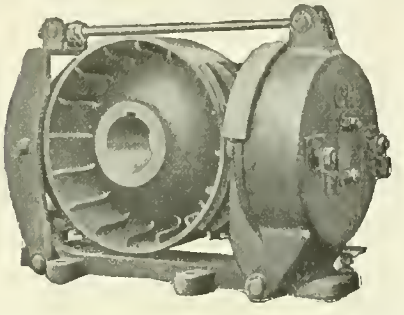

USES SMALL AMOUNT OF ELECTRIC ENERGY

Rapid and Accurate Computer

Simplicity and completeness are the two main features claimed for the Ross rapid computer that is being manufactured by the Computer Manufacturing Company, 25 California Street, San Francisco, Cal. It is so simple, the maker claims, that any one who can read numbers can use this computer. It consists of two dials and a clamped reading arm. When it is desired to multiply or divide, the problem is set under the arm and an arrow automatically points to the answer and another arrow points to the proof. It reads three to four significant figures and is claimed to give an average accuracy of one-twentieth of 1 per cent. It is especially desirable for use on design and construction work because it gives a quick and accurate method of solving otherwise tedious problems.

Magnet-Operated Brake

Simplicity of construction is one of the main features claimed for a magnet-operated brake that is being manufactured by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis. This is accomplished, the maker claims, by lowering the position of the magnet and making the magnet armature an integral part of one of the arms carrying the brakeshoes. Fewer parts are required, compactness is secured, and the parts are made extremely strong and rugged without adding excessive weight. The new design requires less head room, as it is but slightly higher than the brake wheel—an important point to be considered when the brake is used on a crane, hoist or bridge.


SMOOTH OPERATION ADAPTS THIS BRAKE TO ELEVATOR OPERATION

The brake is applied by means of a spring in the center of the coil, which tends to force the armature and magnet apart. The force acts directly in line with the center of the brakeshoes; thus the operation is not affected by any wear in the brake linkage. The retarding torque exerted on the brake wheel is the same in both directions of rotation. The magnet is of the iron-clad clapper type, working on a very small air gap, which increases the efficiency of this type of magnet. The armature and magnets are both movable and rotate on the same center. This construction reduces the angular movement of all bearings to less than one degree, making the wear negligible, according to the manufacturer. It also eliminates the side friction found in magnets which have the armature mounted on a member extending through the center of the magnet coil.

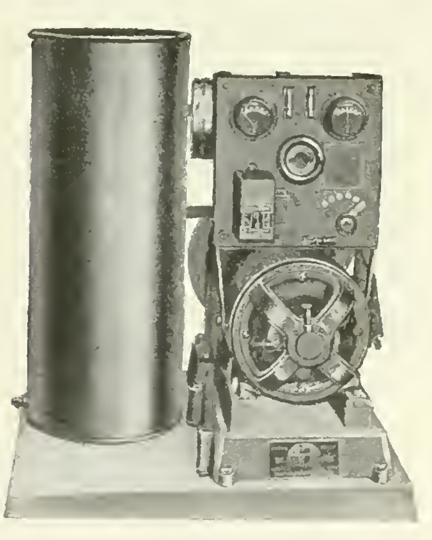
These brakes are manufactured in standard sizes varying from 8 in. to 30 in. (20.3 cm. to 76.2 cm.) in diameter and rated at from 15 hp. to 300 hp.

Electric Sterilizer for Doctors

That it is extremely valuable for medical practitioners is the claim made for the Rentz electric sterilizer that has been placed upon the market by the Santiseptic Manufacturing Company, Inc., Corn Exchange Bank Building, St. George, Staten Island, N. Y. The heating elements in this sterilizer consist of a wire wound over a suitable insulator which surrounds the chamber where the sterilizing is done. The wires are exposed directly to the steam or moisture used in making the superheated steam. The length of the wire used, the area it covers and the fact that it operates at a temperature that seldom exceeds 650 deg. F. (343 deg. C.) makes danger of burn-outs small and reduces maintenance to a minimum. The operation is simple and effective and once heated to operating temperature the sterilization process takes place very rapidly.

Small Electric Light and Power Plant

An electric light and power plant for farms, stores, schools, churches, etc., is being offered to the trade by the Black Swan Company, Waseca, Minn. This plant is furnished with an automobile-type gasoline engine, self-starter, automatic circuit breaker, voltmeter and meter rheostat and 1000-watt generator. It is equipped to furnish brilliant light, to operate a washing machine or fanning mill, electric irons, pump water, etc.


DRIVEN BY AUTOMOBILE-TYPE GASOLINE ENGINE

Trade Notes

ORDNANCE FLAG FOR WAR PLANTS.—Those plants with an output of which more than 50 per cent is for the government will be allowed, it is reported, to fly a special flag bearing the Ordnance Department insignia.

THE WALTER A. ZELNICKER SUPPLY COMPANY, St. Louis, Mo., recently secured the services of Merle G. Peterson, who is now connected with the company's Chicago sales force at 428 First National Bank Building. Mr. Peterson was formerly associated with the Niles-Bement-Pond Company and the Pratt & Whitney Company.

THE INDUSTRIAL ELECTRIC FURNACE COMPANY, Chicago, maker of the Snyder electric furnace, is installing a 5-ton furnace in the plant of the Zimmerman Steel Company, Bettendorf, Iowa. It is a three-phase furnace, designed for acid operation, and will be used for general work. C. H. Atherton, manager of the Zimmerman Steel Company, ordered the installation to replace the converter which that company had been using.

IMPORTATION OF CREOSOTE OIL.—List of Restricted Imports No. 1 has been so far modified as to permit the importation from Japan of 2,000,000 gal. of creosote oil during the remainder of the present calendar year. Licenses for the importation of this quantity of creosote oil from Japan may be issued during the remainder of the present calendar year when the applications are otherwise in order, with the proviso that such oil is shipped on vessels approved for that purpose by the shipping control committee of the United States Shipping Board. The amount so permitted to come forward will be allocated by the Bureau of Imports of the War Trade Board.

RUBBER IMPORTS IN AUGUST AND SEPTEMBER.—After a study of the situation regarding supplies of crude rubber in this country, rate of consumption and related matters, and after consultation with the War Industries Board, the War Trade Board has decided to permit importation of crude rubber during the months of August and September at the rate tentatively fixed for the quarter ending July 31, 1918, viz., 100,000 tons per annum. The amount of crude rubber to be licensed for importation from overseas during the months of August and September has, therefore, by this ruling of the War Trade Board, been limited to 16,666 tons. This amount will be allocated by the Bureau of Imports of the War Trade Board along the general lines of the previous allocation, certain changes therein having been made to take care of new manufacturers and increased government requirements.

ANOTHER VACUUM CLEANER COMPANY IN PRICE MAINTENANCE WEB.—The Federal Trade Commission has issued complaints against three additional manufacturers believed to be practicing resale price maintenance. The firms are the Enders Sales Company, New York City, in the sale of safety razors; the Vortex Manufacturing Company, Chicago, in the sale of paraffine cups and dishes and metal holders, and the Hoover Suction Sweeper Company of New Berlin, Ohio, in the sale of vacuum cleaners. The Enders and Hoover companies were charged with attempting to force dealers to maintain standard resale prices to the public, and the Vortex company with attempting to force standard resale prices on jobbers and wholesalers handling their products. All were charged with refusing to sell dealers or jobbers who sell at their own prices. The cases will be heard in Washington on Sept. 20, 21 and 23.

CAUTION TO USERS OF WORLD TRADE DIRECTORY.—Through the War Trade Board it has come to the attention of the Bureau of Foreign and Domestic Commerce that American firms have been corresponding with firms in neutral countries whose names appear upon the enemy trading list. It has further appeared that in many instances the names of the enemy firms have been taken from the "World Trade Directory" published by the Department of Commerce and Labor in 1911. Notice is hereby given to all persons and firms who may have in their possession a copy of this directory that no letter should be addressed to any person or firm in a neutral country without a careful examination of the enemy trading list published by the War Trade Board for the purpose of ascertaining whether or not said firms are listed therein. Application for copies of the enemy trading list should be made to the Division of Information, War Trade Board, Washington, D. C.

THE IVANHOE-REGENT WORKS of the General Electric Company, Cleveland, Ohio, make the following announcement: "It has been the custom for manufacturers of industrial lighting equipment, as well as for manufacturers of similar products, to give the best discount to jobbers and distributers without making any distinction in discount between the contractor-dealer and the industrial-plant consumer. The Ivanhoe-Regent Works, however, after a study of the Goodwin plan, has come to agree with Mr. Goodwin that the present organization of the electrical industry is necessary to an economic distribution and merchandising of electrical material, and that all of the units composing the electrical industry—central stations, wholesalers, contractor-dealers—are entitled to recognition and assistance from the manufacturer. Beginning on Aug. 15, 1918, the Ivanhoe-Regent Works puts into effect an arrangement whereby its merchandising and distribution schemes conform to the Goodwin plan. Under this arrangement the jobber and distributer will receive his discount, and the consumer who buys in quantities will also be permitted a discount as before; but the new plan provides a differential discount on Ivanhoe metal reflectors and fittings to the contractor-dealer also."

Trade Publications

BATTERY-CHARGING OUTFIT. — The Electric Products Company, Cleveland, Ohio, has issued a booklet describing and illustrating its line of battery-charging outfits.

METER.—A circular has been issued by the Esterline Company, Indianapolis, Ind., describing and illustrating the new Esterline Model MS graphic recording instruments.

LUGS.—The Benjamin Electric Manufacturing Company, 806 West Washington Street, Chicago, has issued a leaflet reproducing copy of advertisements which it will furnish to the trade.

FARM-LIGHTING PLANT.—The Schroeder Headlight & Generator Company, Evansville, Ind., is distributing a leaflet describing and illustrating its farm-lighting plant. This equipment is known as the "Farm-lite."

REFRIGERATING OUTFITS. — Iceless refrigerating machines are described and illustrated in a booklet that is being distributed by the Sanitary Refrigerating Machine Company, Milwaukee, Wis. Typical installations of these machines are also illustrated.

ELECTRICAL DEVICES.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has issued a revision of bulletins Nos. 2165, 5120, 5225, 9116, 10,010 and 10,011. These bulletins cover motor starters, controllers, starting switches and pressure regulators.

ELECTRICAL APPLIANCES.—A catalog listing electric ranges, electric hot plates, electric table stoves, electric irons, electric toasters, electric radiators, etc., has been issued by the Rutenber Electric Company of Marion, Ind. The catalog is entitled "Cook the Electric Way."

MOTORS.—Polyphase induction motors are described and illustrated in bulletin No. 2005, dated July 1918, that is being distributed by the Triumph Electric Company, Cincinnati, Ohio. The principle of operation, the construction and applications of these motors are described and illustrated.

REFRIGERATING MACHINES.—"Cold Facts" is the title of a pamphlet that is being distributed by the Peerless Ice Machine Company, 120 Broadway, New York, illustrating an installation of the Peerless automatic refrigerating machine. The advantages of these machines in different stores are told.

ELECTRICAL ADVERTISING MATTER.—The Society for Electrical Development, Inc., United Engineering Societies Building, 29 West Thirty-ninth Street, New York, has issued a circular describing a campaign of conservation for members and non-members. This is the "Saving by Wire" campaign which becomes a patriotic duty and war-time necessity, according to the society, to save fuel, food, time and money in the home.

FARM POWER PLANTS. — Lighting plants of ¾-kw. and 3-kw. rating are illustrated and specified in a pamphlet called "Delco-Light," which may be obtained from the Domestic Engineering Company, Dayton, Ohio. Each power plant consists of a gasoline-engine-driven generator (32 volts or 110 volts) and a storage battery. A utility motor is also handled by this firm.

SOLDERING IRON.—"Electric Soldering Iron and Hand Tools" is the title of an eight-page envelope folder just issued by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis. This folder shows two views of the soldering iron, which has a threaded heating core over which the tip is screwed. A new automatic rack lately placed upon the market is explained in detail.

POTENTIAL STARTERS. — Potential starters for squirrel-cage induction motors are described and illustrated in a circular that is being distributed by the Allis-Chalmers Manufacturing Company, Milwaukee, Wis. The pamphlet discusses this starter as applied in places where the operator may be unskilled and points out the various features of the device. It is listed as No. 1102.

ELECTRIC FITTINGS.—The Steel City Electric Company, Pittsburgh, Pa., has issued catalog No. 33, describing and illustrating its line of electric fittings. This catalog lists bushings, fixture stems, fixture hangers, marine fixtures and outlet boxes, fish wire, conduit benders, junction boxes, outlet boxes and covers, insulator supports, telephone outlets, floor outlets, attachment plugs and various other fittings used by contractors.

DAYLIGHT MOTION-PICTURE MACHINE.—"The Attractograph—What It Is, What It Does," is the title of a bulletin being distributed by the Attractograph Company, Inc., Candler Building, 220 West Forty-second Street, New York. This bulletin illustrates and describes the automatic daylight motion-picture machine manufactured by this company, and shows front and rear views of the mechanism. It also tells where the machine can be used and its most important advantages.

ELECTRICAL APPLIANCES.—The Hotpoint Division of the Edison Electric Appliance Company, Ontario, Cal., has issued a circular entitled "How to Help the Government with the Conservation Plan." It consists of an attractive advertising folder of the Hotpoint lamp line, giving effective window displays to cultivate business and sales helps, Hotpoint "headlites," full-page advertisements, a profit-making scheme, newspaper advertisements, copy and cuts, reproduction of Hotpoint "ads," and households hints from the *Ladies' Home Journal.*

New Incorporations

THE VENEDOCIA (OHIO) ELECTRIC LIGHT COMPANY has been incorporated with a capital stock of $5,000 by David Davis and others.

THE FAWN TOWNSHIP LIGHT & POWER COMPANY of New Park, Pa., has been chartered, with a capital stock of $20,000, by H. M. Anderson and others.

THE BOERNE LIGHT & ICE COMPANY, Boerne, Tex., has been incorporated with a capital stock of $10,000. The incorporators are J. J. North, Alfred Pfaendler and L. H. Bowden.

THE DOWNINGTON ELECTRIC LIGHT & POWER COMPANY of Philadelphia, Pa., has been incorporated with a capital stock of $5,000 to construct and operate an electric-lighting plant. J. E. Aimmerman is interested in the company.

THE SUBURBAN LIGHTING CORPORATION of Norfolk, Va., has been chartered with a capital stock of $10,000 by E. H. Danforth and R. E. Trant. The company proposes to manufacture and deal in lighting fixtures, etc.

THE AUSABLE FORKS (N. Y.) ELECTRIC COMPANY has been incorporated by J. Rogers, G. Chahoon and M. Sheffield of Ausable Forks. The company is capitalized at $25,000 and proposes to generate and distribute electricity for lamps, heaters and motors.

THE HOUGH MANUFACTURING & SALES COMPANY files notice of authorization to operate a plant at 512A Bergen Avenue, Jersey City, N. J., for the manufacture of electrical and gas appliances. John A. Hough, 15 Lexington Avenue, heads the company.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

FARMINGTON, ME.—Plans are under consideration by the Franklin Power Company, Inc., for the early construction of a new local hydroelectric power plant, about 25 ft. by 45 ft. George E. Farnham, Monmouth, is architect.

LEWISTON, ME.—The power plant of the Androscoggin Electric Company at Deer Rips was badly damaged by fire, caused by lightning, on Aug. 9.

AMHERST, MASS.—The Massachusetts Agricultural College has awarded a contract to Allen Brothers, Amherst, for the construction of the proposed new turbine plant and coal-handling works at the institution. The work is estimated to cost about $55,000.

BOSTON, MASS.—The Edison Electric Illuminating Company of Boston and the New England Power Company of Worcester have petitioned the Board of Gas and Electric Light Commissioners for permission to make the necessary extensions and connections so that electricity can be interchanged between the two companies. The proposed line for such interconnection will extend into or through the city of Boston and the towns of Dedham, Westwood, Dover, Natick, Sherborn, Framingham and Southboro.

BROCKTON, MASS.—Preliminary plans are being prepared for the construction of a new power plant at the local works of the Walk-Over Shoe Company. Jenks & Ballou, 753 Grosvenor Building, Providence, R. I., are engineers.

DEERFIELD, MASS.—Plans have been filed by the Boston & Maine Railroad Company, Boston, for the erection of a new local one-story engine plant. The structure is estimated to cost $75,000. Contract has been awarded to the H. Wales Lines Company, 134 State Street, Meriden, Conn.

HAVERHILL, MASS.—Notice has been filed with the Commissioner of Corporations of an increase of $175,000 in the capital stock of the Haverhill Electric Company, bringing the total capital to $945,000.

UXBRIDGE, MASS.—Plans have been prepared for the erection of an addition to the steam power plant of the New England Power Company at Uxbridge. The Harry Hope Engineering Company, 185 Devonshire Street, Boston, has charge of the engineering work.

WORCESTER, MASS.—The Worcester Electric Light Company has petitioned the Board of Aldermen for permission to place conduits in Belmont, Grafton and Jackson Streets.

Middle Atlantic States

BUFFALO, N. Y.—The City Council has approved the resolution calling for the installation of the proposed new flashlight police signal system in different sections of the city. Plans will be prepared at once.

BUFFALO, N. Y.—Plans have been prepared by the Niagara Electro Chemical Company, 2700 Buffalo Avenue, Niagara Falls, for the erection of two-story addition, 38 ft. by 251 ft., to its plant at Buffalo Avenue and the Connecting Terminal Railroad.

BUFFALO, N. Y.—The Pierce-Arrow Motor Car Company of Buffalo has awarded a general contract for addition to its power house, 43 ft. by 53 ft., at Elmwood Avenue and the New York Central Railroad to the Stone & Webster Engineering Corporation, Boston, Mass., to cost with equipment about $300,000. The company will also erect a testing building, 50 ft. by 100 ft.

GARDENVILLE, N. Y.—Work has begun on the construction of the new engine terminal at the local yards of the Pennsylvania Railroad Company. The proposed plant will cost about $700,000 and will consist of an engine house with a capacity for twenty-four locomotives, machine shop, with turntable and other buildings.

GENEVA, N. Y.—Contract has been awarded by the United States Lens Company of Geneva to J. J. Prindeville, Framingham, Mass., for the construction of a new one-story plant, 105 ft. by 180 ft., on Lyceum Street, to cost about $50,000. The company is also considering the erection of a new power plant for which plans are now being prepared. A. T. Wilson is president.

MECHANICSVILLE N. Y.—The J. Livingston Company, 70 East Forty-fifth Street, New York, has been awarded the contract for all electrical work in connection with the construction of the new plant of the West Virginia Pulp & Paper Company. The project will consist of eight large manufacturing units, with auxiliary buildings, to cost about $350,000.

NEW YORK, N. Y.—Contract has been awarded to the A. B. See Electric Elevator Company, 220 Broadway, for the installation of electric elevators in the proposed new Assay Building to be constructed at 30 Wall Street at $19,150. The entire structure will cost about $585,000.

NEW YORK, N. Y.—Bids will be received until Aug. 29 by the Commission of New Prisons, Hall of Records, in connection with extensive improvements to be made at Sing Sing Prison, Ossining, for work as follows: Additions to the central heating plant, including underground piping and the installation of conduits at Detention Building No. 5, Clinic Building No. 8; the installation of a new underground electric conduit and feeder system and pump house, same building, and improvements in the water supply system, Detention Building No. 5, Clinic Building No. 8. Lewis F. Pilcher, Capitol Building, Albany, State Architect.

PHOENIX, N. Y.—Plans are under consideration by the John Dunlop Sons Company, 254 Fifth Avenue, New York, for the erection of a new one-story power house, 50 ft. by 50 ft., in connection with the proposed silk mill in Phoenix.

SCHENECTADY, N. Y.—The General Electric Company, it is reported, is planning to build a large power plant in the extreme northern part of Salisbury. Land for this purpose, it is said, will be acquired in the towns of Salisbury, Ohio, Fairfield and Norway. The government is said to be back of the entire project, the development and utilization of water power being considered a war measure.

SYLVAN BEACH, N. Y.—The Public Service Commission has granted William V. Cottman permission to operate an electric lighting plant at Verona Beach and Sylvan Beach on Oneida Lake, under franchises given by the town authorities. The Sylvan Beach Electric Light & Power Company formerly supplied electricity for lighting the Oneida Lake resorts. It discontinued business in 1912, and since then these places have been without electric service.

SYRACUSE, N. Y.—To aid in the conservation of fuel, and in compliance with the recent orders of the Fuel Administration, the City Council is planning to reduce the service in the ornamental electric street-lighting system. The city officials have rejected the bid recently submitted by the Syracuse Lighting Company for street lighting.

UTICA, N. Y.—Plans have been filed by the Utica Gas & Electric Company for the erection of an addition to its plant. Contract for the building has been awarded to the Kimberly Construction Company of Utica.

BEDMINSTER, N. J.—Plans are under consideration by the Township Committee for improvements to the electric street-lighting system.

BROWN MILLS, N. J.—The Board of Public Utility Commissioners has granted permission to the Brown Mills Electric Light & Power Company to issue bonds for $17,000 for extensions and improvements to its system.

CALDWELL, N. J.—Plans are under consideration for the installation of a new electric street-lighting system in connection with the development by the War Department of the new rifle range at Great Piece Meadow.

DOVER, N. J.—Arrangements are being made by the New Jersey Power & Light Company for furnishing the International High Speed Steel Company of Rockaway with 20,000 hp. additional per month to operate its plant. At the present time a total of 150,000 kw.-hr. per month is required by the company.

DOVER, N. J.—Plans have been filed by Paul Guenther, Inc., 69 King Street, manufacturer of hosiery and knit goods, for improvements and alterations in the power plant at the works. Contract has been awarded to J. J. O'Leary, 500 Bloomfield Avenue, Passaic, N. J.

DOVER, N. J.—Contract has been awarded the New Jersey Power & Light Company by the Wharton Steel Company for supplying power for the operation of additional equipment recently installed in its Scrub Oak iron ore mines, including a new 350-hp. compressor. A new 11,000-volt transmission line has just been completed extending to the plant of the Atlas Powder Company at Landing.

HARRISON, N. J.—The Crucible Steel Company of America, South Fourth Street, is planning to commence work on the construction of a new one-story gas producer works, about 80 ft. by 180 ft., at its plant. The structure is estimated to cost about $80,000. Contract has been awarded to W. H. & F. W. Cane, Woolworth Building, New York.

HOBOKEN, N. J.—Contract has been awarded by the United States government to the F. G. Fearson Company, 280 Madison Avenue, New York, for the construction of a new power house in Hoboken, to cost about $19,400.

NEWARK, N. J.—The Sundh Electric Company, 51 East Forty-second Street, New York, N. Y., has increased its capital stock from $120,000 to $170,000. The company manufactures electric controlling devices. Its plant is on Parkhurst Avenue, Newark, N. J.

NEWARK, N. J.—The Maas & Waldstein Company, 437 Riverside Avenue, has awarded a contract for the construction of a large new brick one-story boiler plant at its works to Henry M. Doremus Company, 36 Orange Street. The structure will cost approximately $50,000. The company will also erect a radial brick stack for the plant, to cost about $9,000.

POMPTON LAKES, N. J.—In connection with the construction of the proposed new addition to the municipal hydroelectric plant, the Borough Council has awarded the contract for the structure to Fred Kilgus, Inc., 13 South Sixth Street, Newark, at a cost of $31,406. Immediately upon completion of the structure, the necessary equipment will be installed, bids for which have been received as follows: Hydraulic Turbine Company, Camden, N. Y., turbines, $7,065; S. Morgan Smith Company, York, Pa., electric generators, $10,000; General Electric Company, New York, electrical apparatus, switchboard, etc., $9,948.

TRENTON, N. J.—The Department of Architecture, State House, will receive bids until Aug. 28 for the construction of a new radial brick stack at the State Home for Boys, Jamesburg. Francis H. Bent, State Architect.

TRENTON, N. J.—Bids will be received by the Mercer County Board of Freeholders, Trenton, until Aug. 27 for the installation of two electric motors, wiring, etc., for operating the drawbridge on Southard Street across the Delaware & Raritan Canal, Trenton. John McCullough is director of department of bridges.

HARRISBURG, PA.—Permission has been granted by the Public Service Commission for the issuance of bonds and securities for improvements and extensions to the following companies: The Metropolitan Edison Electric Company of Reading, $3.400,000; the Lancaster (Pa.) Light, Heat & Power Company, $105,650; the Edison Electric Company of Lancaster, $77,500; the Beaver County Light Company of Beaver Falls, $96,500.

LANCASTER, PA.—Notice has been filed with the Public Service Commission by the Edison Electric Company of the issue of capital stock for $77,500, to provide for expansion.

NICETOWN, PA.—Plans have been filed and contract awarded to Barcley, White & Company, 1713 Sansom Street, Philadelphia, for the construction of additions to the local gun-maufacturing plant of the Midvale Steel & Ordnance Corporation, Widener Building, Philadelphia. The work includes the erection of a new electric generating station, about 55 ft. by 120 ft. The cost of the entire work is estimated at about $750,000.

PHILADELPHIA, PA.—Plans have been filed by the George W. Smith Company, Forty-ninth Street and Botanic Avenue, for the erection of new boiler plant at its works. Contract for the structure has been awarded.

PHILADELPHIA, PA.—Plans have been prepared by the Bureau of Yards and Docks, Navy Department, for the erection of a submarine battery building, 90 ft. by 340 ft., at the local navy yard, to cost about $125,000.

PITCAIRN PA.—Contract has been awarded by the Pennsylvania Railroad Company to Irwin & Leighton, 126 North Twelfth Street, Philadelphia, for the construction of new shop buildings at Pitcairn. The cost with equipment is estimated at about $1,000,000 and will include a machine shop, engine house with a capacity of thirty-four locomotives, ice house and other buildings.

PITTSBURGH, PA.—A permit has been granted the Westinghouse Electric & Manufacturing Company for the construction of an addition to its plant on Amberson Avenue in the Shadyside section.

PITTSBURGH, PA.—The Beaver County Light Company has recently filed notice with the Public Service Commission of the issuance of bonds to the amount of $96,500, the proceeds to be used in part for extensions and improvements.

PITTSBURGH, PA.—Contract has been awarded by the Pennsylvania Chocolate Company to the Turner Construction Company, 11 Broadway, New York, N. Y., for the construction of an addition to its power plant, 50 ft. by 75 ft. Work has begun on the building.

PITTSBURGH, PA.—The Duquesne Light Company, operating power plants in the principal sections of Allegheny and Beaver Counties, is planning for extensive improvements and alterations in its plants and system. The company has completed arrangements for the issue of three-year 6 per cent gold notes for $10,000,000, a portion of this fund to be used for the contemplated work.

PITTSBURGH, PA.—An agreement has been reached between the United States government and the West Penn Power Company whereby the latter will build a 40,000-kw. power station at the mouth of a coal mine in the Allegheny Valley and connect it up by a transmission system with the distribution system of Pittsburgh. The cost of the proposed plant and transmission line is estimated at $5,000,000. The Ordnance Bureau will advance $2,000,000 of this amount, and the company will provide the other $3,000,000. At a period of three years after the war the reduplication cost of the plant is to be determined by three disinterested appraisers. The company undertakes to repay to the government such part of the advance made by the government as represents the excess of the appraised value over the $3,000,000 originally put up by the company.

BLUEFIELD, W. VA.—The Norfolk & Western Railway Company is contemplating the installation of a motor-generator set at its local works. J. E. Crawford of Roanoke is chief engineer.

MOOREFIELD, W. VA.—Plans are being prepared for extensions and improvements to the municipal electric lighting plant.

WYATT, W. VA.—Plans are under consideration by the Consolidated Coal Company for the construction of a new electric power plant at its works for operation.

PORTSMOUTH, VA.—Contract has been awarded by the Bureau of Housing, Department of Labor, Washington, D. C., to the Hegaman & Harris Company, New York, N. Y., to develop an industrial city in the section known as Villa Heights and Paradise Creek, about 3 miles from Portsmouth. The plans call for about 1000 buildings, including 800 dwellings, community buildings, stores, two schools, police and fire department, hospital, churches, electric power plant, etc. George B. Post & Sons, 101 Park Avenue, New York, N. Y., are architects.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Aug. 26, under Specification 3244, for extension to boiler-plant building at Washington. The cost of the work is estimated at about $160,000.

WASHINGTON, D. C.—To meet the needs for electric power in shipyards, munition and other war factories, a bill approved by the War Industries Board has been introduced to Congress authorizing the President to construct power plants to meet the immediate demands at Pittsburgh, Philadelphia, New Jersey cities and other Eastern industrial centres. The bill also would authorize the President to take over privately owned power plants, increase their capacity, or to require the owners to place all or part of their power at the disposal of the government. The bill includes an appropriation of $200,000,000 for construction, acquisition, maintenance and operation of such plants.

North Central States

REPUBLIC, MICH.—The Cleveland-Cliffs Iron Company is planning for the construction of a new local substation at its properties for the operation of mining machinery, etc. The company will build a transmission line from its hydroelectric power plant to the new substation, and it is planned to commence immediate construction of this line. The company is now building a new hydroelectric power station on the Dead River, making the third such plant to be operated.

CINCINNATI, OHIO.—Contract has been awarded by the Huenfeld Company of Cincinnati for an addition to its power plant. New automatic stokers, boilers, etc., will be installed. Charles E. Pfau is secretary.

CLEVELAND, OHIO—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, until Aug. 30 for soot blowers for the division of light and heat.

CLEVELAND, OHIO.—Bids will be received at the office of commissioner of purchases and supplies, City Hall, Cleveland, until Aug. 30 for boiler house at the garbage plant, Willow, Ohio. Specifications may be obtained at the office of the city architect.

DAYTON, OHIO.—Plans, it is reported, are being prepared for a large addition to the power plant of the Dayton Power & Light Company.

CENTRAL CITY, KY.—The Illinois Central Railroad Company is contemplating the erection of new buildings at Central City, to cost about $150,000, including a machine shop, power plant, engine house with capacity for twelve locomotives and a 85-ft. turntable.

STITHTON, KY.—John Griffith & Son of Chicago, Ill., have been awarded a large section of the general contract for the construction of the new artillery cantonment at Stithton and, it is reported, will sublet heating, lighting and plumbing contract. Waterworks are to be installed and also a refrigerating plant erected. The cost of the cantonment is estimated at $15,000,000.

MILWAUKEE, WIS.—Contract has been awarded by the Universal Machinery Company, 784 Thirtieth Street, Milwaukee, to the Lakeside Bridge & Steel Company of North Milwaukee, for structural steel for the new power plant of its new foundry and machine shop at Sixty-fourth Avenue, West Allis. Contract will soon be awarded for the machine shop. Frank E. Gray and Val. A. Siebert are associated architects.

RACINE, WIS.—The Board of County Supervisors has authorized the board of trustees of the county asylum to purchase two new 150-hp. water-tube boilers and to erect a 125-ft. smokestack, to cost approximately $14,000.

COUNCIL BLUFFS, IOWA.—The Chicago, Rock Island & Pacific Railroad Company of Chicago, Ill., is planning to erect a one-story power plant, 40 ft. by 60 ft., at its local yards.

RICH HILL, MO.—Contract has been awarded by the city to the Merkle Machinery Company, Interstate Building, Kansas City, for alterations and improvements in the municipal electric plant and waterworks to cost $11,000.

SPRINGFIELD, MO.—Plans, it is reported, are being prepared by Sanderson & Porter, engineers, 52 William Street, New York, N Y. and for the construction of a new power plant for the Springfield Gas & Electric Company.

PIERRE, S. D.—Bonds to the amount of $100,000 have been voted to rebuild the water and electric light plant recently destroyed by fire.

Southern States

GASTONIA, N. C.—In connection with the erection of a new plant to provide for increased capacity, the Parkdale Mills are arranging for the installation of electrically operated machinery.

GREENSBORO, N. C.—Plans have been filed by the Agricultural & Technical College for extensions in the heating plant at the institution. Contract for the work, which is estimated to cost about $55,000, has been awarded to B. MacKenzie, Greensboro.

ROARING RIVER, N C.—The Blue Ridge Mill Company, recently organized, is contemplating a small hydroelectric development to supply power to operate its proposed grist mills. L. J. Salmon is president.

CHESTERFIELD, S. C.—Plans are being considered by the Chiquola Mills for the installation of electric lighting, sewer and water systems for the mill village.

THOMASVILLE, S. C.—The Ragan Knitting Company is planning for the installation of electrical equipment for operation in the proposed new plant to be erected at a cost of about $25,000.

MONTICELLO, FLA.—Bonds to the amount of $17,500, it is reported, have been voted for the installation of an electric light and power plant in Monticello.

WAUCHULA, FLA.—Bonds to the amount of $24,000 have been issued to acquire the local electric light plant. Of the proceeds $4,000 will be used for the purchase of new equipment.

LITTLE ROCK, ARK.—Bids will be received by Charles E. Taylor, Mayor, at the office of John P. Almand, architect, 1105 Boyle Building, Little Rock, until Aug. 29 for the construction of a four-story and basement building, to be known as the Logan H. Roots Memorial Hospital, City Hospital of the city of Little Rock, including general contract, plumbing and sewerage, heating, electric wiring and vacuum cleaning.

GALVESTON, TEX.—The Navy Department is contemplating the installation of an electric lighting system in connection with the airplane training base on Galveston Bay. The cost of the entire project is estimated at $2,000,000. L. B. Hyde, engineer, U. S. N., is in charge.

Pacific and Mountain States

SEATTLE, WASH.—The contract for the construction of the new wireless plant of the Kilbourne & Clarke Manufacturing Company of Seattle has been awarded to Fred Woodman of this city. Bids will soon be asked for electrical work, heating and plumbing.

SEATTLE, WASH.—The Capital Issues Committee has demanded that the plants of the city and the Puget Sound Traction, Light & Powder Company be connected so that surplus power of either plant could be used, which the officials of both the city and company have agreed to.

TACOMA, WASH.—Steps are being taken by the Mayor and City Council for the acquirement of the Lake Cushman power site, to provide for the future needs of the city's industrial and residential development. No immediate development of the power site is contemplated.

SAN FRANCISCO, CAL.—The Western States Gas & Electric Company of San Francisco is considering the construction of a hydroelectric power plant near Twin Lakes, to cost about $1,000,000.

DENVER, COL.—Bids will be received by the United States Reclamation Service, Denver, until Oct. 1 for furnishing a 5000-kw. vertical hydraulic turbine and generator. For particulars address the United States Reclamation Service, Washington, D. C., or Denver, Col.

Canada

PRINCE RUPERT, B. C.—The Prince Rupert Hydroelectric Company is contemplating the construction of a hydroelectric plant, to cost about $100,000. P. Lorenzen is engineer.

SQUAMISH, B. C.—Work will commence in the near future on a hydroelectric plant for the provincial government, Department of Railways. W. T. Oliver, Minister.

BRANTFORD, ONT.—P. H. Secord & Company, Ltd., 133 Nelson Street, has been awarded the contract for the boiler house for the Waterous Engine Works Company, Ltd., to cost $16,000.

FORT WILLIAM, ONT.—The erection of a $5,000 concrete substation is contemplated by N. M. Peterson & Co.

NORTH BAY, ONT.—Bids will shortly be called for the erection of a $10,000 pumping station for the town council. H. McAusland, engineer.

PORT ARTHUR, ONT.—Construction work on the Nipegon Power Development at Cameron Falls has begun.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing agent, the Panama Canal, Washington, D. C., until Aug. 26 for steel and copper wire and cable, friction shaper, tool grinder, etc. Blanks and further information may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

Record of Electrical Patents

Notes on United States Patents

1,272,402. Electromagnetic Switching Device; Henry C. Egerton, Passaic, N. J. App. filed Oct. 10, 1917. The operation of which may be retarded or delayed for a predetermined period.

1,272,405. Volume-Manganese Depolarizing Material; Carleton Ellis, Montclair, N. J. App. filed Oct. 23, 1915. Non-hydrating and does not expand to any extent in the presence of water.

1,272,407. Non-Conducting Manganese Depolarizing Electrode; Carleton Ellis, Montclair, N. J. App. filed Oct. 18, 1915. Suitable for Leclanché type cell.

1,272,410. Alternating-Current Relay; Oscar S. Field, New York, N. Y. App filed Jan. 3, 1917. Employs a hollow non-magnetic cup rotor in its operation.

1,272,413. Telephone Mouthpiece; Melvin C. Fredrickson, Cameron, Wis. App. filed June 13, 1917. A sanitary mouthpiece of inexpensive construction.

1,272,418. Electric Arc Lamp; Joseph Gelb, New York, N. Y. App. filed June 29, 1916. For photographic work or for projecting work.

1,272,420. Turbo End Bell; Ralph E. Gilman, Pittsburgh, Pa. App. filed March 4, 1915. In which the heating caused by magnetic conditions with the dynamo-electric machine is reduced to a minimum.

1,272,432 Relay; Clarence B. Harlow, Chicago, Ill. App. filed Aug. 28, 1917. Telephone signaling relays intended particularly for transferring a subscriber's call from the telephone line to a high-tension line.

1,272,433. Carburetor Attachment; Linn B. Harrod, Little Rock, Ark. App. filed Dec. 7, 1917. Relates to means for heating the air coming through the air intake of a carburetor.

1,272,444. System for the Transmission and Distribution of Electrical Energy; John S. Holliday, Wilkinsburg, Pa. App. filed Dec. 18, 1914. The transmission line is divided into sections; when the line is to be energized, power is first applied to one section only.

1,272,445. Circuit-Controlling Device; John S. Holliday, Wilkinsburg, Pa. App. filed Dec. 18, 1914. For systems for the transmission and distribution of electrical energy.

1,272,446. Slow-Acting Sectionalizing Device; Harry M. Jacobs, Schenectady, N. Y. App. filed Feb. 17, 1915. Transmission line may be gradually energized in such manner that the starting power is not much greater than the normal load.

1,272,447. System for the Transmission and Distribution of Electrical Energy; Harry M. Jacobs, Schenectady, N. Y. App. filed Feb. 17, 1915. Relates particularly to sectionalized transmission lines.

1,272,463. Distribution System for Vapor Electric Apparatus; Charles A. Kraus and Roy D. Maily, Lynn, Mass. App. filed Aug. 27, 1909. The operation of such apparatus is safeguarded against the short-circuiting.

1,272,469. Electrotherapeutic Instrument; Tiodolf Lidberg, Chicago, Ill. App. filed Dec. 18, 1916. To maintain constant temperature, preferably below that required to cauterize.

1,272,548. Shielding System for Vapor Converters; Edmund F. Sipher, Wilkinsburg, Pa. App. filed Aug. 28, 1915. Will insure a uniform distribution of the power arc over all portions of the anode.

1,272,621. Shielding System for Vapor Converters; Lewis W. Chubb, Edgewood Park, Pa. App. filed Aug. 9, 1915. The arc shall be restricted to certain well-defined portions of the anode.

1,272,624. Telephone-Exchange System; Roy D. Conway, Chatham, N. J. App. filed March 21, 1917. Ringing on a called line starts almost immediately upon the connection of the link circuit therewith.

1,272,632. Method of Starting Three-Phase, Three-Wire Rotary Converters; Walter M. Dann, Wilkinsburg, and Harold H. Rudd, Edgewood, Pa. App. filed April 12, 1915. For starting a rotary converter from its alternating-current side.

1,272,637. Brush Unit; Albert E. Doman, Elbridge, N. Y. App. filed June 8, 1916. A one piece brush-carrying unit of molded insulating material.

1,272,641. Telephone System; Henry C. Egerton, Passaic, N. J. App. filed July 24, 1916. Relates to paging or announcing systems.

1,272,673. Service-Observing Circuit for Telephone Lines; Charles W. Keckler, Newark, N. J. App. filed April 14, 1915. Adapted to be associated with a subscriber's line.

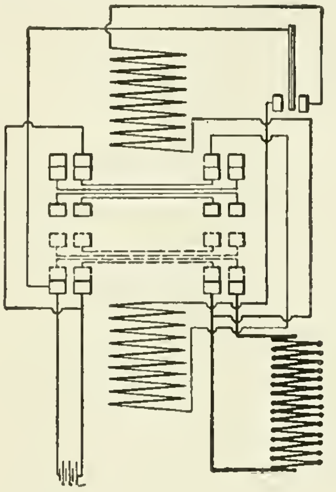
1,272,677. Oil Switchboard, Hubert Krantz, Brooklyn, N. Y. App. filed May 19, 1913. In which the current is of such magnitude as to necessitate the breaking of the electrical circuits.

1,272,689. Telephone-Exchange System; Harry W. MacDougall, East Orange, N. J. App. filed July 2, 1917. In which ringing current is automatically applied to a wanted line.

1,272,692. Transmitting Support; George E. Mather, East Orange, N. J., and Bertram Baily, New York, N. Y. App. filed March 2, 1917. Applicable to transmitters mounted on chest plates and supported on the body of the user.

1,272,693. Retaining Means; Emil Mattman, Wilkinsburg, Pa. App. filed Jan 24, 1914. To provide means for firmly holding transformers in their casings.

1,272,700. Metallic Joint and Process of Making the Same; Harold A. Newcomb Wilkinsburg, Pa. App. filed Oct. 2, 1911 The materials of which they are composed cannot readily be united by ordinary methods, such as soldering.



1,273,188—Electric Switch

1,272,714. Connector for Outlet Boxes; Peter Reinhalter, Wilkes-Barre, Pa. App. filed Jan. 4, 1915. Adapted to receive the conductor, and novel means for locking said body portion with respect to the conductor.

1,272,719. Protecting Casing for Electrical Conductors; Henry L. Rooke, Jr., Houston, Tex. App. filed May 1, 1917. For surrounding the commutator of an internal-combustion motor and protecting the terminals thereof.

1,272,781. Portable Electric Light; John T. Drufa, Longmeadow, Mass. App. filed April 4, 1918. To be lighted by the manual movement of a slide applied upon the exterior casing.

1,272,782. Drip-Pan Alarm; Patrick F. Duffy, Newburyport, Mass. App. filed Oct. 16, 1916. For attaching to the drip pan of a refrigerator whereby the signal bell will be sounded when the water reaches a predetermined height.

1,272,783. Trolley Splicer; Frank T. Elwell, Los Angeles, Cal. App. filed Dec. 2, 1916. The ends of the wire can be overlapped and an equal gripping tension placed on each of the ends.

1,272,808. Trench Flashlight; Arnost Janovsky, Brooklyn, N. Y. App. filed Sept. 11, 1917. Special means are provided to prevent any of the light rays from being cast upward.

1,272,843. Combined Sound Reproducer and Lighting Fixture; Herman G. Pape, New York, N. Y. App. filed Dec. 17, 1914. Adapted for use in auditoriums, churches, theaters, railroad depots, etc.

1,272,844. Electric Railway System; Erich J. Patelski, Chicago, Ill. App. filed March 8, 1915. Arrangement for supplying the current without the necessity of employing either third-rail or trolley wires.

1,272,868. Retainer for Active Material of Storage-Battery Electrodes; James M. Skinner, Philadelphia, Pa. App. filed April 19, 1917. Will cause a material increase in the life of the positive plates.

1,272,869. Cigar Lighter; Maximilian H. Spielman, New York, N. Y. App. filed May 5, 1916. Supplied with an electrical current through a flexible cable running in and out from a reel.

1,272,871. Telautographic Apparatus; George S. Tiffany, Summit, N. J. App. filed Feb. 21, 1912. Relates particularly to telautographs of the variable-current strength type.

1,272,879. Electric Circuit-Controlling Mechanism; Julius B. Wantz, Chicago, Ill. App. filed June 4, 1914. Applies particularly to controlling the circuit which supplies current to an X-ray tube.

1,272,893. Headlight Switch for Automobiles; Harvey E. Bawtinheimer, Red Deer, Alberta, Canada. App. filed July 21, 1917. Electrically connected with a magneto and with lamps for maintaining uniform brilliancy of the lamp lights.

1,272,930. Motor Vehicle; Justus B. Entz, Cleveland, Ohio. App. filed April 3, 1913. Relates to driving or propelling mechanism of the type including the so-called electric transmission.

1,272,941. Switch; Charles E. Godley, Detroit, Mich. App. filed Dec. 30, 1916. May be closed and opened by successive actuations of a reciprocating plunger or button.

1,272,952. Electric Battery Depolarizer; Major E. Holmes, Lakewood, Ohio. App. filed Jan. 7, 1918. Materials that have marked advantages over present depolarizers.

1,272,973. Relay; Samuel M. Lucas, Pittsburgh, Pa. App. filed Feb. 14, 1917. The contacts are controlled by a centrifugal device which in turn is operated by a motor.

1,272,993. Speaking and Signaling Apparatus; Herman G. Pape, New York, N. Y. App. filed Dec. 26, 1914. Adapted for use in closed-body vehicles such as limousines, taxicabs, etc.

1,273,000. Electric Battery; Lloyd R. Rhoades, Fremont, Ohio. App. filed Jan. 5, 1916. Relates to bibulous linings for so-called dry cells.

1,273,015. Electric Insulator; Percy M. Thomas, Upper Montclair, N. J. App. filed Aug. 29, 1913. Adapted for high-tension electric lines.

1,273,027. Level; Paul Budde, Bethalto, Ill. App. filed Jan. 26, 1918. Means for illuminating a level which may be otherwise of the standard type.

1,273,045. Relay Switch; Louis W. Downes and Walter S. Mayer, Providence, R. I. App. filed Sept. 30, 1917 To either open or close an auxiliary circuit when an overload or other abnormal condition occurs.

1,273,050. Process of Making Combustion Gas; Clide F. Euler, Topeka, Kan. App. filed April 4, 1916. The production by the aid of electrolytic decomposition, of a gas suitable for use as a combustible.

1,273,056. Electrical Connection; John H. George, Bridgeport, Conn. App. filed Jan. 12, 1916. A simple and effective means for connecting conductors.

1,273,092. Circuit-Controlling Device; Cleveland Redfield, Ogden, Utah. App. filed Aug. 10, 1916. A means for controlling alternating-current circuits with the maintenance of the power factor.

1,273,101. Overload Apparatus; Jay H. Hall, Cleveland, Ohio. App. filed May 2, 1914. Having adjustments for causing the overload device to operate at different values of current.

1,273,102. Electric Recording and Integrating Device; Paul M. Lincoln, Pittsburgh, Pa. App. filed July 27, 1915. A slow-responding electric measuring device in order to get an integration of the quantity under measurement.

1,273,107. Sound-Transmitting Apparatus; Frank Stevens, Philadelphia, Pa. App. filed Jan. 17, 1917. Means for transmitting all sounds, vocal, instrumental, etc.

14,492 (Reissue). Self-Actuating Safety Panel; Hubert F. Krantz, Brooklyn, N. Y. App. filed Nov. 27, 1917. To afford more convenient access for purposes of inspection and replacement of safety fuses.

1,273,126. Electrical Measuring Instrument; William Anthony, Clyde, Ohio. App. filed Sept. 5, 1916. Body frame and the coil and needle holding spool made in two separate pieces.

1,273,151. Electrical Cut-Out; Robert C. Cole, Hartford, Conn. App. filed Oct. 3, 1917. Cheap to manufacture and assemble and is so constructed that the fusible link is readily renewable.

1,273,154. Relay Selecting Circuit for Artificial Lines; Charles S. Demarest, Flatbush, N. Y. App. filed June 15, 1917. For automatically selecting a suitable artificial line or network for balancing a line or trunk with which a repeater is temporarily associated.

1,273,158. Heat-Coil Protective Device for Electric Circuits; Lewis E. Dickinson, Boonton, N. J. App. filed Sept. 17, 1915. Improved heating element which affects the functioning of devices.

1,273,167. Measuring Instrument; Harry A. Ewen, London, England. App. filed June 28, 1917. Of the type which depend for their action upon the expansion of a body under the influence of heat.

1,273,188. Electric Switch; Will R. Savage, Omaha, Neb. App. filed April 10, 1915. Adapted to be operated by a direct or an alternating current and equipped with solenoids capable of exerting a heavy pull and arranged to be momentarily energized to prevent heating of coils.

1,273,189. Telephone System with Automatic Ringing Disconnect; Fred Schoenwolf, Chicago, Ill. App. filed Nov. 27, 1914. The application of ringing current to the called line is interrupted and a disconnect signal given should the calling subscriber replace his receiver prior to receiving a response from the called substation.

1,273,199. Electric Hair-Curling Kit: Sadio Stuckey, Tulsa, Okla. App. filed July 10, 1917. An electric heater requiring no special support, but which may be set upon any flat horizontal surface and utilized for heating an iron and curling the hair.

1,273,203. Method of Electric Welding; Elihu Thomson, Swampscott, Mass. App. filed Nov. 6, 1917. Tool forced by practically continuous or steady pressure against the work by the application of an intermittently acting power, as, for instance, the power of a pneumatic hammer.

1,273,223. Process for Making Metallic Cerium and the Like; Alcan Hirsch, New York, N. Y. App. filed Sept. 1, 1917. Production of metallic cerium and similar rare-earth metals, such as "misch-metal."

1,273,224. Connector; Bryson D. Horton, Detroit, Mich. App. filed Aug. 31, 1916. For effectively connecting a member of thin blade-like construction to a supporting member; adapts itself particularly for effecting substantial rigidity in the movable contacts of a switch.

1,273,225. Connector; Bryson D. Horton, Detroit, Mich. App. filed July 14, 1916. For connecting switch contacts of the knife-blade type so as to operate in unison and be in perfect alignment with respect to the coöperating contacts.

1,273,245. Electromagnetic Switching Device; Alben E. Lundell, New York, N. Y. App. filed Sept. 11, 1916. Its main object is the insurance of uniform and reliable contact engagement under varying values of operating current and with a minimum required value of holding current.

1,273,246. Connecting Device for Train Telephone Lines; Gustav W. Lundin, Bellevue, Iowa. App. filed Oct. 6, 1916. Electrical continuity of the wires carried by the respective cars of the train may be established through the couplings of the air hose of the brake system.

1,273,247. Automatic Switch; Frank A. Lundquist, New York, N. Y. App. filed Dec. 2, 1916. Employed in telephone systems.

1,273,250. Spring Terminal Clip; William Luxmore, Chicago, Ill. App. filed Jan. 27, 1916. Made of a strip of brass or other metallic ribbon and formed so that two portions of the strip oppose each other in order to grip the conductor.

1,273,258. Electric Lighting System; William S. Mason, Mayfield, N. Y. App. filed June 28, 1915. Employs a plurality of electric lamps of substantially the same resistance whose total resistance bears to their individual resistance the same ratio that the voltage of the current from the dynamo bears to the voltage of the current from the battery.

1,273,274. Terminal Bank; John N. Reynolds and Oscar F. Forsberg, Yonkers, N. Y. App. filed May 25, 1916. Used in automatic and semi-automatic telephone systems.

1,273,313. Insulator; Thomas W. Beatty, Carey, Ohio. App. filed Aug. 9, 1917. Component parts are so held in assembled relation that they are very convenient for handling by the electrician.

1,273,351. Telephone Receiver; Halsey A. Frederick, Hackensack, N. J. App. filed July 20, 1916. To produce a receiver of improved efficiency of transmission and increased quality of articulation and one that is more economical in design from a standpoint of cost of production.

1,273,357. Electrolyzing Apparatus; Henri C. L. Gougnard, Paris, France. App. filed Sept. 4, 1913. To facilitate assembling and taking apart the elements or members of the apparatus.

1,273,378. Means for Controlling Electric Circuits; William O. Kennington, Detroit, Mich. App. filed April 5, 1916. Has particular utility in electrical apparatus employed on engine-driven motor vehicles, and especially in connection with ignition apparatus for such engines.

1,273,389. Electric Water Heater; Wayne D. Ludwick, near Tacoma, Wash. App. filed Oct. 21, 1914. Has sufficient electrical efficiency to enable it to enter into competition with water heaters in which a gaseous fuel is used as the heating agent.

1,273,390. Ticket-Canceling Machine; Harry Lundgren and Frank Teberg, Oakland, Cal. App. filed Feb. 23, 1917. To be used in post office, ticket offices, banks and other places where the canceling of stamps, tickets, papers and the like is necessary.

1,273,408. Lighting Fixture; Milton B. Roller, Palo Alto, Cal. App. filed March 19, 1918. Renders easy the assemblage of the parts of a fixture.

1,273,409. Contact-Ring System; Charles Roulland, Paris, France. App. filed July 17, 1917. Very simple, strong and of cheap manufacture owing to the shaping being done almost entirely in the lathe.

1,273,431. Method and Apparatus for Radio Signaling; Roy A. Weagant, Roselle, N. J. App. filed Jan. 6, 1916. Receiving antennas constructed to exclude interfering electromagnetic waves of a frequency considerably higher than the frequency of the incoming waves to which the receiving apparatus is adapted.

1,273,432. Composition for Electrolytes for Electrical Etching; Joseph H. Weeks, Rutledge, Pa. App. filed April 4, 1917. Improvement.

1,273,447. Dry Secondary Cell; Julius Becker, Chicago, Ill. App. filed March 29, 1917. To provide an arrangement of electrodes and separators or separating material such that the electrolytic will be most fully and perfectly presented to and brought into contact with the surfaces of the electrodes.

1,273,451. Electric Heating Apparatus; Manual Bouzo, Havana, Cuba. App. filed Dec. 13, 1916. Adapted to an electric circuit of 110 volts just as much as to one of 220 volts.

1,273,490. Charging Regulator for Storage Batteries; Arthur H. Hoffman, Ames, Iowa. App. filed May 1, 1916. Means for regulating the charging of a storage battery from a variable-speed generator.

1,273,493. Method of Bonding Rails; William E. Huber, East Cleveland, Ohio. App. filed March 26, 1914. Method whereby bonds of the socket-connected type may be restored to usefulness without being replaced.

1,273,499. Telegraphic Apparatus; Paul Kaehler, Berlin, Germany. App. filed April 4, 1913. Type-wheel printing telegraphs.

1,273,511. Rotating Field Magnet; Birger Ljungstrom, Stockholm, and Fredrick Ljungstrom, Brevik, Lidingon, Sweden. App. filed Jan. 19, 1918. Improvement of magnets provided with parallel slots.

1,273,623. Panelboard; Hubert F. Krantz, Brooklyn, N. Y. App. filed Jan. 23, 1913. To provide a simple but effective panelboard by which means a plurality of branch circuits can be controlled.

1,273,626. Means for Transforming Direct Current; Irving Langmuir, Schenectady, N. Y. App. filed Dec. 29, 1913. An energy-storing device arranged in coöperative relation with electron discharge tubes.

1,273,627. Method of and Means of Controlling Electric Currents or Potentials; Irving Langmuir, Schenectady, N. Y. App. filed Feb. 5, 1914. Variations of potential or current of one circuit are utilized to produce desired changes in the potential or current of another circuit suitably coupled with the first.

1,273,628. Film Conductor and the Method of Making the Same; Irving Langmuir, Schenectady, N. Y. App. filed June 6, 1914. Comprises gas-free metal films formed in a vacuum too high to permit a disruptive electrical discharge and suitable particularly as electrodes for electrical devices, especially devices requiring a very high vacuum in which gas-free electrodes are necessary.

1,273,629. Method of Exhausting Incandescent Lamps; Irving Langmuir, Schenectady, N. Y. App. filed Dec. 5, 1914. Improvements.

1,273,630. Electron-Discharge Apparatus; Irving Langmuir, Schenectady, N. Y. App. filed Oct. 16, 1913. Comprises structural features of novelty which coöperate to improve the operating characteristics of devices of this type as well as to simplify their manufacture.

1,273,647. Brush Holder; Albert B. Moore, Roselle, N. J. App. filed July 24, 1915. For supporting the brushes of small electric machines such as motors and generators.

1,273,659. Double-Current Overload Relay; Robert J. Parsons, Schenectady, N. Y. App. filed Aug. 9, 1915. For operation on a circuit in which the potential of the current differs from time to time.

1,273,661. Interlocking Control for Mine Hoists; Charles L. Perry, Schenectady, N. Y. App. filed March 25, 1918. Hoist may be started, stopped and generally controlled in a reliable, simple and efficient manner.

1,273,666. Electrical Heater; Charles C. Powers, William, Ariz. App. filed Jan. 25, 1918. To provide a convenient and inexpensive way for applying electrically generated heat to air-circulating pipes.

1,273,714. Electric Switch; Carl E. Anderson, Bridgeport, Conn. App. filed March 28, 1918. To provide means for holding the push-buttons in proper position for their most efficient operation and to impart a better appearance to the switch as a whole.

1,273,719. Control of Electric Circuits; Benjamin H. Arnold, Erie, Pa. App. filed Nov. 7, 1917. Improved means whereby the opening of power circuits is effected under safe conditions and the possibility of making improper circuit connections reduced to a minimum.

1,273,744. Means for Protecting Electric Systems; Elmer E. F. Creighton, Schenectady, N. Y. App. filed May 13, 1912. Particularly adapted to the conditions of multiple feeders that exist on nearly all large transmission systems.

1,273,749. Push Button; Thomas M. Demerest, Dumont, N. J. App. filed June 2, 1916. A device of this character which shall be extremely simple.

1,273,754. Rheostat; Ferdinand Eberger, Boardman, Ore. App. filed Sept. 6, 1917. For use in connection with incandescent electric lamps, whereby the luminosity of such lamps may be varied.

1,273,758. Leading-In Conductor; Colin G. Fink and Walter E. Koerner, East Orange, N. J. App. filed Sept. 25, 1915. For evacuated vessels, such as incandescent lamps, its object being to provide a leading-in conductor which is cheap and has great electrical conductivity.

1,273,773. Pole-Changing Apparatus; Louis M. Evans, Alexandria, Va. App. filed April 11, 1917. Current-reversing transmitter or relay for use in connection with telegraph, cable, radio or other systems.

1,273,782. Electric Ship Propulsion; Henry M. Hobart, Schenectady, N. Y. App. filed Nov. 20, 1914. Alternating-current electric generators and squirrel-cage induction motors for starting a ship's propeller and carrying it up to the running speed with ample torque throughout the entire range of speed.

1,273,783. Electron-Discharge Apparatus; Irving Langmuir, Schenectady, N. Y. App. filed Oct. 16, 1913. Provided with an electron-emitting cathode, an anode and a conducting body, commonly termed a "grid," for statically controlling the electrical discharge conditions of the tube.

Electrical World

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Still Debating on Water Power

ALTHOUGH another summer will soon pass into oblivion without any apparent action on water power, there is every reason to hope that the needed legislation will be forthcoming before the year is over. So acute has the power situation become and so serious will our future outlook for coal be that action cannot by deferred much longer. It has taken a long while to educate the public to a proper understanding of the water-power problem, but happily the public has been quicker to grasp it than Congress, and therein lies the hope for early action. One administration after another has tried its persuasive powers on Congress without effect. President Roosevelt endeavored to get something done with our wasted water powers and President Taft continued the work, but Congress thwarted the desires of both. The problem was then passed on to the Wilson administration, but President Wilson during his first term of office was no more successful than his predecessors. In his message to Congress in December, 1914, the President reminded the legislators of their lethargy as follows:

"We have year after year debated, without end or conclusion, the best policy to pursue with regard to the use of the ores and forests and water powers of our national domain in the rich states of the West, when we should have acted; and they are still locked up. The key is still turned upon them, the door shut fast at which thousands of vigorous men, full of initiative, knock clamorously for admittance. The water power of our navigable streams outside the national domain also, even in the Eastern States, where we have worked and planned for generations, is still not used as it might be, because we will and we won't; because the laws we have made do not intelligently balance encouragement against restraint. We withhold by regulation.

"I have come to ask you to remedy and correct these mistakes and omissions, even at this short session of a Congress which would certainly seem to have done all the work that could reasonably be expected of it. The time and the circumstances are extraordinary, and so must our efforts be also."

The words of the President were spoken almost four years ago, but are just as true to-day as the day on which they were uttered. In fact, read in the light of current events they acquire added weight and force. Evidence is not lacking therefore that the attention of Congress has been called to our wasted water powers repeatedly, and the question for each representative and senator to decide for himself is whether or not he can afford to ignore longer the warning or the growing clamor for remedial legislation.

Electrical Supplies for the War

IN THIS issue we publish an authoritative statement from the War Industries Board on the question, vital to the manufacturers of electrical supplies, of what preferential rights to raw materials the demands of the extensive national war program will leave for their essential requirements. This statement, giving in precise terms the general views of the War Industries Board, in effect appears to supplement or supplant the formal ruling of the priorities division in Circular No. 4 so far as that ruling applies to the electrical supply manufacturers. Under that ruling automatic classifications were allowed on orders for materials, equipment or supplies for a number of specific uses, the one touching particularly the electrical supply manufacturing industry being as follows: "(j) For manufacture of electrical equipment other than turbines (but not electrical supplies as distinguished from equipment), B-2."

With the promulgation of this ruling and in the belief that in some way the fact had been overlooked that many electrical supplies are absolutely essential in necessary war construction, the War Service Committee of the Manufacturers of Electrical Supplies took steps to present the conditions again before the Washington authorities. The first announcement concerning these important negotiations, as published in last week's issue of the ELECTRICAL WORLD, was the letter from A. W. Berresford, as chairman of that committee, asking the respective chairmen of the group committees to take immediate steps to perfect the coöperative and conservation program desired by the War Industries Board. This work the committees are now doing as rapidly as possible, and in the meanwhile the board has made the restrictive decisions which are printed elsewhere in these columns.

The case of the electrical supply manufacturers, who must have an uninterrupted stream of raw materials if they are to produce the supplies urgently needed from them in the war program, really goes back to two main points. The first, which we believe they now have clearly established to the complete satisfaction of the War Industries Board, is that a certain proportion of their output is indispensable in virtually all government construction work. The second is that unless they have authority and assured materials to manufacture for stock they cannot have in readiness to furnish promptly, either directly or indirectly through the far-reaching and successful jobbing system in the industry, the lines of supplies required in all sections of the country.

The supply manufacturers are not only willing but anxious to meet the government requirements, and they will accept with patriotic readiness whatever sacrifices are asked in attaining that end. So far as their production is properly classified as essential, they want to have full and fair recognition given to their material needs. When the quantities or classes of their production, as appraised in the light of the war revision, pass beyond the boundaries of what is essential, they ask only the same consideration, if any, that is given to other industries similarly situated. No business men appreciate better than do those in the electrical manufacturing industry the pressing urgency that all things shall be subordinated to the national aim, and none will be more ready to accept and do their part. In this position the jobbers, who are affected by the arrangement with the manufacturers, will coöperate heartily in the sincere wish to do their share patriotically.

The Principles of Rate Making

THE theory of rate making by electric supply companies has been the subject of immense discussion with comparatively small results. A certain section of the public thinks that it is unprincipled at best, while those who have to fight for the annual balance sheet in these days of rising costs have little in the way of definite data on which to fix a policy. Between the two come the commissions, with large powers and no very definite legal or economic basis for their operations. In this state of things the discussion of some of the fundamentals in the matter by Prof. John Bauer will be read with more than a passing interest. The chief question which here arises is whether cost of service or value of service should properly be used in determining rates. As far as supply companies are left quite to themselves, they take up the matter as in any other commercial business and have endeavored in the past to furnish service at a cost which would attract and not repel business and which would yet yield good returns. This is the principle broadly of charging what the traffic will bear, basing the prices, as in any other commodity, on those which will yield, all things considered, the best returns. This implies that forbiddingly high rates should not be charged and that in some way or other the rates should be proportioned to the value of the service to those who elect to take it. In the hands of far-sighted managers this policy has generally led to reasonable rates, as witness the keen comment of the late A. C. Dunham to the effect that every time he had lowered his rates he had increased his net profits.

It is undeniable, however, that at times charging what the traffic will bear has led to serious discriminations which from the standpoint of the publicist must be taken into grave consideration. Fixing rates on the basis of costs looks well at the first glance, but it is very difficult to carry out rigorously, and so much depends on the somewhat arbitrary distribution of costs in the bookkeeping that trouble from inequality of rates is likely to ensue. The commissions as a rule have followed the cost theory. The laws usually require reasonable rates and forbid discrimination. Both these requirements are somewhat vague, for reasonable rates can be defined only in terms of reasonable or unreasonable rates of profit, and discrimination based on costs may be as burdensome as that based on charging what the traffic will bear. The elements of cost are so variable and so numerous that evaluating them fairly is almost out of the question. What has been done in practice, as a rule, has been the somewhat arbitrary assumption of certain conspicuous elements in cost as the variables while the other factors are taken by general average. The maximum demand, as Professor Bauer indicates, has been largely used in determining the cost of service, but the time of the demand, involving its relation to the peak, and the place of demand, involving the distance from the station, are almost always taken by general average, although in many cases more important than the maximum demand itself. There is, therefore, a very natural inclination on the part of the commissions to base the reasonableness of the rates on the return to the corporation. Considering the fact that electric supply is generally recognized as a natural monopoly and that all the tendencies have been toward the elimination of competition instead of its encouragement, this attitude is not an unfair one. Electric supply companies make their earnings in virtue of public franchises and security in monopoly given by public consent. As a rule, therefore, they are not in a position to object to public regulation, and more and more are regarding themselves as public servants with a duty to the community as well as a duty to their stockholders, an attitude which certainly makes for fair dealing all around. Ultimately, then, public regulation comes around to the basis of insuring such fair return on the investment as will encourage good service and an extension of facilities, on whatever theory the original legislation may have proceeded.

One interesting question raised by Professor Bauer is the disposition of excess profits as related to the establishment of rates. Obviously if rates were established on the basis of what the traffic would bear and pushed rigorously toward that limit, the chances are that, since electric service now partakes of the nature of a necessity, the profits could be made to reach a figure which the commissions would regard as unjustifiable in view of the participation of the community in the matter of franchises and protection against competition. If the community freely gives up the idea of competition and protects from it the public service corporation, it certainly is entitled to consideration on this account. Professor Bauer's query is whether it may not be advisable to let rates run beyond the point which would be established merely by a fair return on the investment and then, while allowing this fair return, confiscate the rest for the general good of the public. If this plan were followed, the users of electric light and power would simply be contributing a certain amount to the public funds instead of themselves getting the benefit of it in the form of lowered rates.

This matter involves a very broad question of economic policy. Our view of the case is that electric service at present is so near to a general necessity that public participation in the form of lowered rates is fairer than the turning in of excess profits for miscellaneous use. If only a small part of the community gained the benefits secured by the franchises of the whole community, a good case could be made out for the excess profits plan. Such in fact does not seem to be the situation, so that the now very frequent plan of determining the fairness of rates by just return on the capital will continue to be the preferable one. The commissions are disposed somewhat uniformly to take this view and to provide fairly for proper upkeep of the company and improvements to better public service. At the present time they have to consider the raising of rates in order to cover greatly increased costs both of material and labor, and they have approached this subject on the whole in a fair and open-minded fashion. As a matter of fact, it is total costs to which they chiefly look, so that the general policy in respect to the matter may now be considered as fixed on the cost basis, whatever advantages there may be in the opposite policy.

Electrical Engineering and the Food Supply

THE prospects for adding to the world's food supply by means of electric power is a subject of world-wide importance. Based on food statistics, it is claimed that if the total food supply of the world were evenly divided among all the inhabitants, the individual share of proteids or nitrogen constituents would be one-third less than the quantity agreed among bio-chemists to be sufficient for maintaining full strength; namely, about 20 grams of nitrogen a day per adult. Consequently, at the present time slow starvation is a very widespread cause of destruction of the race. Chemically considered, plants are necessary for the production of all our food, animal food being merely plant-produced food held in suspension. Plants require for their growth, among other things, nitrogen, phosphorus and potassium. The greatest need is ordinarily for nitrogen, notwithstanding the fact that plants and animals alike live at the bottom of an atmospheric ocean in which nitrogen is by far the largest ingredient. The nitrogen carried away from the land in the crops is renewed, in the regular course of natural phenomena, only slowly; so that intensive farming demands fertilization with assimilable nitrogen. These nitrogen fertilizers from known nitrate deposits are tending toward rapid exhaustion.

In all parts of the world the cost of food is rising, owing to the rapid growth of population. In the last hundred years the world's population has nearly doubled. As countries increase in size they tend to drain their local food stocks and seek grain elsewhere. The advantages of greater average wealth, comfort and possessions which should have accrued to the world's inhabitants during the last century by reason of the marvelous advance in machinery, science and arts bid fair to be all consumed in merely keeping a larger population existing at the old rate of average poverty.

Fortunately, the application of electricity to producing plant-food nitrogenous substances from the air has made enormous strides, the machinery so occupied having increased from 150 kw. in 1903 to approximately ten thousand times that. Nevertheless, this machinery can at present supply only a small percentage of the nitrogen in the world's annual cereal crop. After all of the nitrate deposits in the world shall have been exhausted it would appear that nitrogen fertilizers will have to be produced by electrical engineering from water power. We must either expect the nitrogen, phosphorus and potash plant foods to be greatly increased, or the struggle for existence will eventually have to maintain the necessary balance of surviving numbers. A fine field therefore lies open to chemists and engineers for producing the required chemical plant foods with the minimum expense of energy and labor.

Checking Engineering Estimates

IT HAS sometimes been said in criticism of engineers as a class that they are inclined to underestimate the cost of new projects; but that is a frailty of human nature in general and not a characteristic peculiar to engineers. When estimating on probable costs it is easy to forget items of detail which in the aggregate amount to a great deal. On that account the only safe course for the engineer to pursue is to check his summarized detailed estimate with figures obtained from experience with similar work elsewhere. Detailed estimates are not to be despised. As between the engineer who inserts details in his estimates without checking his final results and the engineer who cuts out much of the detail and calculates by means of total results per unit with figures derived from ample experience the latter is far less liable to estimate too low and incidentally gets his results quicker. The mistakes he makes, if any, are attributable to abnormal costs of some details of the work. Too much delving into detail oftentimes causes the estimator to lose sight of the broader aspects of the situation. Engineers have been known to figure the cost of some details down to fractions of a dollar and make rough guesses on the larger quantities involved, resulting in a large per cent of error. A proper perspective is all that is lacking.

The Coming Issues

DEVELOPMENTS at Washington are of large significance to the industry in these days, and they will be outlined with the same watchful care which has characterized the reports of past activities in that important center. In the further study of rate questions a second article by Prof. John Bauer will appear as a conclusion of his discussion of "Cost Versus Value of the Service." Other articles which deal not only with the rate issue in war time but also with the future of this question in central-station management will be printed. An article which will be published in an early issue discusses the development of 2500-volt fuses.

Cost Versus Value of Service in Rate Making—I

Discussion of Fundamental Purposes and Factors That Must Be Considered in General System of Public Utility Control—Charging "What the Traffic Will Bear"—Popularity of Cost Rates

BY PROF. JOHN BAUER
Princeton University

TO WHAT extent should cost or value of service be used in the determination of electric rates? To answer this question, others must first be raised as to the fundamental purposes and factors that must be considered in a general system of public utility control.

First, what is the fundamental purpose of rate regulation? Public utilities are monopolistic industries furnishing essential public services. The monopolistic nature has become so extensively recognized that not only has the attempt to enforce competition been given up, but monopoly is being protected and fostered by law. But under these circumstances, to prevent excessive private gains, the law has provided for the regulation of rates.

The public utility laws almost generally require reasonable rates and forbid discrimination. But they do not define, except in vague terms, what are reasonable rates and how they shall be determined. Then arises the more precise question, whether the primary purpose of the law is really to fix rates or to restrict the return on capital invested in a public and monopolistic service. Is the chief object to protect the consumers, or to prevent excessive earnings in essential non-competitive enterprises?

The view that is commonly expressed by the public service commissions in rate cases is undoubtedly the former. The assumption is simply that, by right, rates should be fixed at cost including all operating expenses, taxes and fair return on investment, and that rates in excess of such cost are therefore unreasonable. But this view is more easily stated than applied. Even in the simplest utilities, rough approximations have to be made in establishing cost rates. In the more complex utilities, while the total revenues collected through rates may be substantially adjusted to the total costs, including fair return on investment, the distribution of the total costs among the different classes of consumers involves much more than merely a proper cost assignment. And in the extreme case of the railroads, even the adjustment of total revenues to total costs cannot be accomplished by individual railway systems, and cost simply cannot be taken as the basis of rates*.

RETURN ON INVESTMENT

In any rate proceedings, however, apart from the removal of clearly discriminating practices, the chief consideration in determining a rate schedule is the return on investment. If the revenues exceed a fair return, the rates are too high and are reduced; but if they are less, then the rates are too low and are raised. The standard of reasonable rates, therefore, is the fair return on investment. This clearly indicates that the fundamental purpose is the control of return, and not the fixing of reasonable rates as such. This is well illustrated by the increase in railroad rates recently announced by Director General McAdoo. Most of the advances amount to 25 per cent or more, and yet there is practically no opposition by the shippers or the public. Why? Partly, of course, for present patriotic reasons, but probably chiefly because the increases will serve the public and not private interest—which, too, is patriotism. Except for obvious discriminations, railroad rates have never been considered unreasonable as such. The opposition to the advances sought by the railroads from time to time in recent years has not been due to unreasonableness itself of the proposed rates, but rather to the unreasonable returns that would be obtained by many companies. There probably would have been no substantial opposition at any time if the advances had been on public and not private account.

If the view is correct that the primary purpose in rate regulation is the control of return on investment, we then face the question whether this control is better maintained through the adjustment of rates or by leaving the companies practically free to fix rates according to ordinary commercial considerations and then taking the excessive earnings above a fair return for public purposes. It would, of course, be unreasonable to allow a company more than a fair return in a monopolized public service. Whether the one method or the other for restricting the return be used must depend upon the circumstances of each particular class of utilities.

WHAT THE TRAFFIC WILL BEAR

Cost rates in themselves have no fundamental claims to reasonableness. Rates based on so-called value of service, or, as often stated, on what the traffic will bear, are not unreasonable *per se*. They are such as the masses of possible consumers will pay rather than substitute for or go without the service. Their purpose is to produce maximum profits and thus fix the greatest value for the business. They are the so-called monopoly rates or prices. But they cannot be arbitrary; they must have regard for the needs of the consumers, else they will result in less than the greatest profit or maximum value of the business. They must be carefully guarded so as not to charge more than the traffic will bear. The value of the service must be judged from the standpoint of the different groups of possible consumers, not according to single individuals, or the rates will not bring the maximum profits.

If the term "charging what the traffic will bear" is properly understood and is scientifically applied, there simply cannot be anything unreasonable in the rates themselves. Of course, business managers are always likely to attempt to charge more than the traffic will bear, and to introduce discriminating practices, which finally mean less than maximum profits. These matters

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*See the writer's "Return on Public Service Properties," *Political Science Quarterly*, March, 1915; also "The Federal Valuation of Railroads in Relation to a Definite Policy of National Railway Control," *Proceedings* of Am. Econ. Asso., March, 1917.

should always be under the supervision of the commission. But if value of service rates are really what the traffic will bear, consumers have no clear ground for objection. The only unreasonable thing would be an excessive return realized by the investors.

Cost Rates Popular

Whether the control of the return on investment should be exercised through cost rates or through value of service rates with excessive profits taken for public purposes depends upon the desirability and the practicability of fixing cost rates. In general, however, there does seem to be a natural feeling in favor of cost rates, and they probably should be applied unless there are clear reasons to the contrary. The question really turns on the practicability. Still, where service is used extensively by well-to-do and wealthy people, and very little by the poorer classes, there is no urgent reason for attempting difficult rate protection below what the traffic will bear, while there is good reason if the service forms practically a necessity to the poorer people.

Further, if the service is used in production, not in direct consumption, there would be little expediency in shielding the purchaser from the full value of the service, for the rates would form only part of the production cost, and a reduction might not benefit the ultimate consumer; and there would be little sense in fixing the price of one factor in production and leaving all the others, as well as the final product, to be determined according to market conditions. But if the service goes into direct consumption, then a reduction in rates actually benefits the final consumers, and it probably would be desirable, especially if the service goes to the poorer classes and if cost rates can be practically determined.

Practicability of Cost Rates

The practicability of cost rates depends upon (1) whether there is a single service or at any rate few services whose costs may be clearly separated, or whether there are several services with a large proportion of joint costs; (2) whether there is a single locality or few localities whose costs may be separated, or whether there are many interdependent localities whose costs are merged and whose rates cannot be made independent of each other.

As to the first point, there is, of course, no public utility which strictly furnishes a single service. Still, practically, we may say, that a street railway performs only one service, passenger transportation, and its rates may be fixed according to cost. The total costs, including return on investment, may be divided by the number of passengers, and the result may be used as the proper rate, with a moderate allowance for contingencies. On the other extreme, the steam railroads furnish services of a thousand sorts, involving joint investment and expenses, so that even a rough determination of cost for each service becomes an impossible matter.

As to the second point, again no public utility strictly supplies only one locality. The same city usually furnishes so many different circumstances as to amount to different localities. Still, practically, in most instances of so-called local utilities, rates may be fixed on the same general cost basis within a city or a clearly defined similar area. But when several cities or widely separated areas are united by continuous service, so that there must be a network of interdependent rates, cost determination becomes an utterly arbitrary matter. Most of the costs are jointly incurred between localities; how shall they be apportioned? Rates must form a continuous system; how may that be accomplished?

DYNAMIC BALANCING OF ROTATING SECTIONS

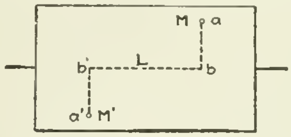
Simple After Static Balance Is Obtained—Rational Unit for Expressing and Measuring the Tolerance Allowed

BY CARL HERING

IT IS well known that a piece of machinery to be rotated about an axis, like an armature, a turbine rotor, an automobile or aeroplane crank shaft, may be balanced when placed on knife edges or between pivots—called static balancing—yet may be very much out of balance when it is rotated, especially when such rotation is rapid. Correcting the latter condition is called dynamic balancing.

In the latter case, if the piece has first been corrected with reference to static balance, it is always true that the dynamic balancing could be secured by adding or taking away two equal masses, equally distant from the axis and at a certain distance apart measured along the axis. In the diagram, for instance, let it be assumed that the piece is balanced statically yet unbalanced dynamically, then the latter could always be corrected by adding or taking away two equal masses M and M' at equal distances ab, $a'b'$ from the axis and at an axial distance apart L equal to bb'.

As it is often unnecessary and too expensive to carry this dynamic balancing to perfection, a certain small amount of lack of balance is permissible or tolerated, and this amount depends on the use to which the piece is put, its natural period of vibration, the pressure on the bearings, the strength of the shaft, etc., and largely on the speed of rotation. As this limit of tolerance must be capable of being stated in specifications and may be the subject of dispute, it is very desirable to be able to express it in terms of a definite and rational unit, instead of stating it, as at present, in loose, vague, almost meaningless terms which are not definite and admit of different interpretations. A tolerance stated in specific, clearly understood terms also eliminates the factor of the personality of the constructor and the particular "make" of machine. All makers who can work down to such a stated tolerance are then equally good in this respect. The purpose of the present article is to show what this rational unit should be.



MEANS OF PRODUCING DYNAMIC BALANCE

Returning first to static balancing, it is evident that an unbalanced state can always be expressed in terms of a single resultant—namely, one definite excess of mass M at a definite distance D from the axis—but neither of these quantities need be known separately. All that is necessary is their product; that is, the moment or torque. No matter what the speed is, this statically unbalanced condition can always be corrected by adding or taking away another mass *m* at another distance *d*, provided only that the two products or moments are equal; that is, that $md = MD$. This is important in practice as it is often more convenient to add or remove this mass at certain definite places where the distance *d* becomes fixed; the amount of the mass can then readily be adjusted so that the product *md* is the required amount.

UNIT FOR EXPRESSING STATIC-BALANCE TOLERANCE

The unit for expressing the tolerance or allowable lack of static balance is therefore the product of a mass and a distance. In the metric system it would be a centimeter-gram, and in the system of units which we have unfortunately inherited and must still tolerate it is the ounce-inch; that is, the product of ounces and inches. These two smaller units are preferable to the pound and the foot, because the latter are in most balancing cases such large units that inconveniently small fractions would have to be used. (1 ounce-inch = 72.008 cm.-grams; 1 cm.-gram = 0.013887 ounce-inch.)

Physically that which causes unbalance is a moment (a mass multiplied by a lever arm), but as our units of mass, like the gram, ounce, pound, etc., are also used very frequently to represent forces, and as in those cases their product with a length represents energy, like gram-centimeters, foot-pounds, etc., it becomes very desirable, in order to avoid confusion, to make a distinction between these two physically different products, and this is best done by expressing these moments in ounce-inches or pound-feet, and the energies as usual in inch-ounces or foot-pounds.

Hence the tolerance in static balancing may be expressed correctly and definitely in terms of the unit ounce-inch; and as the amount of permissible unbalance, other things being equal, decreases in direct proportion to the square of the speed, the stated number of ounce-inches should be accompanied by the speed to which it applies. According to N. W. Akimoff, who has made a special study of balancing, a fair limit of tolerance for the static balancing of such a piece as an armature weighing not over 200 lb. (90.7 kg.) might be about 0.4 ounce-inch (28.8 cm.-gram) for a speed of about 1000 r.p.m., or one-quarter of this for 2000 r.p.m., etc. This value, however, varies with the particular piece and the nature of the machine in which it is used. This means that there is 0.2 ounce (6.2 grams) too much at a distance of 2 in. (5.1 cm.) from the axis, or 0.4 ounce (12.4 grams) at 1 in. (2.54 cm.), etc., and that a mass of this amount at the corresponding distance must be removed or must be added diametrically opposite, in order to bring about perfect static balance. The limit in balancing is governed more largely by the permissible amount of vibration, the natural period of vibration of the machine as a whole, and by the pressures on the bearings, than by the bending of the shaft. It is also greater for heavier bodies.

UNIT FOR TOLERANCE IN DYNAMIC BALANCING

Coming now to dynamic balancing, any lack of balance involves two moments or products *md*, like those in static balancing, but in addition there is the axial distance between them, *L* or *bb'* (see diagram). After balancing statically these two moments are necessarily always in the same axial plane and equal to each other, but only as moments, since the two excess masses and their radial distances may be different. The necessary condition is that their products are equal. Hence these moments themselves may again be expressed and measured in ounce-inches, and as they are always equal (after balancing statically), the same tolerance as to the moments themselves applies equally to each; hence only one of them needs to be considered in stating it.

A pair of such equal moments at a distance *L* apart, as in the cut, produces the unbalancing as when the moments are half as great but are twice the axial distance apart, or as twice the moments at half the distance apart. For the same moments the unbalancing is in direct proportion to the distance *L* apart. This distance therefore enters into the unit like the radial one; hence the correct unit to use in dynamic balancing is the ounce-inch-inch, which is a moment of a moment,* or a centrifugal couple. This form, however, leads to the tendency to write it ounce-inch^2, which would be misleading as it implies the squaring of one distance, instead of the product of two very different ones. Although they are both the same physical quantity—namely, a length—yet they differ as vectoral quantities, being different in their angular directions. Hence this unit might perhaps better be specified as inch-ounce-inch, or, in the metric system, as a centimeter-gram-centimeter. (1 inch-ounce-inch = 182.90 cm.-gram-cm.; 1 cm.-gram-cm. = 0.0054674 inch-ounce-inch.)

A permissible unbalance at 1000 r.p.m. would have to be reduced to a quarter for 2000 r.p.m; that is, it is again inversely proportional to the square of the speed. Hence a standard tolerance in dynamic balancing must also state the speed to which it applies. When unbalancing is stated in terms of these specific units, it is a simple matter to determine by trial how much tolerance in unbalancing may be permissible with any particular machine, if there is available one that is perfectly balanced. One need merely temporarily to attach two equal known weights at equal known distances from the axis, on opposite sides, and at a known axial distance apart; then increase these weights or distances until it is found that the vibrations or bearing pressures become excessive.

According to Mr. Akimoff, a fair limit of tolerance for the dynamic balancing of such a piece as an armature might be about 12 inch-ounce-inches (2190 cm.-grams-cm) for a speed of 1000 r.p.m., or a quarter of this for 2000 r.p.m, etc. This value, too, varies with the particular piece and its uses. He has found that quantities as small as one-third or one-quarter of these suggested tolerances can easily be detected by a well-built machine intended for measuring the amounts of unbalance.

Dr. Akimoff, who has made a special study of balancing and is carrying it out in practice, more especially in difficult cases, is using the above-mentioned units in his work and finds them to be satisfactory in every way. The writer is indebted to him for reading over and approving the statements that are made in this article.

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*In the C. G. S. system this quantity has the same dimensions as a moment of inertia.

New Industrial Lighting Code for Wisconsin

Old Code Is Discarded on Account of Vagueness—New Rules Define Terms Used and Provide for Definite Values of Illumination and Glare—Experts Aid in Revision

BY JOHN A. HOEVELER,
Illuminating Engineer, Industrial Commission of Wisconsin

AS A result of the appointment of an advisory committee to consider the revision of shop-lighting orders of the Industrial Commission of Wisconsin, a new code was adopted which is much more specific in its provisions and thus more readily understood and enforced. All technical terms used are defined for the benefit of factory superintendents. More definite specifications provide for adequate light distribution for various classes of work, taking into account daylight as well as artificial illumination, and, for the elimination of objectionable glare, the brightest square inch of visible light source permitted is 75 cp. for overhead lighting and 3 cp. for local lighting.

In order that all interests might be represented and thus given the opportunity of advancing constructive criticism, the advisory committee was made up of ten members, including the superintendent of a lamp-manufacturing factory, the manager of a gas company, the illuminating engineers of a central station, of the city of Milwaukee, of the United States Public Health Service and of the Industrial Commission, the chief electrician of a manufacturing plant, the works manager of a manufacturing plant, an electrical contractor and an oculist.

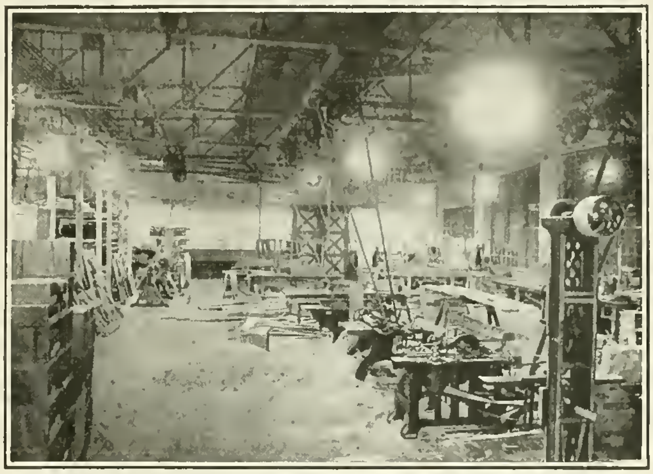
This advisory committee at its first meeting did little more than decide that the shop-lighting orders of the Industrial Commission, in effect since 1913, should be repealed and an entirely new code adopted, patterned after the Illuminating Engineering Society "Code of Lighting for Factories, Mills and Other Work Places," and the similar codes of Pennsylvania and New Jersey. It was also decided to solicit the assistance of prominent illuminating engineers, both in and outside Wisconsin, and of the committee on lighting legislation of the I. E. S., of which L. B. Marks of New York is chairman. The committee expresses its indebtedness to T. F. Foltz of the Department of Labor and Industry of Pennsylvania, Lewis T. Bryant, Commission of Labor of New Jersey, Francis A. Vaughn of Milwaukee, Arthur J. Sweet of Milwaukee and the above committee of the I. E. S. for much valuable information.

The 1913 shop-lighting orders were repealed because they employed a unit of illumination intensity "which does not definitely specify the quantity of illumination which must be received at the work and fails to meet the requirements of a proper code of lighting in the following respects: (1) Insufficient distinction is made as to the requirements for different classes of work; (2) requirements in some instances are too low; (3) requirements are indefinite in that they sometimes do not specify a particular intensity of illumination, apparently leaving the selection to the employer."

Concerning the proposed new orders, the committee recommended that "the scope of the new orders be extended to include all portions of industrial plants—(1) roadways and yard thoroughfares; (2) stairways, passageways, aisles, storage spaces; (3) manufacturing spaces; (4) offices.

The parts of the new code, as recommended by the committee, which differ from provisions of other industrial commissions are specified as follows:

The new lighting code differs from the 1913 orders and many existing codes in that it defines terms used, definitely specifies the intensity of illumination to be provided at the work for the different classes of work (the unit of illumination employed is the foot-candle), provision is made for adequate properly applied natural illumination (a feature other states have not adopted as yet), shading of lamps is mandatory under certain conditions which are recognized to be bad when lamps are permitted to be exposed, and thus provision is made to minimize glare, the distribution of light on the work must be reasonably uniform, emergency lighting is required, pilot or night lights and easily accessible control are specified, and maintenance is made mandatory.



LAMPS INSTALLED TO CONFORM WITH WISCONSIN CODE

The light distribution is uniform, the lamps being placed 9 ft. (2.7 m.) above the floor and 12 ft. (3.6 m.) apart to obtain this result.

The committee states as its opinion "that these orders, if adopted, will make it possible to secure lighting in industrial plants which will reduce avoidable accidents, and if the industrial commission, through its deputies, will urge employers to provide the intensities of ordinary practice, working conditions will be greatly improved to the benefit of both employer and employee."

Although the committee agreed that all new buildings preferably should be constructed so as to make proper provision for adequate natural lighting, it was also agreed that this frequently is impossible (no matter how much glass area may be provided) in congested districts. Therefore a general requirement (Order

2110) was worded so that either natural or artificial light may be used. Obviously it is to the advantage of the owner to utilize as much natural light as possible, and when the code is published by the industrial commission it is proposed to include an appendix which will point out the advantages of natural ilumination and briefly discuss economical means of securing it in adequate intensity, properly applied.

Illumination Intensities Specified

The illumination intensities at the work, specified for different classes of service in Order 2112, are the same as recommended by the I. E. S. committee on lighting legislation, with the exception of "(d) Toilets and Washrooms," which was added at the suggestion of the writer, after having seen it included in a draft of proposed lighting standards for federal industrial establishments formulated by the Bureau of Standards. The committee felt that toilets and washrooms were important enough spaces in the industrial plant to warrant a separate specification, as all too frequently these are the darkest and most unsanitary parts of a factory.

The reduction of harmful glare with artificial lighting systems occupied much attention on the part of the committee. As mentioned by Prof. C. E. Clewell in the Electrical World some time ago,* the Wisconsin advisory committee was of the opinion that the I. E. S. glare specification ("Lamps shall be suitably shaded to minimize glare") is too indefinite, and that a more definite rule would aid the inspectors who are called upon to determine when the limits of glare are exceeded. The glare specification, as embodied in Order 2113 ("Shading of Lamps for Overhead Lighting") and Order 2114 ("Shading of Lamps for Local Lighting"), is the outcome of correspondence with the I. E. S. committee on lighting legislation and a sub-committee which was appointed to investigate this matter and of which Ward Harrison was chairman.

The committee fully realized that the glare rule adopted may require revision after being tried out, but that is the reason the State of Wisconsin has abandoned making safety and sanitation laws by statute and instead has created an industrial commission and given it full powers to issue orders which have the legal force of statutes on these subjects. The state government realized that advances in industry bring about change in conditions of employment, and that an elastic method of dealing with such changes would be the only successful one. The I. E. S. continued the above mentioned sub-committee to coöperate with the Industrial Commission, and it is expected that this coöperation will result in gaining more information on this important problem. Although the advisory committee knew that there was not sufficient knowledge to state definitely the maximum allowable brightness permissible, it was convinced that the maximum set was not unreasonable.

Since opaque metal or mirror reflectors are chiefly used in the industries of Wisconsin, this requirement will insure good eye protection because of the fact that for locations coming within the scope of the rule reflectors which screen off all light within approximately 14 deg. below the horizontal of necessity will be used.

When glass reflectors are used they must be dense enough to reduce the brightness to less than 75 cp. per square inch. Light sources of lower brightness than 75 cp. per square inch, as, for instance, mercury-vapor lamps with a brightness of but 14.9 cp. per square inch, may be used exposed; but, as explained in the accompanying note, conditions of individual installations may require the shading of light sources of even such low brightness.

As regards the distribution of light on the work, the advisory committee considered the wording "a good distribution of light on the work" of the I. E. S. code too indefinite, and, as mentioned by Professor Clewell in the article previously referred to, several attempts were made to make the rule more definite. Finally the matter was settled by wording the rule as in Order 2115 ("Distribution of Light on the Work"). The term "reasonably uniform distribution," it was felt, would give the inspectors a better idea of what is considered satisfactory light distribution. Local lighting only is not permitted, except where the light from the lamps falls principally upon light surfaces and where the ceilings and walls are light, under which condition there is often sufficient general illumination.

The question of emergency lighting caused much difference of opinion among the committee members. All were agreed that some emergency lighting is necessary, but that the necessity varies much with the different industries, that large plants need it more than small plants, and that the character of emergency lighting which may be secured at reasonable cost varies considerably in different localities. A general rule (Order 2116) was agreed to, but it was considered essential that explanatory notes be included in an appendix to indicate what the Industrial Commission would consider satisfactory compliance with the order.

Maintaining the Equipment

When all is said and done regarding the proper requirements of a lighting system, either natural or artificial, and the factory is properly equipped, of what use is the lighting if it is not maintained? To meet this objection, Order 2118 ("Maintenance") was included in the code. The committee realizes that this provision can be enforced much less rigidly than the others, because the Industrial Commission has too few inspectors to make it possible to visit all the factories at frequent intervals, as would be necessary if the maintenance of the lighting were to be checked up. In fact, an inspector at present can hardly cover his territory in a period of a year.† However, if when the inspector visits a plant, he finds the lighting facilities poorly maintained, he will be clothed with the authority to order a general clean-up and replacement of defective equipment. It is calculated that this will in time help matters, especially in view of the fact that the inspectors do their work in a coöperative way and spend much time educating the plant superintendents and foremen in safety, sanitation, lighting, ventilation, welfare and supervision of male, female and child labor and in arbitrating disputes between employer and employee.

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*"Changing Aspects of Factory Lighting Legislation," Vol. 71, No. 13, p. 666.

†The Wisconsin inspectors do their work in an intensive manner. Each factory inspected is given careful study. Meetings of the foremen are called, at which the unsafe practices of the plant are discussed and remedies suggested. The foremen are made to realize that it is their duty to instruct their men how to perform their work safely, to see that machines are guarded, that the shop is sanitary and that the many other requirements of the commission are carried out; that these requirements have been drafted by committees of practical shopmen and experts in various lines, only upon due consideration, and that as a result they represent what is considered a minimum to make the conditions of employment better. Consequently fewer factories are visited each year than if the work were confined merely to looking for violations of the commission's orders and issuing an order for the correction of the violation.

The various orders were read and discussed at a public hearing in Milwaukee, and practically no objections were raised. On the other hand, some favorable comments were expressed. On May 20 the Industrial Commission adopted the code, which took effect on July 1, 1918, for new construction and will be effective on July 1, 1920, for additions to existing lighting systems. Replacements of existing systems not in accordance with the code must be prosecuted as rapidly as circumstances permit. In the latter matter the Industrial Commission will exercise its best judgment as to how rigidly to enforce the provision. When these orders are published in bulletin form, which is being done now, it is proposed to include an appendix which will discuss each order in detail and suggest how it may be complied with. The purpose of this appendix will be to assist architects, electrical contractors, shop superintendents and electricians who design lighting installations to interpret the code properly.

EXTRACTS FROM WISCONSIN LIGHTING CODE

Order 2112—Artificial Light.

When the natural light is less than twice the minimum permissible intensities of illumination set forth in the following table, artificial light shall be supplied and maintained in accordance with the table. The intensities of recommended practice indicate the desirable illumination for best working conditions.

ILLUMINATION INTENSITY AT THE WORK IN FOOT CANDLES

	Minimum Permissible Intensity	Ordinary Practice
(a) Roadways and yard thoroughfares	0.02	0.05–0.25
(b) Storage spaces	0.25	0.5–1.0
(c) Stairways, passageways, aisles	0.25	0.75–2.0
(d) Toilets and washrooms	0.5	1.5–3.0
(e) Rough manufacturing, such as rough machining, rough assembling, rough bench work, foundry floor work	1.25	2.0–4.0
(f) Rough manufacturing involving closer discrimination of detail	2.0	3.0–6.0
(g) Fine manufacturing, such as fine lathe work, pattern and tool making, light colored textiles	3.0	4.0–8.0
(h) Special cases of fine work, such as watchmaking, engraving, drafting, dark-colored textiles	5.0	10.0–15.0
(i) Office work, such as accounting, typewriting, etc.	3.0	4.0–8.0

Note.—The measurements of illumination are to be made at the work with a properly standardized portable photometer.

The minimum foot-candles specify the lowest illumination intensity with which the employees can be expected to work with safety when artificial light is used. It is to the advantage of the employer to provide the intensities of the ordinary practice, as this results in less eye strain, greater accuracy of workmanship, increased production for the same labor cost and less spoilage. When part daylight and part artificial illumination is used, it is desirable to use even higher intensities than those of ordinary practice in the table above. (See note accompanying Order 2111.)

In order that the illumination intensities shall never fall below the minimum during the interval between inspections, installations should be designed to produce initial values at least 25 per cent higher.

Order 2113—Shading of Lamps for Overhead Lighting.

Lamps suspended at elevations above eye level less than one-quarter their distance from any position at which work is performed must be shaded in such a manner that the intensity of the brightest square inch of visible light source shall not exceed 75 cp. (See appendix for method of measuring brightness.)

Exception.—Lamps suspended at greater elevations than 20 ft. above the floor are not subject to this requirement.

Note (a).—Glare from lamps or unduly bright surfaces produces eye strain and increases the accident hazard.

The brightness limit specified in this order is an absolute maximum. Very much lower brightness limits are necessary in many interiors illuminated by overhead lamps, if the illumination is to be satisfactory. In some cases, the maximum brightness should not exceed that of the sky (2 cp. to 3 cp. per square inch)

Note (b).—Where the principal work is done on polished surfaces, such as polished metal, celluloid, varnished wood, etc., it is desirable (but not mandatory at present) to limit the brightness of the lamps in all downward directions to the amount specified in this order.

Order 2114—Shading of Lamps for Local Lighting.

Lamps for local lighting must be shaded in such manner that the intensity of the brightest square inch presented to view from any position at which work is performed shall not exceed 3 cp.

Note.—In the case of lamps used for local lighting, at or near eye level the limits of permissible brightness are much lower than for lamps used for overhead lighting, because the eyes are more sensitive to strong light received from below, and because such light sources are more constantly in the field of view.

Order 2115—Distribution of Light on the Work.

The reflectors or other accessories, mounting height and spacing employed with lamps shall be such as to secure a reasonably uniform distribution of illumination, avoiding objectionable shadows and sharp contrasts of brightness. If local lighting is used, there shall be employed in addition a moderate intensity of overhead lighting.

Exception.—Where the light from the local lamps falls principally upon surfaces which are white or nearly so and the ceiling and walls of the room are light, there is often a sufficient general illumination received indirectly by reflection to obviate the necessity of additional overhead lighting.

Note.—When local lighting is used as the sole source of illumination of an interior, the field of illumination from each lamp is in contrast to the surrounding darkness, thereby causing eye strain and increasing the accident hazard.

Order 2118—Maintenance.

All lighting equipment and windows shall be periodically cleaned, inspected, kept in order, and when defective replaced, so that the intensities of illumination will never fall below those specified in Order 2112.

LAUNDRY CONSTRUCTION AT MAIN CANTONMENTS

Power to Operate the Laundries to Be Supplied by Special Power Houses to Be Erected at the Same Time

The War Department authorizes the statement that laundries are to be provided in all of the principal camps and cantonments. The average cost of each will be $150,000, and $5,754,990 for this purpose has been authorized. The work will be done by the Construction Division.

Power to operate the laundries will be supplied by special power houses which will be erected at the same time. The buildings in each of the larger camps will cost $176,000, while $130,688 is provided for each of the smaller camps.

Instructions have been issued to proceed with the work at the following camps: Johnston, Sevier, MacArthur, Las Casas, Devens, Gordon, Dodge, Grant, Pike, Taylor, Greene, Hancock, Shelby, Sheridan, Beauregard, Wadsworth, McClellan, Meigs and Mills, and Forts Wright and Terry.

Our country is going to live long after this war, and one of the things we will need after the war will be trained young men to take the place of the older who go out. So that I would think it a great mistake for the educational institutions of our country to shorten their courses or in any way cease to provide this trained product, just as I think it a great mistake for our young men to leave these courses before they are trained, excepting those who may be strictly needed.—*Gen. William M. Black, Chief of Engineers, United States Army.*

Pin or Arm Insulation Not Sufficient

Placing Dependence on It on High-Voltage Lines, Especially Where Subjected to Salt Air, May Cause Charring Due to Current Leakage—Some Remedies That Have Been Tried Are Suggested

IN HIGH-VOLTAGE lines all dependence for insulation should be placed on insulators, not on pins, according to a paper read at the recent meeting of the Pacific Coast Section, N. E. L. A., on the "Standardization of Pin-Type Insulators." As pins are designed primarily as mechanical supports, any attempt to utilize them as subsidiary insulators must inevitably weaken their mechanical strength. Wood thimbles on steel pins are especially objectionable whenever they are subjected to appreciable charging or leakage currents, since there results a "digesting" or charring of the wood and failure of the pin to hold the insulator properly. This deterioration is accentuated on pins of this compound type, probably owing to the concentration of the electrostatic stress on the comparatively thin wooden shell of the thimble.

It is evident that in any installation of the higher voltage class (10 kv. and up) in which porcelain insulators of either the pin or suspension type are used the principal insulation is in the insulator, and any subsidiary insulation secured from wood pins or cross-arms must be of minor value. Of course, in arid districts lines will often operate for considerable periods after insulators have been broken and the dry wood of the cross-arm or pole is the only insulation remaining intact. But in districts of ordinary humidity dependence on wood as a subsidiary insulator, particularly where the leakage or charging current must cross sections of restricted area, is not only useless but may be hazardous. Porcelain of good quality will withstand for long periods without deterioration leakage currents and streamers resulting from surface deposits of salt or dust. On the other hand, wood is rapidly deteriorated by such current, and if the wood constitutes a mechanical support at the point of failure, line failure results.

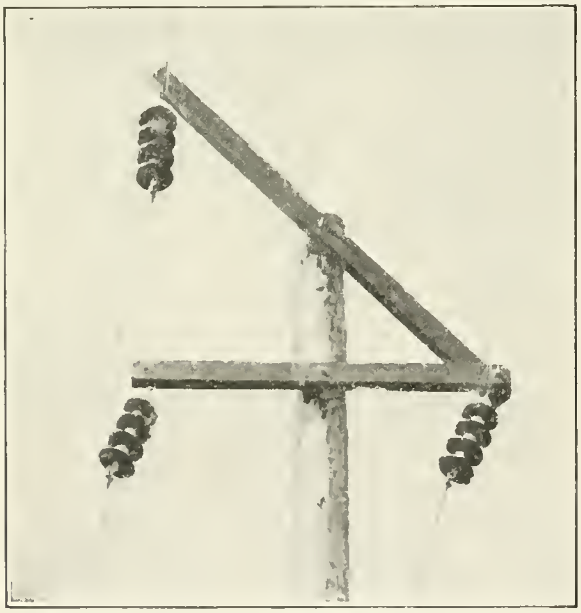


FIG. 1—CHARACTER OF CONSTRUCTION USED ON 70-KV. LINE

Before bonds were installed the wood cross-arms were badly burned, especially at bolts attaching the insulator strings to the arms and at the bolt connecting the arms together.

Failure of wood by burning is, of course, due to the heating of the wood to the point of combustion by the leakage current; that is, by the I^2R loss in the wood. As wood dries out its resistance, R_w increases, and consequently I^2R_w increases, provided that I does not correspondingly decrease. But in any case having to do with a porcelain insulator in series with a wood insulator (pin or cross-arm) the leakage current I is primarily fixed by the greater comparative resistance R_p of the porcelain insulator; thus if $I = E/(R_p + R_w)$ and if R_p is great compared with R_w considerable changes in R_w will have little effect on I. So that as a wood member dries out the I^2R loss in that member increases, for there is an increase in R_w without a corresponding decrease in I. On the other hand, as R_p decreases I greatly increases even though R_w may be on the increase. Thus we may look for charring of wood at times when R_p is on the decrease and R_w is constant or increasing.

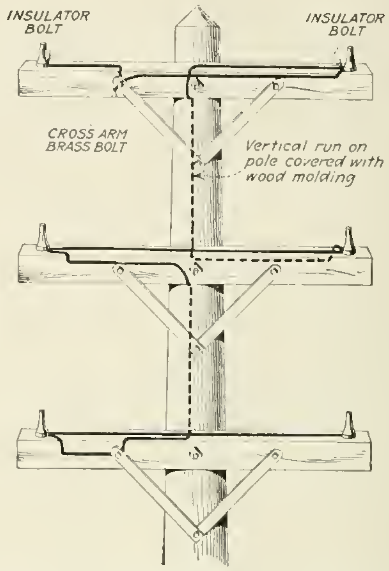


FIG. 2—METHOD OF RUNNING BOND IN ONE PIECE ON TWIN-CIRCUIT, THREE-CROSS-ARM CONSTRUCTION

On the California coast there is a general condition of a rainy and a dry season. Following rains the insulators are clean and consequently R_p is high; I is minimized and the leakage causes no trouble. Even during periods of heavy precipitation when R_p might be assumed to be low on account of the quantity of water on the insulator surfaces I may be comparatively great, but at the same time R_w is low, owing to the water on the wood, and damage does not result. During the dry season which follows the wet dust and salt gather on the insulators, R_p is gradually reduced and I correspondingly increased. Finally there comes a time of cool summer fogs and the deposits of the insulators become relatively conducting, but the wood parts, on the contrary, do not accumulate sufficient moisture greatly to reduce R_w. This is the time of burned cross-arms and charred pins.

The only remedies are the use of all-metal pins and the electrical connection of such pins together. The latter expedient is not always necessary on moderate voltage lines, provided that a sufficient degree of over-insulation is used so that the leakage current does not become excessive before the winter rains clean the insulators.

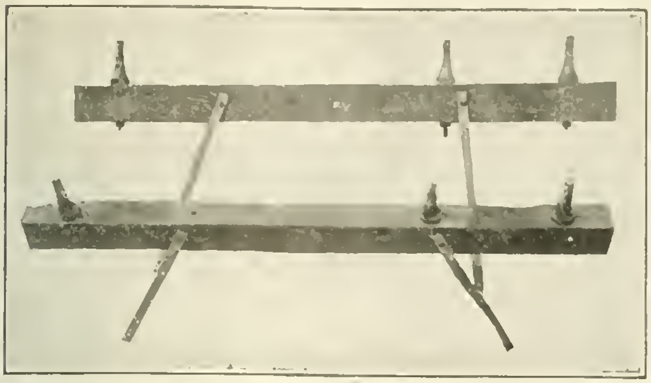


FIG. 3—WOOD CROSS-ARMS IN VARIOUS STAGES OF DEPRECIATION

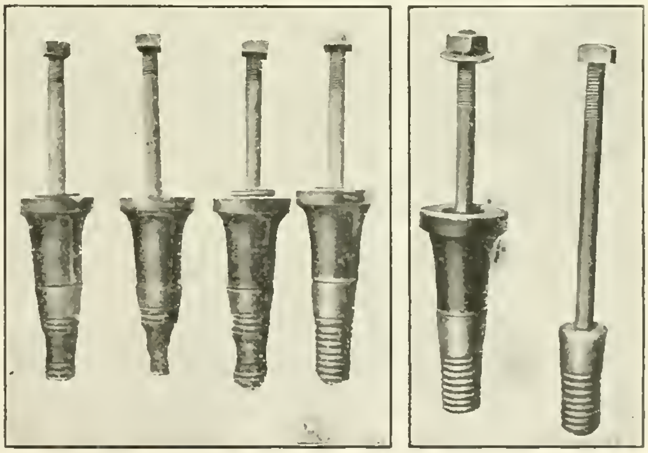
Actual examples of difficulties with wooden members as subsidiary insulators may be of interest. A certain 75-mile (120.7-km.) stretch of 70-kv. three-phase (grounded-neutral) line closely paralleling the coast was first placed in service May 21, 1918. This line is constructed with wood poles and cross-arms. On all but 18 miles (29 km.) of the line ¼-in. (6.35-mm.) steel cables had been installed to connect electrically the pole ends of the suspension insulator strings. The 18 miles of unbonded line represented an earlier type of construction, this being the reason for the omission of the bonds. Although difficulties due to cross-arm burning were foreseen and provided against in the building of the last 57 miles (91.7 km.), it was at first thought that the original 18 miles might successfully operate without bonds. However, on June 3 one insulator string burned loose from an arm, causing the dropping of the line. On June 4 two more arms burned off, the second failure also burning off the entire pole top.

An examination was then made of the 18-mile section where the connecting conductors had been omitted, and it was found that without exception every cross-arm was charred at the point of contact with each bolt supporting an insulator string. Furthermore, charring had proceeded at the point of contact between cross-arms (Fig. 1) and in some cases about the bolts holding the cross-arms to the pole. Thus it will be seen that charring had taken place, particularly where current spread from metal parts into wood, these being the points of maximum concentration. The charred areas radiated from the bolts and to a certain extent the burns followed the wood veins. Following the third failure the unbonded section of line was shut down and connecting conductors were installed, thus obviating further difficulty. It is not known why the trouble took ten days or more to develop, unless during this time the arms were being thoroughly dried out by leakage current. There was no change in climatic conditions during this period, the temperature varying from 54 deg. to 67 deg. Fahr. (12.2 to 19.4 deg. C.).

Connecting bonds as installed on this line consist of ¼-in. (6.35-mm.) extra-galvanized standard steel strand. These are cheaper and probably as effective as copper. The bonds are installed on the top of each arm and are held between pairs of washers where passing around each bolt. Attempts are always made to run the bond in one unbroken piece. Vertical runs along the pole are covered with wood molding. Fig. 2 shows the method of running the bond on a standard twin-circuit vertical construction. The bonds should not only be connected to the bolts holding the insulator strings, but also to those holding the cross-arm braces to avoid burning at these points. On poles having insulators in horizontal strain positions galvanized steel strap is preferable to cable, as it affords a flat bearing surface for the eye bolts or other dead-end members. The bonds described are not grounded except on those poles to which guys are attached.

Under a state law it is necessary to install strain insulators in all guys attached to wood poles. To have installed insulators of the suspension type adequate to the line voltage would have involved an expensive installation and one which was mechanically undependable. On the other hand, to have placed insulators of the ordinary interlocking type in the guys would have given adequate mechanical strength, but these would have been electrically insufficient. Thus line insulator failures would almost certainly have led to the electrical failure of the strain insulator in the guy followed by the burning off of the guy and a most serious mechanical line failure. To avoid these difficulties mechanically strong insulators of the interlocking type were employed in the guys and at the same time the bonding conductors at all guyed poles were grounded, thus short-circuiting the guy insulators.

Cross-arm burning may be serious even on lines of moderate voltage where the insulation is inadequate to the physical conditions imposed. Fig. 3 shows cross-arms removed from an 11-kv. line after seven years of service. The top and sides of the arm are seen to be seriously charred. The pins also have suffered, the 1-in. (2.54-cm.) thimbles being badly digested. The insulators in this case were two-piece porcelain of fairly modern design rated by the manufacturers at 15 kv.



FIGS. 4 AND 5—WOOD PINS IN VARIOUS STAGES OF DEPRECIATION; ALSO LEAD THIMBLES USED TO REPLACE THEM

The wood-thimble pins were removed from a 11-kv. line, where they were used in conjunction with insulators rated at 27 kv. The lead thimbles are made in plaster of paris molds.

They were quite evidently inadequate to the service imposed.

Wood-thimble pins often suffer charring without any evidence of cross-arm burning. Fig. 4 shows a group of pins with 1⅜-in. (3.49-cm.) thimbles and ⅝-in. (15.8-mm.) bolts in various stages of deterioration. The pins were removed from an 11-kv. line in the fog district but outside of the spray belt. The insulators were rated by the manufacturers at 27 kv., and the pins when removed had been in service five years. The cross-arms were unaffected in this case. In fact, there are many lines utilizing wood-thimble pins which suffer severe depreciation of thimbles yet in which cross-arms are unburned. This would tend to indicate an especially concentrated stress on the thimbles. It is also possible that during the first seasonal rains, when cross-arms are protected from excessive I^2R losses by moisture on surface, the pin being shielded would be subject to particularly heavy leakage. Pins in dry districts are virtually unaffected.

All-steel pins on the lines from which the pins shown in Fig. 4 were removed give good results with insulators of the same type, there being no burning of cross-arms. It has been quite evident from the experiences of this company that wood-thimble pins are unsuited to its lines, and they have been superseded in new work by all-metal pins with slotted thimbles and felt insertion. There have been no difficulties due to cracked insulators with these pins; the expansion troubles which are usually feared with all-metal pins have not materialized.

Pins of the wood-thimble type with porcelain bases are reused, if in good condition, but the wood thimbles are split off and replaced with lead thimbles made up in plaster of paris molds (Fig. 5). These give good service, although the porcelain base weakens the unit as compared with an all-metal pin.

Lines along the Pacific Coast are not only subjected to severe stresses, owing to spring and summer fogs, but if within a mile or more from the shore, especially if the cliffs are not high, they are subjected to spray. For long periods the steady trade winds sweep in from the west, and the spray from the breakers on the beach is carried inland as a fine mist, often for a distance exceeding 2 miles (3.2 km.). On clear days this can be plainly seen as a white streak about 100 ft. (30.5 m.) high with a quite definite outline. This spray makes the insulation of lines close to the coast particularly difficult and accentuates any troubles arising from the use of wood as a subsidiary insulator.

Although most of the charring of pins and cross-arms probably takes place during the summer, actual line failures are likely to occur during the first winter rainstorms. In some cases the pin threads cease to hold the insulators and they are blown entirely off the pin. At other times the first rains are light in character, and before the summer dust and salt deposits are washed off flashovers occur which start pole fires despite the reduction in the cross-arm resistance.

Lines built with all-wood pins do not seem to be so susceptible to pin destruction as those built with combination pins of the wood-thimble type. However, if the leakage is considerable the destruction of the pin will proceed. The threads especially are affected, and even if there is no blackening or other evidence of charring, the threads gradually disintegrate.

ECONOMIZING OF FUEL DISCUSSED BY A. S. M. E.

E. L. Cole of the Fuel Administration Cites Instances in Which Inferior Fuel Was Turned Back to Mine Operators

An extended discussion of modern boiler-plant practice was a feature of the late convention of the American Society of Mechanical Engineers at Worcester, Mass.

E. L. Cole, secretary conservation division federal Fuel Administration of Pennsylvania, cited instances in which inferior fuel shipments have been turned back to the mine operators and emphasized the determination of the administration to enforce the stated standards. During January more than half the coal delivered contained 40 to 55 per cent of slate.

"The administration formulated a standard of impurities that should not be exceeded," said Mr. Cole. "The operators thought it was a joke, and not until inspectors were appointed did they realize that the government would not permit delivery of inferior fuel. Coal that was delivered in Philadelphia was sent back to the mines. Seven cars were hauled to the dumping ground; three cars in one day were given to a church, eighteen cars to a hospital, and the operators were compelled to pay the freight, demurrage charges and cartage bills. In addition, the name of every operator was published; the name of the jobber was published, as was the point to which the coal was delivered or diverted, and the anthracite and bituminous operators, realizing that this was going to limit their profiteering, actually had the audacity to go to Washington to try to cripple our effectiveness. Of course they failed."

Mr. Cole said that quite early in the year one of the largest anthracite producers in Pennsylvania had had the effrontery to ask the Fuel Administration to increase the amount of impurities permitted in anthracite coal to the extent of 2 per cent. This would be equivalent to dumping on the market 1,600,000 tons of slate and dirt at an additional profit of $6,000,000 to the operators.

"You can readily see," said the speaker, "why we need more data, so that when these men approach us, as we expect them to, we shall have data compiled and submitted by this society to the administration and can chase them back to the mines and tell them: 'Clean your coal and deliver it, and make your usual profit.'

"Any suggestion for the delivery of coal in the market containing more impurities than at present allowed should be accompanied, if it is an honest suggestion, by an offer to reduce the price of coal in the market in exact ratio to the decreased fuel value. On behalf of William Potter, the Federal Fuel Administrator of Pennsylvania, we say he pledges himself and his administration to aid any measure undertaken by this society or any other organization to provide consumers, industrial and domestic, with reasonably clean coal as a permanent institution in the United States. The consumer of coal who accepts coal which is inferior has himself to blame for the inferior results from using it, because the government has fixed the price and standardized both bituminous coal and anthracite coal."

What the Commissions Are Doing on Rates

Final Presentation in Series of Reports from State Commissions Showing the General Attitude of These Bodies on the Problems Created by Higher Operating Costs of Electric Utilities

The following article concludes the series dealing with the course of the public service commissions in the different states in the matter of electric service rates. The other articles of the series appeared on June 8, June 29 and July 27.

REGULATION, like all other issues to-day, is properly subordinated in principle and in detail to the national aim in the war. The national purpose calls, in the words of President Wilson, for "maximum efficiency" of the utilities. It calls, in effect, for the exercise of such authority by the directly regulatory bodies as will not only permit but promote that maximum efficiency.

To maintain this state of efficiency is now the first duty of the utility officials. If the resources within their control do not enable them to do this, their next course is to lay the fact frankly and completely before the governing commissions. If then the state commissions neglect or refuse to act as the facts justify, there can be little doubt what the eventual outcome will be. It will be the substitution of national control for state control.

Reports from various state commissions follow:

Viewpoint of the Illinois Commission

The Illinois Public Utilities Commission has not in general authorized increased rates solely on a basis of the increased costs of operation. The commission has felt that, in addition to this, it should have some idea of the value of the property, an analysis of the operating expenses, methods of operation, the amount of revenue which will be realized under the increase and other pertinent information. It has not insisted upon a complete and full detailed valuation of the property but has considered such evidence as the utility might have available without the making of a detailed valuation and has also considered the report of the engineering department based upon a hurried valuation of the property. Such reports of the engineering department have usually indicated that a minimum value of the property was at least a certain amount, with the statement that a detailed appraisal might show results in excess of this figure. Such a showing as to valuation has been regarded as sufficient for the present emergency conditions.

While the commission has insisted upon a showing of the above character before rates are authorized to become permanently effective, in cases where a financial emergency has appeared to exist the commission has authorized temporary rates upon a showing by the company of the need for immediate relief. These authorizations for temporary rates have been given pending further investigation by the commission as to the justice of the increases that are asked for, and they have carried with them a provision that the company should refund the differences between the rates thus temporarily authorized and any rates which the commission might later determine as being just and reasonable to meet the particular situation. These temporary authorizations have been granted in a number of cases in which the utilities represented that their situation demanded immediate relief and presented evidence to the commission in support of this contention. In granting such temporary authority, the commission has felt that it was acting in accordance with the expressed wishes of the United States government that public utility service be protected during the present emergency, and that it has acted in a way to conserve the interests of the consumers of electric service.

It is the opinion that increases have been asked in about 60 per cent of the communities of the state which are receiving electric service. This by no means involves 60 per cent of the companies operating in the state since so many of the companies serve a large number of communities. It is doubtful if the number of companies which have asked for increases would amount to 30 per cent.

It is felt by the commission that the present situation is one of emergency and that it would appear that conditions will be greatly relieved upon the cessation of the war. However, it does not believe that conditions will revert immediately to their former status. It is anticipated that during the next few years readjustments will have to be made in electric rates rather frequently. There are several cases in which electric utilities which have secured one increase of rates have requested authority for a second increase. The commission, in all of these cases, is retaining jurisdiction for the purpose of making such adjustment either to increase or decrease as may appear to be justified by current conditions.

Approximately seventy applications for electric rate increases were made to the Public Utilities Commission of Illinois in 1917. Most of these were technical increases, but in reality did not amount to much. Probably twenty-five involved material increases. In 1918 up to June 1 the commission had received about eighty applications, and of these fifty were for material increases. The commission has had pending applications covering rates for over 200 communities. In the great majority of the cases the commission has found that some relief should be granted, although not always to the extent covered by the application.

Development Anticipated in Arizona

Ben Ferguson, engineer Arizona Corporation Commission, writes:

"To date two companies have made application for revision of rates, namely, the Tucson Electric Light & Power Company and the Douglas Traction & Light Company. Several other applications will, no doubt, be received soon.

"From the studies made in this office, we think that electricity utility rates will likely return to the old figures when normal conditions return, for the reason that the most important factor in operation is the cost of fuel oil, which it is fair to expect will eventually be considerably less than the present figure, and for the further reason that the material resources of Arizona are being developed rapidly, causing profitable new outlets for power."

[The applications made by the companies mentioned were presented in accord with an order of the commission, issued on application of the Arizona Gas, Electric Light & Power Association. This association, on behalf of its members, presented by petition the situation produced by higher operating expenses and requested an order authorizing "such companies as can show deficiencies in current revenues to amend their present rate schedules by the addition" of a surcharge. The commission in its order set forth the higher cost conditions, particularly in oil, and the desirability in the public interest that the properties be maintained and continue to render the best service possible under the circumstances. Although, before authorizing a surcharge, the commission asked sufficient data to assure it and any one else interested that such a surcharge is fully justified by the operations of the individual company, it said: "There will be some unavoidable impairment of these facilities due to difficulties in securing money for maintenance, but we believe that any concern facing an actual deficit should be permitted to increase its rates without unnecessary formalities and prolonged proceedings."—Eds.]

"Up-State" New York Commission's Attitude

Secretary Francis X. Disney of the New York Public Service Commission, Second District, says to the Electrical World:

"It is quite impossible for the commission to give categorical answers to your inquiry. It should be explained, first, that under the general law applicable to this district both gas and electric companies may increase their rates upon filing thirty days' notice of their intention to do so and without the approval of this commission. Rate cases therefore usually come before the commission upon complaint of the consumers, and while an increase of rates is quite likely to bring a complaint, it does not necessarily do so. The commission has not been required so far to pass upon many increased electric rates, and can only say that its intention is to make as careful an inquiry as possible in each instance and render the decision which seems to be just and reasonable, all factors considered."

[A number of increases have been made in the "up-state" district without appeal to the commission. In a case decided recently it was held that in the existing circumstances the commission should be mindful of the admonition of the President of the United States, based upon the action of the Comptroller of the Currency and the Secretary of the Treasury, to respond promptly to the necessities of the situation as regards the needs of public utilities; that it should also bear in mind the attitude of the War Finance Corporation in respect of supplying means for new capital expenditures, and while it should not fix rates unnecessarily high, it should not pursue a policy of starvation with the possible effect of depriving the public of its utilities. The commission expressed the belief, however, that the public service corporations must and do expect to submit to their share of the common sacrifice, and that neither the appeal of President Wilson nor the ruling of the War Finance Corporation had in view the maintenance in all cases of normal profits.—Eds.]

Montana Commission Recognizes Increased Cost

Charles P. Cotter, secretary of the Railroad and Public Service Commission of Montana, writing to the Electrical World, says:

"This commission is authorizing electric utilities to increase rates on a proper showing of increased cost of operation. The increase applies to all classes of consumers, unless discrimination exists, when it may apply to a special class of customers.

"Since Jan. 1 applications have been received for increases from two electric utilities. The commission has initiated hearings in five additional cases. One increase of approximately 10 per cent was granted; in the other case the rates were equalized without materially affecting the income. The remainder of the cases are pending at this time. We estimate that about 5 per cent of the utilities have requested increases. At this time it is impossible to state whether the conditions of the utilities will be altered permanently, or if the situation is merely a temporary war emergency."

Practice in Colorado

George A. Flannigan, secretary Public Utilities Commission of Colorado, says to the Electrical World:

"If there is an electric utility in the state that has not had an increase in operating expenses, the commission would be very glad to know about it. The rule in this regard is no different from what it has always been. If the increase in earnings has been sufficient to offset such increases in operating expenses or if the net earnings of the utility are sufficient to provide for a fair return to the owners of the property, no increase in rates would be authorized on a showing of increased operating costs.

"The practice in this regard [application of increases to different classes of consumers—Eds.] must necessarily vary. In some cases certain classes of service are served on a very low margin—so much so that with an increase in operating expenses such service is given at a loss. Obviously, the rates for the various classes of service must be so fixed that the consumers in these classes will bear their portion of the burden. In general an attempt is made to place the burden on the consumers who should bear it.

"There are only a few cases in which the commission has authorized increases in the rates of electric utilities after hearing. On the other hand, the law in this state is such that public utilities may make increases in their rates by filing such rates with the commission for a period of thirty days before their effective date. If objections to such rates are not made or if not suspended by the commission, they automatically become effective thirty days after filing. A number of the electric utilities have made rate increases in this manner. There are at this time five applications for rate increases pending upon which the commission has taken no action.

"The number of electric utilities at this time seeking higher rates is very small in comparison with the number operating in the state."

STATION & OPERATING PRACTICE

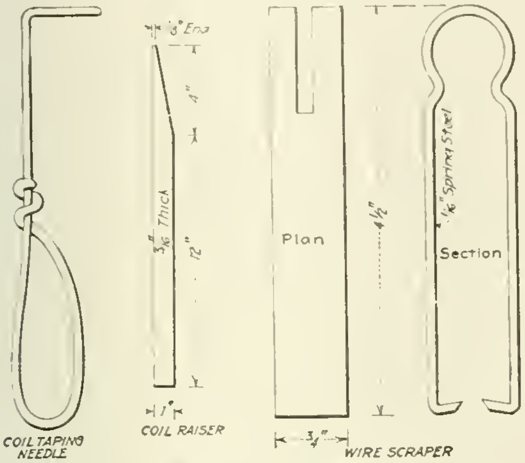
A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

HOME-MADE TOOLS AID IN ARMATURE COIL WINDING

Wire Scraper, Coil-Taping Needle and Coil Raiser Are Easily Made and Convenient for Use in Electrical Repair Shops

BY MAURICE M. CLEMENT

Oftentimes when considerable coil winding must be done certain minor tools are needed which cannot be purchased ready-made. These tools, however, are usually small and can be constructed in the shops. The coil-taping needle illustrated herewith consists merely of 1 ft. (30 cm.) of No. 14 banding wire shaped so that it can be used for taping coils in closed-slot stators. After the user is accustomed to this device high speed may be attained.



TOOLS ALL MADE FROM COMMON STOCK

The coil raiser consists of a piece of steel, 16 in. by 1 by $\frac{3}{16}$ in. (40.6 cm. by 2.5 cm. by 0.5 cm.) with a 4-in. (10-cm.) one-sided taper on one end for stripping open-slot armatures and stators. This also can be used to good advantage in removing grounded coils from a newly wound armature or in raising coils sufficiently to allow for insulating weak spots in the coils, the main object in this case being to lift out a tight-fitting coil without damaging the insulation.

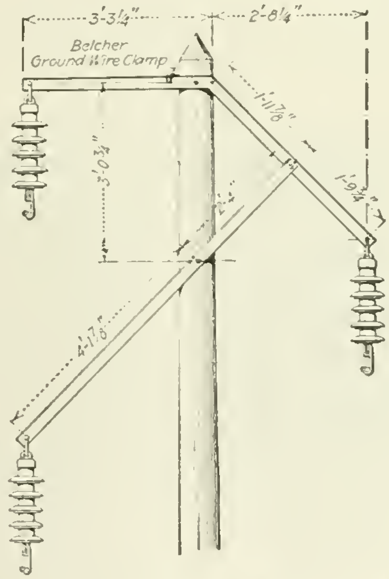
The wire scraper is very simply made and very economical, because it eliminates the use of a knife, whose life is short on account of the rough treatment accorded it. This device is made of spring metal, 12 in. by $\frac{3}{4}$ in. by $\frac{1}{16}$ in. (30 cm. by 1.9 cm. by 0.2 cm.). The knife edges can be sharpened by means of a file and the tool used indefinitely. A section the shape of a rectangle is cut from the metal at the handle end, greatly increasing the spring effect of the device.

For driving fiber wedges between the top of coil and the lamination overhang in closed-slot machines a wedge drift, made of a piece of tool steel, 8 in. by 5 in. by $\frac{3}{32}$ in. (20.3 cm. by 12.7 cm. by 0.23 cm.), over which is fitted a loose-fitting steel sleeve, $\frac{1}{16}$ in. (0.16 cm.) thick, is very convenient. This is used by inserting the fiber wedge about $\frac{1}{4}$ in. (0.6 cm.) into the slot; then, with the drift pulled back into the sleeve, the sleeve is fitted over the wedge, which is driven into the proper place, the sleeve holding the wedge in position.

SIMPLE STEEL CROSS-ARM OF EASY CONSTRUCTION

Arm Is Light and Affords Wide Clearance—Held to Be Superior to Wishbone Construction for Some Purposes

A simplified modification of the wishbone cross-arm worked out by the engineering staff of H. M. Byllesby & Company for use on Southwestern properties is held to have advantages over other styles. Its construction is very simple. It consists of two pieces of 2.5-in. by 2.5-in. by $\frac{5}{16}$-in. (6.35-cm. by 6.35-cm. by 0.78-cm.) angle iron held together by a single bolt. The upper piece contains only one bend and the lower member is straight. The pieces, which together weigh 65 lb. (29.5 kg.), are held together by a $\frac{5}{8}$-in. (1.59-cm.) bolt 1.5 in. (3.8 cm.) long. The arm is bored for two $\frac{5}{8}$-in. (1.59-cm.) through bolts, for three 0.75-in. (1.9-cm.) insulator "C-hooks" and for a $\frac{9}{16}$-in. (1.42-cm.) Belcher ground wire clamp. The arm shown is made for 66,000 volts. It has been used by the Oklahoma Gas & Electric Company, and in this lightly loaded district it has given general satisfaction. It is light in weight, is easy to manufacture and assemble, on account of having so few bends, and affords ample clearances.



CROSS-ARM MADE OF ANGLE IRON WITH ONLY ONE BEND

REDUCING THE COST OF INDUSTRIAL SWITCHBOARDS

Plan Developed on Pacific Coast Entirely Does Away with Marble Panels and Copper Busbars—Resulting Board Is Flexible

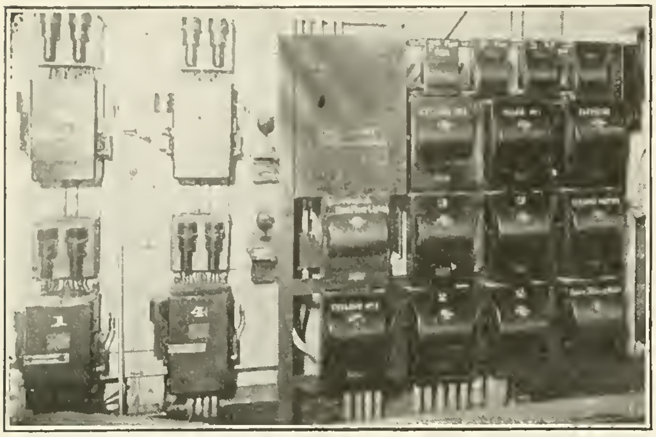
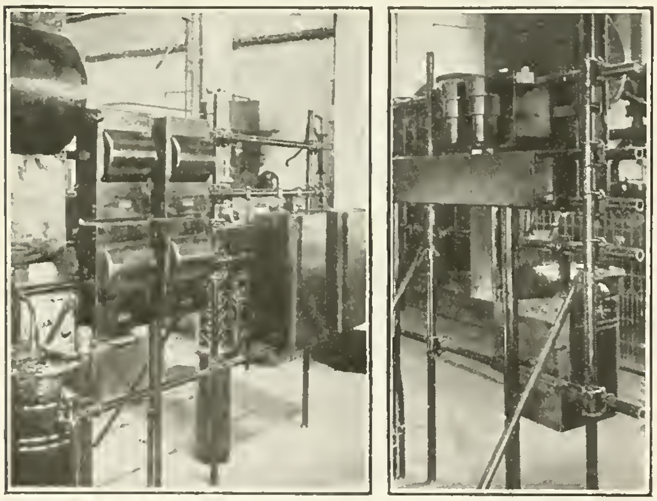


FIG. 1—SWITCHBOARD IN ICE FACTORY HAS NO COPPER BUSBARS OR MARBLE OR SLATE PANELS

A new development in switchboards for industrial plants, conceived by Louis F. Leurey of San Francisco, is being adopted by many concerns doing industrial plant wiring on the Pacific Coast. By eliminating the use of copper busbars and marble panels and substituting instead insulated wire leads properly housed and iron pipe or angle-iron framework carrying inclosed switches, these companies are building boards at low cost. It is reported, moreover, that the boards thus built are operating just as satisfactorily as any of the older types. If it is desired to make the job appear more complete, steel-boxed panels made of ordinary sheet steel can be used, but these boards are still inexpensive. Eliminating the necessity for busbars effects a still further reduction in cost. The mains are brought to the switchboard in conduit or can be run either across the front or the back of the board in galvanized-steel troughs made by any tinsmith. This box has flanged sides to which a removable cover is screwed. Taps to each switch are made through ordinary types of connectors. This construction is said not only to be less expensive in first cost but also to permit extensions and changes at costs less than those incident to changes on boards using bar copper.



FIGS. 2 AND 3—REAR OF BOARD SHOWING SHEET-IRON TROUGH FOR LEADS TO SWITCHES AND DETAILS OF IRON-PIPE CONSTRUCTION; STEEL-BOXED PANELS OF ORDINARY SHEET IRON MAKE NEAT JOB

One particular advantage of these boards is that they may be made up on short notice because all of the necessary material can easily be secured locally and very little machine work is necessary. On marble and slate panels made to specifications in the factory delays are likely to occur. Another advantage is that these boards need to be made to conform only to the requirements of space available and equipment to be mounted. Panelboards, on the other hand, must be laid out according to certain prescribed standard panel dimensions. This advantage of flexibility is considered especially important where electrical apparatus is to be installed in a structure already built. It is expected that these boards will grow in favor as the necessity of conserving copper and eliminating unnecessary transportation of such heavy products as slate becomes more urgent.

AMICABLE STANDARDIZATION OF JOINT-POLE PRACTICES

Committee Made Up of Utilities Concerned Draws Up Rules That Prove Satisfactory to All Companies of Connecticut —Adopted by Commission

So much difficulty is entailed in pleasing everybody when central stations, telephone and telegraph companies wish to use the same poles for light, power and communication lines that it is usually decided to build separate lines regardless of the high cost. Now that materials are hard to get and public utilities are paring costs whenever possible, many companies are making extreme efforts to come to some decision whereby every one interested shall receive proper consideration. In Connecticut the Public Utilities Commission arranged for a committee to be appointed that consisted of three members of the light and power interests and three representatives of the communication companies. The chief engineer of the commission was made a member ex officio of the committee.

At an informal hearing called by the commission the rules formulated by the committee were discussed, and after the specifications were revised slightly by the utilities they were accepted by the commission and adopted. In order to simplify the rules as much as possible each class of conductor and attachment was considered under its own individual heading, thereby eliminating the necessity of making cross references.

One important point was gained for the lighting interests when the telephone companies agreed to the joint use of poles carrying a constant-current, series, metallic circuit of not more than 10,000 volts because the previous limit as outlined in the N. E. L. A. rule was 7500 volts. The current, however, is not to exceed 7.5 amp. In order to operate more safely it was decided that the vertical distance between primary or series circuits and communication conductors should be 72 in. (183 cm.), instead of 40 in. (101 cm.). The vertical spacing of secondaries and communication conductors is 48 in. (122 cm.), instead of 40 in. (101 cm.), as permitted by the N. E. L. A. rules.

Although the rules were not intended to serve as specifications for materials or even complete specifications for construction methods, they do attempt to define precise relative locations of the various power, communication and lighting conductors and attachments. It is believed that the classification and systematic typographical arrangement will go far toward facilitating an extensive improvement in all new joint-use construction where hitherto the conflicting interests frequently have been responsible for conditions hazardous to their own employees, the employees of others, pedestrians and even to consumers.

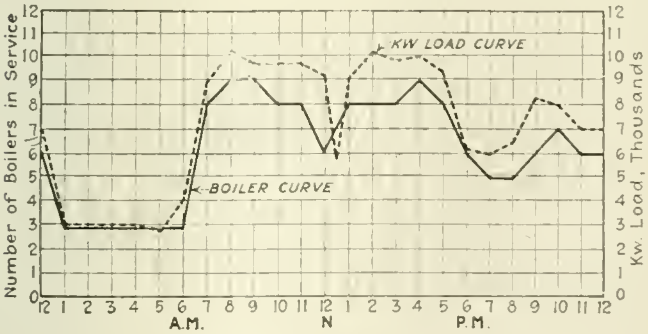
One point of considerable interest is the fact that the specifications do not provide for carrying communication conductors and conductors for trolleys of over 700 volts on the same pole. This has left the question in such a way that each case may be decided by mutual agreement as to the particular conditions under which trolley conductors may be operated on the same pole with communication conductors, with the understanding that the agreement will have to be ratified or approved by the Public Utilities Commission.

These rules are intended to amplify, systematize and hence supplant those on pages 133-163 of the 1911 report of the committee on overhead-line construction of the N. E. L. A., the latter rules having hitherto been recognized by this commission. The Western Union and Postal Telegraph Companies were directly represented, and the action of the Southern New England Telephone Company may be construed as expressing the agreement of the American Telephone & Telegraph Company to these formulated rules.

HOW TO AVOID EXTRAVAGANT UTILIZATION OF BOILERS

Record-Keeping System Which Tells Instantly Whether Too Many Boilers Are Kept Under Full Head of Steam as Load Varies

Curves plotted to show the results of operation in both the turbine room and the boiler room are used by the engineers and managers of an Indiana plant as a check against extravagant operation of boilers. The curve chart is arranged so that the number of boilers in service and the load on the plant in kilowatts are plotted against time. By using the same abscissas for both curves and by choosing a proper ordinate scale the curves fall very near together if proper operation is obtained. Any variation from normal operation is at once noticeable, owing to the wide divergence which the lines show. When this occurs the manager generally demands an explanation from the chief of the boiler room. There must always be a good reason for carrying more boilers than the chart indicates are necessary.



BOILER CURVE SHOULD NEARLY COINCIDE WITH KW. LOAD

Data from which these curves are plotted are collected separately by the man in charge of the boiler room and the man in charge of the engine room. The relation of the two curves to each other is therefore known to the boiler-room chief only after he has turned in his data. This precludes any possibility of getting "doctored" figures into the report. To assist the boiler-room chief in holding just the right number of boilers on the line, or in readiness to go on, it was of course necessary to place in the boiler room a totalizing wattmeter to indicate the station load.

TABULATING TROUBLES ON TRANSMISSION LINE

Line Data Filed to Give Permanent Information on Performance of Equipment—Can Be Used to Forestall Trouble

When trouble occurs on the transmission system of the Public Service Company of Northern Illinois a complete record is made of the incident by filling out a blank form like the one reproduced. The questions asked are those pertinent to this company's system, but a similar chart can be compiled especially applicable to any system on which it is to be used. Under "Remarks" are drawings of two standard transmission pole tops. If an insulator or bracket arm is defective, it can be designated by an arrow. This record can be filed under headings indicating apparent effects, so that if an accident occurs the chart may be looked up and the cause immediately found.

DATA ON TRANSMISSION LINE TROUBLE

191
Weather conditions
Location of trouble
How located
Nature of trouble
Repairs made by
3 4 5 7 8 11 13 58 64
Station on system
Generator capacity in service
Load on station
Load on transmission line (indicate on diagram)
Miles of transmission line connected to system or section
System sectionalized at Joliet, Streator, Blue Island
Was INU Co carried on our system If so, how much
Switch on opened* at M Relays set at kva sec.
Switch on opened* at M. Relays set at kva sec.
Switch on opened* at M. Relays set at kva sec.
Switch on opened* at M. Relays set at kva sec.
Switch on opened* at M. Relays set at kva sec.
Switch on opened* at M. Relays set at kva sec.
Switch on opened* at M. Relays set at kva sec.
Switch should have opened Relay set at kva sec.
Switch should have opened Relay set at kva sec.
What effect noted at stations 3 4 5 7 8 11 13 58 64
Was voltage lowered
Duration of same
Was frequency lowered
Duration of same
Did lightning arrester operate
(Give phases and line number)
Ground detector indicated
Type of line construction
Location of defective insulator
Were pins grounded on pole?
What phase was trouble on?
Was there ground wire on pole?
REMARKS:

* Note whether automatically or by hand.

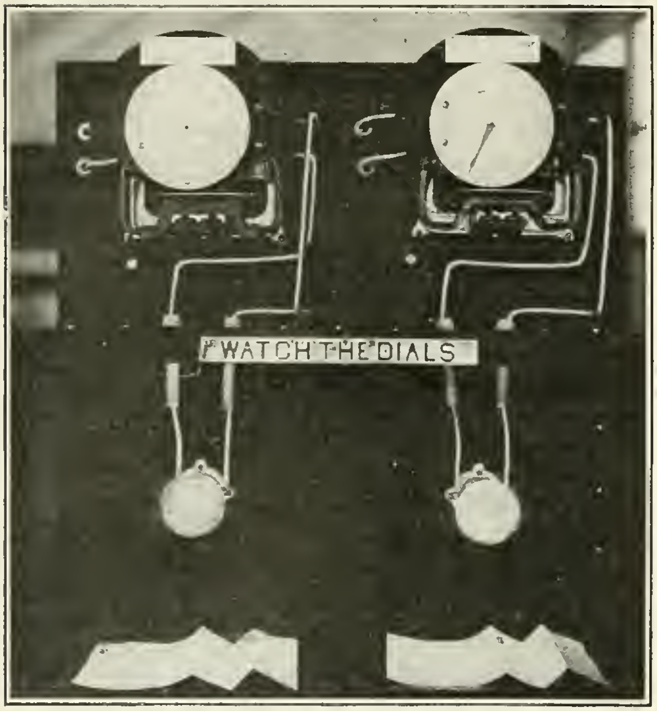
CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

REDUCTION OF LAMP RENEWALS RESULTS FROM DIRECT DRIVE

Educational Campaign, Coupled with Popular Interest in Coal Conservation, Enables Houston Company to Save Over $6,000 Annually

The Houston (Tex.) Lighting & Power Company last fall inaugurated a campaign of education for the purpose of reducing the annual burden of lamp renewal expense and has been so successful that already a very large saving has been effected. Of course the Houston public has read as much about the "mazda" lamp as the people of any other city, but the company had been granting free renewals on "gem" lamps and a large number of consumers had continued to burn these lamps.



AN EDUCATIVE DISPLAY USED IN HOUSTON, TEX., IN CAMPAIGN TO REDUCE LAMP RENEWALS

The great popular interest in coal conservation and other war-time savings, however, suggested the possibility of a special campaign for "mazda" lamps that would call attention to the wastefulness of the less efficient incandescent lamps and secure the general adoption of "mazda" lamps.

H. O. Clarke, commercial manager, in commenting on the campaign, says:

> The policy of free lamp renewals carried out by a great number of large central stations is to-day merely the inheritance of a mistaken and misguided policy of the past, and in the central-station game a precedent once set and established becomes a rule which it is hard to change, especially so in the furnishing of free renewals. A great many people believe that the abolishment of a practice which gives them something free is simply an effort on the part of the central station to make for itself additional money and to take from the customer a service to which he is entitled. Selling the idea to the public of the advantage of purchasing a high-grade lamp rather than accepting free an inferior lamp is really the basis of a campaign to reduce lamp renewals. To aid us in driving home the thought we have hit upon the plan here in Houston of using a counter display rack, which consists of two compartments, in one of which is placed a "mazda" lamp and in the other a free-renewal lamp or exchange lamp. The two compartments are connected separately, each to a meter, and the meter dials are calibrated to read in dollars and cents.
>
> When a customer comes into our office the first thing we do is to take him to this display box and show exactly why we can afford to give away an exchange lamp. At the same time we show him a comparison of the color values of the lamps, and we follow this with war-time arguments, appealing to the patriotism of the customer on the basis of fuel conservation. The dials assist us in showing that the fuel consumption necessary to serve the "gem" lamp is twice that required to serve an equivalent candlepower of "mazda" lamp.
>
> The work has been very effective, and we expect that we shall be able to reduce our free lamp renewals to the value of $400 for the entire year. We do not expect to have to furnish a single free lamp in 1919. When one stops to consider that in the short period of time since "mazda" lamps came in we have been able to reduce our free lamp renewals from $7,000 to $400 per year—and in 1919 we hope to reduce them to nothing per year—it will be agreed that our educational work along this line has been most effective. Last year our total cost was $1,646.40.
>
> We have not done any advertising in this campaign, nor have we announced any policy of abolishment of free lamp renewals, and our results are attributed solely to untiring personal efforts in educating and appealing to the patriotic sense of the consumer.

ELECTRIC COOKING LOAD OF SMALL CALIFORNIA CITY

In Less Than Twelve Months an Additional Load of Nearly 1000 Kw. Has Been Added to Central Station Company's Lines

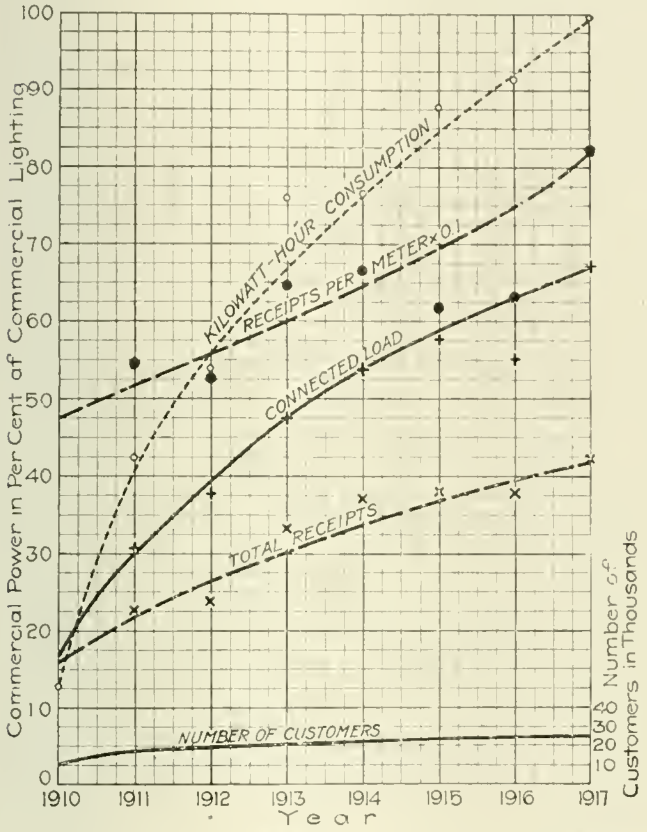
Since the beginning of the electric cooking and heating campaign of the Stockton (Cal.) division of the Western States Gas & Electric Company a little more than a year ago, nearly 1000 kw. of this class of business has been added to the company's lines. The following table shows the number of ranges and heaters sold and their total capacities:

	Total Capacity, Kw
101 ranges	668 160
89 water heaters	174.700
84 air heaters	151 467
1 plate	0.880
Total	995.207

RELATION BETWEEN COMMERCIAL POWER AND LIGHTING BUSINESS

Analysis of Relative Income, Connected Load and Energy Consumption of Two Classes of Service in Farming Region

The accompanying curves illustrate the relative growth of commercial power compared with commercial lighting business as deduced from the statistics of a Western central station. It is interesting to note the rapidly increasing importance of the power business which has been characteristic of central-station operation during the past few years. Although the lighting department has sustained a consistent and creditable growth, the number of customers having nearly quadrupled in eight years, the power business had progressed at a far more rapid rate, and this despite the fact that the community served is not a manufacturing center.



RELATIVE GROWTH OF COMMERCIAL POWER AND COMMERCIAL LIGHTING BUSINESS IN WESTERN CENTRAL STATION

The company from the records of which these figures were taken has approximately 22,500 customers in all. An energetic new-business department began operations in 1909, and the results of its labors were apparent almost immediately. Although the lighting department was by no means neglected, naturally the power business was given more attention. In 1910 the customers using power numbered only 2.6 per cent as many as those for lighting. During the next few years competitive forms of motive power were gradually eliminated until in 1915 the number of power customers reached apparent saturation at 6.2 per cent of the number of the lighting cusotmers, which figure has remained practically constant since. The total receipts increased steadily from 15.9 per cent in 1910 to 42.5 per cent of the lighting receipts in 1917. The kilowatt-hour energy consumption of power customers has increased from 12.2 per cent in 1910 to practically 100 per cent, or equal to the lighting consumption, in 1917.

The steeper slope of the kilowatt-hour curve as compared with the curve of total receipts is, of course, due to a higher percentage reduction in the power rates than in the lighting rates, although it might be noted that both rate schedules were reduced several times during this period. The ratio of connected power load to connected lighting load has advanced steadily from 16.3 per cent in 1910 to 67.4 per cent in 1917.

An interesting comparison is that shown by the curve of relative receipts per meter. In 1910 the receipts per power meter were 4.71 times as great as the receipts per lighting meter; in 1917 they were 8.23 times as great. The receipts per lighting meter have been fairly constant during the period, reductions due to rate decreases having been very soon made up in all cases by increased consumption. But the receipts per power meter have gained steadily in spite of greater per cent reductions in rates than the lighting reductions. This has been due to the acquisition of larger customers and better load factors.

As might be expected, the points for numbers of customers and connected load fall close to smooth curves, as these are largely unaffected by rate changes and general business conditions. The curve of kilowatt-hour consumptions is to a large extent independent of rates but is influenced by any condition which causes a change in the one class of service without a corresponding change in the other, as, for instance, weather conditions in agricultural districts, which greatly affect the irrigation consumption but are without influence on the lighting. The curves of ratios of total receipts and receipts per meter, being affected not only by such conditions but also by rate changes, are naturally susceptible to considerable variations.

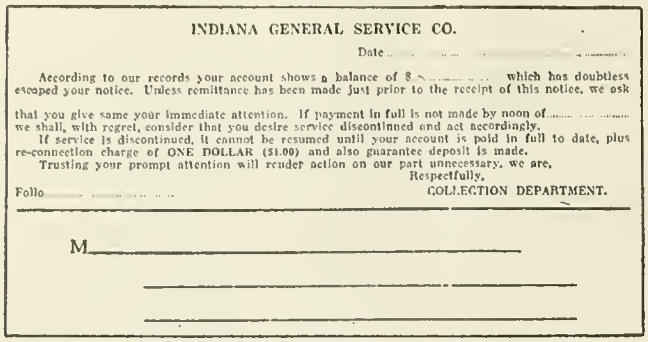
In deducing these curves only commercial lighting and power have been considered. Municipal lighting and railway power are not included.

METHOD USED TO DECREASE DELINQUENT ACCOUNTS

Notice That Declares Central-Station Customers Will Be Subjected to Reconnection Charge Produces Desired Effect

Among the plans which are being developed to assist in hastening customers' collections, those which are based on the reconnection charge idea are said to be most effective. The accompanying form shows how this idea is applied by the Indiana General Service Company of Muncie. With this company all bills are due on the tenth of the month. After the tenth all delinquent accounts are taken off the books and notices like that in the illustration are sent to those in arrears. It is the company's policy to give the customer five days from the date of sending these notices to pay his bill. Service is then disconnected without further notice. After negotiations have reached this stage it is necessary for the delinquent customer to come to the office, settle his bill in full, pay $1 for reconnection and make a deposit to insure payment if he has not already established credit with the company.

Notices of this type were used by the Indiana General Service Company for the first time in July, 1918. As a result Thomas F. English, general manager of the company, stated that a very material reduction was noticed in the number of delinquent accounts.


INDIANA GENERAL SERVICE CO.

Date ....

According to our records your account shows a balance of $.................. which has doubtless escaped your notice. Unless remittance has been made just prior to the receipt of this notice, we ask that you give same your immediate attention. If payment in full is not made by noon of.................. we shall, with regret, consider that you desire service discontinued and act accordingly.

If service is discontinued, it cannot be resumed until your account is paid in full to date, plus re-connection charge of ONE DOLLAR ($1.00) and also guarantee deposit is made.

Trusting your prompt attention will render action on our part unnecessary, we are,

Respectfully,
COLLECTION DEPARTMENT.

Follo..................

M______________________________

TYPE OF DELINQUENT NOTICE THAT GETS RESULTS

METHODS OF FINANCING EXTENSIONS OF LINES

Resume of Plans Which Are Being Tried Out to Provide Service to Essential Lighting and Power Installations

Before a recent meeting of the commercial men of the Indiana Electric Light Association, R. Thurman of Muncie presented a comprehensive digest of plans used by various utility companies in the Central West for financing extensions under the present conditions.

Owing to the high cost of materials and labor and to the fact that utilities probably will not be allowed to capitalize at this high figure, only absolutely essential additions will be made, Mr. Thurman pointed out. As to what is considered essential, this will vary with each utility and with every case presented. However, there are in most cases different ways of taking care of lighting and power customers. A brief summary of a few of the different system follows.

In the standards of electrical service established by the Public Service Commission of Indiana, dated Jan. 2, 1918, Rule 31 provides that each utility shall, upon request for service, make free of charge any line extension necessary to give this service, when the income for the first year from the prospective customer is equal to one-half the direct cost of the extension. If the cost of the extension is greater than the estimated income for the year, the customer is required to deposit the cost of the extension above the free limit. If other customers are taken on this extension, the original consumer is to receive a rebate of an amount equivalent to the cost of the free extension for each customer so taken.

A number of companies are using this rule with reference to both light and power, particularly lighting consumers. In figuring the cost of the extension, the majority of utilities include the cost of material, cost of labor, including meter and meter installation, and to this add 10 per cent to cover cost of engineering and superintendence.

The Pacific Light & Power Company of Portland, Ore., uses the same method as given in Rule 31 (see ELECTRICAL WORLD, Feb. 9, 1918, page 311).

Some companies are requiring the total amount of the cost of extension to be advanced by the consumer, especially the power consumers. This is returned to the customer in energy, in some cases the total amount of the bill being applied each month, in other cases from 25 per cent to 60 per cent of the bill. Other companies use a plan in which the total cost is advanced and an amount equivalent to the 1914 cost is returned in service. This applies in the majority of cases to large extensions for additional power consumers. This seems to the author to be a very good method of taking care of high-cost extensions, owing to the fact that it is probable the utility will not be allowed to capitalize the full amount expended on these extensions.

One company at the present time is asking that the total cost be advanced and promises to return nothing. This applies only to lighting consumers. In this connection the question of how an extension made in this way can be capitalized arises. Another plan is to set a limit for cost and then to ask the customer to pay any additional expenditures. This plan applies particularly to lighting consumers, and the amount set as a limit to be spent for each lighting customer varies from $20 to $50. The consumer is required to deposit in most cases any additional amount, which is returned to him in energy. Under the terms of still another system the prospective consumer is required to purchase preferred stock to the amount of the cost of the extension. In most cases this preferred stock pays a dividend of 6 per cent, which really amounts to borrowing the money from the consumer at that rate. This seemed to the author to be one of the very best methods of taking care of extensions at the present time, owing to the fact that it not only secures the necessary capital but also gives the customer an interest in the company.

In securing data for this paper a circular letter was sent to each of the central-station members of the Indiana Electric Light Association asking for information regarding their method of taking care of extensions. Answers from seventeen central stations were received, which are classified as follows:

FOR LIGHTING CUSTOMERS:	
No extensions being made	5
No advance required	5
Extensions made according to commission Rule 31	3
Total amount advanced by customer, nothing returned	1
Customer required to buy preferred stock equivalent to cost of extension	1
FOR POWER EXTENSIONS:	
No extensions being made	5
No advance required	4
Advance required, but total amount returned in energy	5
Customers required to buy preferred stock equivalent to cost of extension	1

A number of the replies from central-station companies, especially the smaller ones, revealed the fact that they were having trouble with their customers in securing necessary cash to finance extensions. In some cases this had assumed such proportions that it was necessary absolutely to call off plans for extensions of any kind, on account of prospective customers refusing to advance the money by any of the above methods. This, however, the author believed is because the applicants for service had not been educated up to a point where they understood that it was impossible at this time for a utility company to make an investment in any other way.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Investigation of the Fuel Problem in the Middle West. —A. A. POTTER.—This investigation of the fuel problem confronting power plants of the Middle West indicates that the total operating expenses have increased enormously within the year 1917-1918 owing to: (a) The increased cost of fuel; (b) the necessity of burning fuels of different grades with equipment suitable for one particular grade; (c) the greater amount of ash and other non-combustible matter; (d) the increased cost of labor and the poor quality of labor available; (e) the increased cost of repairs, supplies and new equipment. After detailing the methods resorted to in various states to meet the increased operating expenses, the author summarizes his conclusions in part as follows: The power plants of the Middle West are convinced that future emergencies can be averted by more adequate fuel storage, by greater attention to fuel economy, and by the more careful regulation on the part of the government of the quality of fuel leaving the mines and of the fuel-transportation facilities. In the case of power plants using natural gas, a gas-storage-tank capacity sufficient for a ten-day period is considered practicable. Such a storage capacity will take care of gas shortage during extremely cold weather. More attention will be paid in the future to the proper furnace design for high-volatile bituminous coals. The combustion chambers of the furnaces in the majority of the smaller power plants are not large enough for the air to mix with the gases given off from the fuel bed and before such gases come in contact with the comparatively cool heating surfaces of the boiler. Some attention should be given to the use of peat in certain parts of Michigan, Minnesota and Wisconsin for domestic use and possibly also for power generation. With the increasing scarcity and higher cost of coal and oil, low-grade fuels must be given greater consideration in connection with the generation of power. It has been advocated recently that the price of coal be regulated by the government according to the quality of the fuel produced, in order to give the coal operator a real incentive to clean his coal as he should. A detailed study of coal-car movements in the Middle West during the last four years discloses the fact that the average time required to move cars is extremely long. In most cases cars carrying coal will average less than 20 miles (32 km.) per day. When to this time is added the time required for empty cars to return to the mines, it is evident that the coal tonnage handled per car per year is very limited and very much smaller than reasonably efficient operation should produce. This delay is due partly to the practice by railroads of throwing cars on sidings and into yards with unnecessary switching, instead of delivering them to their destination in one or two hauls. Pooling of engines, cars and routes can be made to relieve this situation substantially. Relief can also come by so routing coal as to avoid as far as possible the congested terminals at the larger cities. Where freight cars must pass through such cities movements could be expedited by constructing belt lines around them. The coal shortage can also be reduced if greater efforts are made by all coal users to unload cars as soon as they reach their destination.—Abstract of paper read at convention A. S. M. E., June 4, 1918.

Boiler-Feed Water Softener.—In this paper water-softening apparatus for use in treating boiler-feed water is discussed. Water and chemicals are automatically added as necessary, and provision is made for stirring the mixture and filtering.—*Power*, July 30, 1918.

Use of Transformer with Series Alternating-Current Motor.—M. ERNST.—The machine which is under consideration in this article is the three-phase series motor with six brushes on its commutator. Used with the machine is a transformer, which may be connected in front of the machine or between the armature and the field. The latter arrangement is found to be preferable, because the transformer is smaller and cheaper, and also owing to the fact that the operating characteristics of the motor are improved. In the first place, the light-load speed is limited, which prevents the racing of the motor that would occur if the transformer were connected in front of the stator and rotor windings, and in the second place saturation of the transformer iron stabilizes the speed on heavy loads. The extent to which the transformer acts in this manner depends on the brush position. The above effects are deduced from vector diagrams of the motor, and curves are plotted showing the relations, two by two, between the torque, speed and brush shift, and also for the power factor of the motor, both for the case when the transformer is connected in front of the whole machine and intermediately between the stator and rotor windings.—*Science Abstracts, Section B*, May 31, 1918 (abstracted from *Elektrotechnische Zeitschrift*, Nov. 29, 1917).

Variation of Alternator Excitation with Load.—F. D. NEWBURY.—There are three primary factors that affect the amount of increased excitation required to maintain constant voltage of an alternator with increase of load: The magnetizing effect of the armature (or armature reaction), the reactance voltage of the armature, and the resistance voltage of the armature. The effect of the last two expressed in terms of exciting ampere turns is influenced greatly by the shape of the upper part of the saturation curve of the alternator. In considering this subject the distinction between armature reaction and armature reactance is important. The lack of this has been responsible for considerable trouble in the past, and a better appreciation of it by present-day designers has led to a marked improvement in alternator operation on low power-factor loads.—*Electric Journal*, July, 1918.

Generation, Transmission and Distribution

Choice of Material for Pressure Pipes.—Ralph Bennett.—In discussing the various materials of which hydroelectric pipe lines may be made, the author points out that steel is by far the most commonly used and is practically the only available material for very high head. Reinforced-concrete pipes require nearly as much steel for strengthening as is necessary in all-steel construction, but they are used commonly for heads up to about 100 ft. (30 m.). The wooden stave pipe, on the other hand, is a very good substitute for steel and has been used for heads up to about 200 ft. (60 m.). The wood is somewhat perishable and requires constant maintenance, but the present high cost of steel plate is extending the use of wood staves up to heads as high as 400 ft. (120 m.).—*Journal of Electricity*, Aug. 1, 1918.

Boiler-House Operating with Reference to Various Fuels.—Knust.—It is admitted to be economically preferable to distill hard coal rather than use it directly under boilers. All bituminous coals should be subjected to distillation. The author investigates the possibilities of substitutional fuels for boilers. A mixture of one part of coke to two parts of hard coal yields no difficulties in working, and a mixture of one part coke to three parts brown-coal briquettes is also satisfactory. Thorough mixing is essential. If coke be used alone, the grate, air supply and stoking arrangements must all be modified. Using brown-coal briquettes instead of hard coal adds about 60 per cent to the grate and 14 per cent to the smokestack duty. A formula is given expressing the cash value of substitute fuels in terms of heating value.—*Science Abstracts, Section B*, May 31, 1918 (abstracted from *Elek. Werk.*, June, 1916, and *Elek. u. Maschin.*, Jan. 28, 1917).

Electric Plant at Canadian Smelting Works.—In this article a description is given of the Granley Consolidated Mining, Smelting & Power Company of Anyox, British Columbia. This company operates both steam and hydroelectric power plants, the steam plants being used when the flow of water is low. The equipment of the power houses is fully described, and details of the motor applications in both the mining and smelting industries are set forth. The present hydroelectric plant consists of two 938-kva. alternators with two 700-hp. overhung Pelton double waterwheels for each alternator. The auxiliary steam plant has a capacity of 6000 hp.—*London Engineer*, July 12, 1918.

Effect of Impurities in Coal.—Incombustibles in fuel have a detrimental effect upon furnace operation out of all proportion to the percentage of refuse contained. It has been asserted that when coal contains 40 per cent of refuse it becomes valueless as fuel. Information is given on the following subjects: Efficiency loss from ash, shipment of weathered coal, influence of sulphur on clinker, effect of impurities in coal, and effect of high-ash content.—*Journal of American Society of Mechanical Engineers*, July, 1918.

Electrophysics and Magnetism

Reversal of Spectrum Lines Produced by a Spark Under Water.—T. Mashimo.—The study was made with metal electrodes of aluminum, zinc, cadmium and mercury. A greater range of frequency than those used heretofore was made use of in this investigation.—*Memoirs College of Science, Kyoto Imperial University*, April, 1918.

Effect of an Electric Field on the Spectrum Lines of Helium—II. — T. Takamine and N. Kokubu. — The paper describes the results obtained by further investigation relating mainly to the more refrangible lines of helium.—*Memoirs College of Science, Kyoto Imperial University*, April, 1918.

Telegraphy, Telephony and Signals

Inductive Effects of Alternating-Current Railroads on Communication Circuits.—H. S. Warren.—A brief discussion of inductive interference in general is first given, including reference to the work of the joint committee on inductive interference in California. Inductive interference due to electrified railroads is then taken up, and various possible means for reducing such interference are considered. A description is given of four important installations of railroad electrification and the specific means adopted in each case for preventing interference, with the degree of success which has been met with.—*Proceedings A. I. E. E.*, August, 1918.

Miscellaneous

Present Situation Regarding Use of Natural Gas in New Orleans.—Howard Eggleston.—The difficulties of controlling natural-gas drillings when the gas was first encountered at the Terrebonne fields, near New Orleans, are enumerated. After a considerable study of the probable gas supply in these fields, the author concludes that it is immense. Now that it has been demonstrated that the gas can be controlled, he advises the city to either take over the pipe lines or control the sale price.—*Proceedings Louisiana Engineering Society*, August, 1918.

Analysis of Mine and Car Samples of Coal Collected in the Fiscal Years 1913 to 1916.—This is the title of a bulletin on the sampling and analyzing of the coals, being the third of a series including Bulletins 22 and 85. Bulletin 22, entitled "Analyses of Coals in the United States," can only be obtained now from the Superintendent of Documents, Government Printing Office, Washington, D. C. Bulletin 85, "Analyses of Mine and Car Samples of Coal Collected in the Fiscal Years 1911 to 1913," is still available from the Bureau of Mines. The present bulletin presents thousands of analyses of coals collected from many hundred mines in the United States during the fiscal years 1913 to 1916. In order that the material in this bulletin may be used to supplement that presented in Bulletins 22 and 85, the same plan of geographical classification has been followed, the analyses and descriptions of the samples being grouped in alphabetical order according to the state, county and town near which the mines or prospects sampled are situated. The three bulletins, which do not conflict, constitute a very extensive analysis of the coals of the United States and should prove of great value to those who purchase large quantities of coal.—*Bulletin 123*, Bureau of Mines.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

PREFERENCE TREATMENT OF APPLIANCES AND SUPPLIES

Statement of the War Industries Board Affecting the Manufacturers of Electrical Supplies—Jobbers Are Recognized

The War Industries Board has issued a statement announcing that manufacturers of electrical appliances and supplies will be accorded a degree of preference for materials conditioned upon certain pledges limiting output to essential products. At present the vacuum-cleaner manufacturers are running along on what stocks they have and it will be decided later how much material they are to have if any. [Since the foregoing was written by our Washington representative the official statement printed in the next column has been received. —Eds.]

The situation as to washing-machine manufacturers is that they have been promised a small amount of material which they must distribute among themselves through their own association. The amount of material has not been definitely decided upon and the washing machine manufacturers are to return to Washington for further conferences, bringing a statement as to their own voluntary reductions in output.

Electric heating-device manufacturers have been told by the board to eliminate curling irons, coffee percolators, chafing dishes and everything else not absolutely essential. No luxuries among such appliances will be allowed and no selling campaigns will be allowed. The amount of material to be furnished electrical heating-device makers is also to be determined later.

The War Industries Board statement follows:

"At a hearing before the Priorities Commissioner and other representatives of the War Industries Board, the War Service Committee, representing electrical jobbers, presented their claims for preferred treatment to maintain their stocks for general distribution.

"As a result of the hearing, the Priorities Commissioner announced that manufacturers of electrical apparatus and supplies will be accorded a degree of preference for their materials to enable them to operate conditioned upon their pledging themselves to limit their output to essential products and undertake to see that such products are devoted solely to essential uses as that term may be defined from time to time by the Priorities Division. The manufacturers must be relied upon to police their own industry and also in a measure to police jobbers, distributers and retail dealers.

"It is believed to be in the public interest that jobbers should be permitted to maintain reasonable stocks from which government agencies, war industries and the civilian population may draw for their necessary essential requirements, provided the jobbers will pledge themselves rigidly to restrict the use of all stocks to solely essential uses and to reduce to an absolute minimum both jobbing and retail stocks. The jobbers will be relied upon to police their own industry and that of the retailers. Any jobber or retailer violating the pledge will be cut off from procuring further supplies."

CONSERVATION PROGRAM FOR VACUUM CLEANERS

Agreement Arranged by the Manufacturers with the Conservation Division of the War Industries Board

The War Industries Board authorizes the following:

Representatives of manufacturers of power-driven portable vacuum cleaners have agreed with the Conservation Division of the War Industries Board, in the interest of economy and conservation, to reduce their lines to not more than two models or sizes of such vacuum cleaners, to discontinue the manufacture of less essential attachments, and to discontinue the use of metals where such use is not absolutely essential.

Under the heading of "attachments" which are to be discontinued are included extra tools for cleaning other than floors or floor coverings, such as those for cleaning curtains, tapestries, wall coverings, furniture and other articles, and the extra suction hose which is cataloged generally with such attachments.

The manufacturers are to discontinue at once the addition of new models or sizes of portable machines and the use of any sort of metal for purely ornamental or other unnecessary purposes. These plans will result in an annual saving of at least 100 tons of steel, 5 tons of brass, 125 tons of aluminum and 1,000,000 ft. of rubber hose.

WEST PENN COMPANY TO BUILD $5,000,000 PLANT

It Will Furnish $3,000,000 and Balance Will Be Advanced by the Government—Appraisal After the War

An arrangement has been made between the United States government and the West Penn Power Company whereby that company will build a generating station in the Allegheny Valley at a cost of approximately $5,000,000 to provide more power for the Pittsburgh district. Contracts for two turbo-generator units of 20,000 kw. each have been let to the Westinghouse Electric & Manufacturing Company.

The company will furnish $3,000,000 and the government the balance. Three years after the end of hostilities the reproduction cost will be determined by three appraisers, one appointed by the company, one by the Secretary of War and one by these two. The decision will be subject to review by the War Department. The company will then pay the government such part of the $2,000,000 advanced by it as exceeds the estimated reproduction cost then.

Ask $200,000,000 for War Power Plants

Views of Government War and Industry Authorities on the Measure to Provide National Fund for Construction of Additional Facilities to Meet the Emergency Need for Power

HEARINGS before the committee on interstate and foreign commerce of the House of Representatives, now in progress at Washington, show clearly the large military purpose behind the two-hundred-million-dollar power-plant emergency bill. The principal provisions of the bill were published in last week's issue of the ELECTRICAL WORLD, page 365. Herewith there is printed the substance of part of the testimony, begun on Aug. 23.

Secretary of War Baker

When Secretary Baker testified before the committee it was for the purpose of making a broad general statement which should express, after conversation with President Wilson, the attitude that should be taken by Congress toward an increase of the power facilities of the country for the purpose of assisting in winning the war.

Secretary Baker said that six or eight months ago it had become apparent that there would be a power famine, and that he had found the situation affected not only the War Department but the Navy Department and the Emergency Fleet Corporation.

"It was suggested, as I recall it," Mr. Baker said, "by President Wilson that the matter be referred to the War Industries Board as the proper agency to make a comprehensive survey of the entire field."

Secretary Baker then related the steps that had been taken. He alluded to reports which had been made to him and conversations he had had with Bernard M. Baruch, chairman of the War Industries Board, and others, as well as with Frederick Darlington, chief of the power section of the War Industries Board, and Lieut. W. W. Stanley, U. S. A., Mr. Darlington's assistant, who presented the case to the committee for the War Industries Board in the absence of Mr. Darlington.

Secretary Baker spoke of Joseph B. McCall of Philadelphia as having been called into consultation and of the fact that certain Cleveland engineers whom he knew personally had been taken into consultation. Secretary Baker mentioned those who had been called into the consultation by the government as representing the Navy Department and the Emergency Fleet Corporation. He said that in particular he had consulted General Keller of the Engineer Corps of the army.

THREE DISTRICTS WHERE CHIEF SHORTAGE EXISTS

After creating this background of authorities the Secretary of War said, in part:

"The three principal shortages center around the so-called Pittsburgh district, which includes a very wide reach of country around Pittsburgh devoted to manufacturing industries; then again Philadelphia, and a section of New Jersey. We attempted to meet the emergency by apportioning these three districts, allowing the War Department, so far as it could out of funds at its disposal, to supplement the power in the Pittsburgh district; the same for the Navy Department in the New Jersey district, and the same for the Emergency Fleet Corporation in the Philadelphia district.

"It required very great ingenuity to work out a plan," the Secretary of War continued, "by which the funds in the War Department could be made available for the establishment of supplementary power supplies."

Secretary Baker explained to the committee that in the search for methods of creating more electric power for the industries of the country the Emergency Fleet Corporation might have some elasticity in the use of its funds when it comes to creating more power and that the Navy Department has somewhat less elasticity. He said that all of the government departments had been working at the problem for four or five months.

"So far as I know," he said, "the only progress that has been made is that the War Department has made a contract in the Pittsburgh district with a power company by which we undertake to buy a very large lot of power. By anticipation we supply some of the money necessary for the enlargement of the existing facilities."

The Secretary of War said that the Pittsburgh contract is more or less of a model contract. He said it has been worded most carefully by men of very great intelligence and ingenuity. "But the Pittsburgh contract," the Secretary said, "is only a drop in the bucket."

THE GOVERNMENT'S PROPER COURSE

Mr. Baker then devoted himself to a discussion of whether the government should step in and supplement the facilities of the power companies, or whether, to use his own language, the companies "could be required or relied upon to supplement their own facilities." He pointed out that the public utilities of the country were financed up to the limit before the war began, and he said that there are very few forms of industry in which there have been as intricate financing as there has been in the electrical industries of this country.

Mr. Baker then took up the inability of the public utilities to borrow money to make the needed expansions the government wants. He analyzed that difficulty, speaking of the substantial percentage of the cost of things above normal times. In this connection he said:

"The attitude of these companies was that if they were called upon to increase their generating capacity by a very large addition the difference between the normal cost and the war cost ought to be borne by the government, in whose interest the additions were made, and that some way of having government aid in their finances would have to be devised."

The Secretary of War explained that the bill commits to the President's discretion the particular mode of dealing with a public utility in any particular place.

At this point Secretary Baker's statement ended and he was interrogated by the members of the committee.

Explaining what the situation is as to cost, Mr

Baker said: "Using figures which may or may not be accurate, but have been used as the basis of discussion, it is said by the power companies that the plant which to-day would cost $100 to install could in normal times be installed for $60, and the contention of the companies is that the government ought to pay that difference of $40 because the plant would not be expanded by its owners to meet the war needs unless the government's interests required it to be done. The theory upon which we have been attempting to meet that contention is that we ought not to jump at an estimate of the difference beween peace-time value and war-time costs, but ought to make an arrangement by which the government will aid in the financing as far as may be necessary and allow the exact amount of the government's contribution to be determined after the war is over and things have returned to normal by an appraisement of the value of the plants to the company, and let the government then pay the difference between the appraised value and the cost during war times."

Representative Esch asked if it was the primary purpose to install the power plant at the mine mouth and thus save haulage of coal. Secretary Baker said that that should be done wherever it could be done. It could not be done in some places, as, for instance, in the Philadelphia district, where the transmission loss would be too great.

Secretary Baker said that it would be a mistake to pass the bill without the precaution contained in Section 6 providing that no structure affecting the navigable capacity of any navigable waters shall be constructed or installed until the plans have been approved by the Chief of Engineers and the Secretary of War. He thought, however, that the language might be amended to read "or such other body as may be authorized by Congress to pass on such subjects."

NO NEW HYDROELECTRIC PLANTS CONTEMPLATED

Mr. Baker said that he believed it was not any part of the present plan to construct any hydroelectric plants, although there may be some enlargements of some existing plants. The government is seeking very much more rapid power development.

Secretary Baker said that some companies are already capitalized to the limit. No one rule could be laid down and applied to all. One of the largest power plants and one of the most advantageously located, the new station at Windsor, W. Va., is almost at the mouth of the mine and can get along without government aid of any kind. In other plants in the Pittsburgh district it was found that the financial condition was such that the companies apparently were wholly unable to borrow money to go forward with their expansion.

"I have no theory of dealing with them," said Secretary Baker, "except that the government ought to extend as little aid as it consistently can to get the thing done and under as great safeguards as can be devised in order to make the government's ultimate contribution, its loss because of war costs, as little as possible and to get back for the government when the war need is over as much as can be salvaged of its expenditures."

Secretary Baker, answering an inquiry from a committee member, said that there is existing power to take over plants and operate them on government account, and the War Department has taken over some and is operating them.

Representative Dewalt asked if it were true that the supply of power of some large business enterprises had been cut by the federal authorities from 25 to 50 per cent because of the shortage.

Secretary Baker said that he had no doubt of it, and perhaps much more than that in some instances.

Representative Dewalt cited the case of some plants whose supply had been cut 25 per cent, while another order about to be issued would make another reduction of 25 per cent. He said that this would virtually compel the mills to close.

Mr. Baker did not know of the particular cases, but said that they are excellent illustrations of the situation, and that even more exaggerated restrictions will be found to be necessary in the Niagara district. It is not intended, as Secretary Baker understands, in the operation of the bill, to attempt to increase the power supply so as to be able to take care, without limit, of all the customers, but to increase it adequately to take care of all those whose continued operation is important to the prosecution of the war.

Representative Dewalt asked about the clause providing that the President may retain any property and operate any plants for such time as he may deem necessary or advisable for the purpose of selling or otherwise disposing thereof. He asked whether that did not look almost like permanent ownership and if it might not be so construed.

Secretary Baker in his reply said in part: "I think that would give the President power to retain permanently things of that sort. I think it is highly important that he should have that power, for two reasons. In the first place, any fixed period within which the things would have to be sold might require the government to sustain a very great loss because of the inopportuneness of the time of sale. The second reason is that some of these large power additions may very well be built near to a permanent government establishment of a large kind. If there should be among these plants a large power-plant addition which was especially well adapted to be a continuing adjunct to a government plant, the President ought to retain it as a permanent government asset."

Representative Dewalt—While recognizing the force of what you say in the individual instance that you have mentioned, I think you still recognize the fact that there is a rather well-grounded sentiment against public ownership of such utilities—that is, federal ownership of such utilities—and I merely throw out that suggestion. Do you not think it would be wise to amend that section so that this possibility, not probability, of unlimited federal control and ownership of public utilities should in some way be hedged about?

GOVERNMENT OWNERSHIP DISCUSSED

"Personally," replied Secretary Baker, "I do not share the prejudice against government ownership of enterprises of this kind, so that my natural disposition would be to favor rather than to discourage the retention of these things by the government in places where it was appropriate."

Representative Dewalt—With all due respect to your opinion, nevertheless I judge there are others who have a different opinion, possibly a larger number having the same opinion that some others may have contrary to yours, and therefore, would it not be well, in your judgment, to somewhat hedge that section about, and, if so, will you be kind enough to have your attorneys inform me because, perhaps, the other members are well informed on that subject?

Secretary Baker—I would not be able to suggest the language which might be appropriate to carry out that idea. The lawyers will be here and will doubtless be able to do it. But I will say generally that I agree with you perfectly. This is not the place to settle the great policy of federal ownership. What we want to do now is to get the power.

Mr. Baker also added, a few minutes later: "I should say that when we are doing things to make war we ought to do things having that sole object and purpose in view and not attempt to accomplish a collateral object." He thought that in passing legislation of this sort the question should be left wide open so that the succeeding Congresses will be free to determine the great peace policy when the time comes for them to turn their attention to it.

Bernard M. Baruch

Bernard M. Baruch, chairman of the War Industries Board, in beginning his testimony said that his attention was called to the matter some time ago in a general survey of the war program, that which involved the War Department, the navy, the Shipping Board, the Emergency Fleet Corporation, the railroad administration, etc.

From time to time sporadic instances were brought to the attention of the board as to the lack of power. A study showed that it was necessary to do something immediately. It was difficult for any one department to do this because the work in any one district involved work for all of the departments, and it was difficult to tell exactly in what proportions each of the departments was involved, and it was also impossible to tell how many of the sub-contractors who did not have direct contracts with the departments were involved.

In endeavoring to meet the situation the board had the departments make studies to see whether they could possibly furnish the money, and in only one or two instances in the War Department was this found possible.

The board feels not only that it should help work out the war program, but that it should look after the necessary and vital civilian needs—that is, the heating, lighting and transportation necessary in order that the populace may live in ordinary comfort.

"We have studied the various points from the standpoint of seeing how much we can save by reducing the less essentials," said Mr. Baruch, "and we have found on examination that it was impossible to meet the war program even if we cut out the less essentials entirely, and we have come to the conclusion that the only way this can be done is to do it in this way.

"I asked the gentlemen who were drawing the bill not in any way to have it drawn so that it would accelerate or retard public ownership, as that was a moot question, and, in fact, to draw it in such a way that only the emergency war matters should be met and that any other great questions involved in it be left to be decided at another time and leave the status quo where it is to-day.

"This bill is drawn for the purpose of giving us the needed emergency power as quickly as can be done and with as little expense and with as little loss to the government as possible. It has been made wide in its power because it is rather difficult to lay down a rule which would cover a large number of cases. Each individual case will have to be taken up by itself.

"I cannot impress upon you too strongly the grave necessity for immediate relief How it will be afforded I am not prepared to say now. The winter is coming along, and in this bill is not only contained relief for the present but relief extending into the program of 1919 and 1920. It is not proposed that any one who will administer this bill will do things other than those absolutely necessary for the military program, and when I say the military program that involves all the war activities."

Representative Esch called attention to the fact that the consideration of the steam stations proposed would mean an increased demand upon the coal supply, and Mr. Baruch in confirming this added that the bill has the approval of Dr. Garfield, Fuel Administrator. Representative Esch said that he had led to that in order to see whether there was coördination in the demand for an increase of power from steam with the Fuel Administration, which was trying to speed up coal production.

Mr. Baruch said that they were very insistent upon this because some of the departments had anticipated putting up isolated plants for some particular purpose. The Fuel Administrator objected to that because he thought it was more economical to use coal in a large central plant or use it where the large central plants had been increased.

In speaking of the coal situation Mr. Baruch declared that the real reason why the legislation is wanted is the immediate need of power in the quickest way to get it, and he believes that the cheapest way to get it and the only way to get it is as suggested by this bill. He said later in regard to the legislation:

"We have got to have it to get our war program through, and it is the only possible way we find of getting it at the time we need it. The real dominant factor is the absolute necessity of power and to get it to-day and not to-morrow."

Representative Dewalt asked what means of relief exist now.

THE SITUATION AT NORFOLK

Mr. Baruch said he had not any. He had tried every possible means to get the departments to furnish relief. There is a serious situation in Norfolk to-day, and in his opinion the war program there is going to be seriously interfered with. The population has risen rapidly from 180,000 to 450,000. The situation there in regard to power as well as to some other things is almost tragic. "We have made efforts in scattered directions," he said "to bring about some little relief but have brought no relief in any amount. Time is the essence in this thing, and it is not a thing that wants to be done to-morrow but to-day."

Mr. Dewalt asked whether Mr. Baruch had from his own investigations ascertained the fact that the electric power producing companies are not able at this time to finance the matter themselves although they would be willing so to do.

Mr. Baruch—You are quite correct.

Mr. Dewalt—They cannot get the capital?

Mr. Baruch—It is absolutely impossible.

Mr. Baruch replied to questions on the situation in New Jersey, a study of which shows that the manufacturing which has to take place there in increasing amount is going to need much more power than is now available.

Replying to an inquiry of Mr. Hamilton as to what he would do in a case like that, Mr. Baruch continued: "A study would be made of each particular case. One of the things we had in mind was carrying across a line from New York City, taking power from the Edison company and getting about 20,000 kw. more, but we have been unable to get any department to do that. Being impressed with the necessity of immediate action, I tried to get Mr. McAdoo, the Railroad Administrator, to carry the power from the Edison company through the Hudson tubes, which are under his command, but it does not make any difference who does this so long as the thing is done. We want to get the power and that seemed the quickest way."

Mr. Baruch also declared that in almost every instance existing facilities would be used by enlarging them.

Replying to a question about the details of the financing where an existing company enlarged its facilities, Mr. Baruch said: "We would make the best trade we could, all the time looking to the fact that we wanted the power and wanted to get the government's interests as fully protected as possible and get all the money back we could. In order that there may be no misconception about this, some of this money will in all probability be war waste. I do not want you to think that where we advanced money we are going to get it all back.

Mr. Hamilton—And what you cannot get back you are going to consider invested in the cause?

Mr. Baruch—Yes sir, that is exactly the fact. I could not have stated it better.

Later Mr. Baruch added: "There is no desire so far as I am concerned or so far as the men I have asked to draw this bill are concerned to either accelerate or retard government or municipal ownership. We want to keep that question out of it. This is a war emergency, and we want to keep the conditions just as they are to-day."

Lieut. W. W. Stanley

Lieut. W. W. Stanley, executive assistant to Frederick Darlington, chief of the power section, War Industries Board, testified for Mr. Darlington, who was unable to be present. He spoke of the new partial surveys made of the situation, mainly by army engineers assigned to the War Industries Board by the Chief of Engineers. A great deal of information was gathered from the power companies.

"They have been very glad to help us in every way they could," said Lieutenant Stanley, "but in each case before we adopted that information as our recommendations or amended it, we have analyzed that information ourselves with the government men so that we feel that the evidence I am going to submit is entirely unbiased."

The situations were very largely in the eastern district. The Niagara district was not handled because that was already being handled by R. J. Bulkley and General Keller for the Secretary of War. That is a separate problem, full of international complications.

"The way in which the problem was attacked was something like this," Lieutenant Stanley testified: "Manufacturers and government agents depending on power for the manufacture of war munitions and material appealed to the War Industries Board when they began to find they could not get adequate service. Army engineers were sent to make examinations of the situations, the generating apparatus, the efficiency, operating conditions, etc. They took the reported loads, customers' records, and visited customers to see that they were operating with economy and on war work. They also checked the construction work of consumers and the amount of power they were asking for the future."

"This kind of survey," said Lieutenant Stanley, "has been made in the most critical places and most of the larger places. It has not been made in full, although it has been made to the extent of establishing the fact that there is a shortage, that the situation is normal, or that there is a surplus of power in a great many of the smaller places.

"As a part of the work," said Lieutenant Stanley, "information was also gathered as to the amount of available power that was used for several purposes but principally to try to regulate as far as possible the placing of more industrial work, so that it would be allotted where there was sufficient power."

In the Philadelphia, Chester and adjacent district there is a present installation of about 220,000 hp. There will be required during this year and next year on the basis of orders already placed about 120,000 hp. additional. In round figures the estimated cost of providing this will be $14,500,000.

New Jersey has a present installation of about 303,500 hp. It will require this year and next year at least 14,000 hp. [40,000 hp.?], estimated to cost $5,500,000.

PITTSBURGH DISTRICT'S NEEDS

The district called the Pittsburgh district, including the territory from Akron, New Youngstown, Pittsburgh, Connellsville, Wheeling, Canton, Massillon and back to Akron—the western portion of Pennsylvania and the eastern portion of Ohio—now has a generating capacity of 456,450 hp. It will need this year and next year 440,000 additional hp., and the estimated cost is $35,000,000.

Baltimore, Lancaster and the territory between have a present installation of 167,460 hp. They need 53,000 hp. more, and the cost is estimated at $3,942,000.

All these estimates are on the basis of existing contracts for the sale of power to manufacturers, taking into consideration also the normal expansion in the use of power by plants.

The Pennsylvania anthracite region includes the Hauto plant, now producing 26,000 kw. Fully equipped with boilers, it could develop 37,000 kw. This district needs 53,000 kw. additional. This involves an estimated cost of $8,000,000, including a considerable amount of transmission.

Replying to an inquiry as to other plants in the district which might be connected with the Hauto station, Lieutenant Stanley said that so far as had yet been found the other plants would have a very small amount of surplus power this summer but would have no surplus this fall and winter. The quickest solution to the problem in that district is to increase the Hauto plant.

In 70 of the larger New England plants, out of a total of about 260, there is 1,200,000 hp. They will need 75,000 hp. additional, and the cost is estimated at $14,625,000. That will be probably best and most quickly obtained by increasing the steam reserve that can be fed onto the lines of the New England Power Company.

Lieutenant Stanley said that about 1,000,000 hp. is installed in the Southern States. It is estimated that the additional power required there for 1918 and 1919 is 135,000 hp. It will cost approximately $15,000,000. At present the cotton-manufacturing districts, supplied partly by hydroelectric systems and partly by steam, in North Carolina, South Carolina, Georgia and Tennessee, are short of power. This is due to unusual water conditions and the fact that the stations are fully loaded for normal conditions. The Southern situation is susceptible, said Lieutenant Stanley, of fairly rapid increase in power resources. It is not in the congested district, which means that it has available fuel, labor and railroad transportation. This district is more properly described as the Southeastern States.

A miscellaneous group of smaller power systems was mentioned by Lieutenant Stanley as existent in the Eastern and Middle West States. The particular systems found to be short have a capacity of about 350,000 hp. and need about 250,000 hp. more. The estimated cost of this is $31,250,000.

Pacific Group Under Survey

The last item in the summary is the Pacific group west of the Rocky Mountains now being surveyed. Only preliminary information has been obtained on that. The territory is short of power, owing principally to the increase in shipbuilding on the Pacific Coast, and a preliminary estimate of desirable expenditure for this year and next year is not less than $10,000,000. The total figures show a present installation of about 3,716,210 hp., and an additional 1,233,300 hp. is required at a total cost of $138,427,000. The Geological Survey had listed up as the essential plant power in the country, not including any power in individual plants, covering the electric light and power and electric railway situation, a total of 13,000,693 hp.

The normal growth in installation, said Lieutenant Stanley, is generally accepted by engineers as an average of 10 to 12 per cent per year. The total increase listed, 9 per cent of the present installation, is a sub-normal increase, indicating that the companies have not expanded during the war as they would have done normally.

Lieutenant Stanley said that it was not intended that the figures should be final so far as the whole war program is concerned. It could not be predicted in power what the increase of the army to 5,000,000 men would mean. These figures do not make allowances for that increase. The figure of $200,000,000 is not too large by any means, because as fast as the war program develops power work all over the country will have to be started this fall and next winter and next spring, as soon as weather conditions are considered favorable, to get the plants built in time to pick up the load that will come on as the army and navy contracts are being fulfilled.

In the Central West, Michigan, Illinois, part of Wisconsin, Ohio, Minnesota and some of Kentucky have been surveyed. There have also been surveys at places where shortages have appeared in Oklahoma, Missouri and Arkansas, and a little has been done in Texas. Something was done in Iowa, and Lieutenant Stanley thought that the representatives had been in Nebraska. Lieutenant Stanley guessed that more steam power than water power was involved.

One of the things that have developed is the problem of interconnection of existing companies so far as possible and desirable. This will undoubtedly have to be done in a number of cases. Lieutenant Stanley also indicated that the board regards other work than war industries as important; while not on the basis of war work, power must be supplied for these purposes.

Clarence Dillon

Clarence Dillon, representing the War Industries Board, testified that some time ago the War Industries Board began to get complaints from manufacturers in the Philadelphia and Pittsburgh districts who had government contracts that they could not get enough power. It was found on investigation that there were very large demands for power for actual war orders and that the power could not be supplied. The same state of affairs was found in the New Jersey district. Representatives of the different power companies, called to Washington, said that they would have to have financial help to furnish more facilities. Afterward, at a meeting in New York, with company representatives and their bankers present, it was shown that the companies were unable to raise capital.

Mr. Baruch, said Mr. Dillon, then went to the different departments to see if they had available funds. It developed that the Navy Department had none. The Shipping Board had a small fund. The War Department had no funds available for this purpose, but could secure probably small amounts which could help in a very insignificant way. Mr. Baruch then asked "Mr. Meyer and some other gentlemen to prepare a bill to relieve this situation."

When it was found to be impossible to do anything before the recess, the matter was taken up with the three departments mentioned, and the three districts were divided, giving Pittsburgh to the War Department, Philadelphia to the Shipping Board and New Jersey to the navy.

Nothing has been done by the navy in New Jersey, said Mr. Dillon. Nothing has been done by the Shipping Board in Philadelphia, although the Shipping Board is negotiating with the company there to try to reapportion the power to get some small relief pending this legislation, but any such relief will be infinitesimal. Mr. Dillon referred briefly to a contract made by the War Department with a company in the Pittsburgh district whereby the department furnishes 40 per cent of the cost of the new development and the company financed 60 per cent. The department will absorb any war wastage, and the plant will be taken over after the war by the company at an appraised valuation at that time.

"This contract," Mr. Dillon added, "was very clumsy and difficult to handle because the War Department had no funds for that purpose. The only way it could help was to make advance payment on the power purchased and then to arrange an adjustment of the price of the power purchased in order to take care of the war wastage on the high price of construction at this time."

Mr. Dillon said that it was impossible to get relief in this way "and that unless we get some broad, comprehensive way of working the situation out we are going to fall down on our war program. I am convinced that a very large part of this money will be returned to the government," he added.

Representative Esch asked if the army appropriation bill a year ago did not give the War Department power to commandeer any plant or industry necessary for war production.

Mr. Dillon said that that was true, but there is no one power plant that is necessary for power production for the army. A commandeered plant would have to be commandeered for the benefit of the Shipping Board, the navy, the civilian population and every one else.

WAR WASTAGE OF CAPITAL

Answering a question by Representative Esch as to the estimate to be put upon the war wastage of the capital, Mr. Dillon replied:

"Whether equipment is going to go back to the prices that existed before the war is largely problematical. The general opinion is that it will go off somewhat from present prices, but there is an equally broad opinion that it will not go back to the lowest prices that existed before the war. The terms of the advance will be such that as power is delivered a certain amount of the advance will be taken care of, and the longer the government takes power the more of the money advanced will be returned. These contracts will be made each one upon its merits and each will undoubtedly have different terms and conditions. But if you use that power for any length of time it is reasonable to suppose that a very large part of the money will be recovered. If you increase those plants and the war comes to a very abrupt termination and you do not use a great deal of that power, the war wastage of that equipment may be larger. The government need not sell those plants at the termination of the contract. That can be determined by arrangement.

There are areas not particularly congested, said Mr. Dillon, that are also short of power. The particular places causing worry at present are in the congested districts where the intensive investigations were made.

Mr. Dillon, replying to a question, said that he did not contemplate that much of the additional plant facilities would be dismantled after peace. To the extent that they survived the investment would not be wasted. The money should be loaned by the government just as if it were a private bank.

"I personally should think that immediately after the war," Mr. Dillon said, "the industries that were using the bulk of this power would not have use for all the power that they had been using and therefore there would have to be a redistribution of that power, although other industries to which we are denying power now would then be ready and willing to take power so there would be a readjustment of that power."

Mr. Dillon expressed the belief, following an inquiry by Representative Winslow, that with the power that it is contemplated will be produced there will be more than the normal amount on hand for all purposes when the war is over.

Mr. Winslow asked if there was anything in the bill that contemplated the final control of the power by the government. Mr. Dillon said that it was agreed by every one connected with the draft of the bill that this question should not be brought into the matter.

Speaking further on the use of the power after the war, Mr. Dillon said:

"In the manufacture of war essentials we get right down to the fundamental industries of our modern life. Practically every industry, with few exceptions, is called upon for increased production, so that the use of this power after the war depends largely upon our national life after the war, on general industry and trade. We are not using this power for the conduct of a business that is absolutely useless when the war is over."

Replying to Representative Parker of New Jersey, Mr. Dillon said that the tendency for manufacturers to connect with a central station is marked.

Representative Parker—And if that tendency remains after the war, and there is such saving, may we not fairly expect a great demand for power after the war from various industries which are now not connected with central power plants?

Mr. Dillon—We may, and that may be sufficient to use the entire power extension that we are now making, by the fact that we can furnish power to the small consumer cheaper than he can make his own power, and if he is now making his own power he would discontinue it, which might take up the entire slack that would come after the war.

Later in his testimony Mr. Dillon reiterated his opinion that eventually all the power made in the plants will be used in the normal processes of business.

CONVERTING THE LESS ESSENTIAL INDUSTRIES

Representative Winslow asked whether the board is looking ahead to what might be called the second stage of a demand for power, namely, for those industries which are being classed as non-essential at the moment, but which ultimately are bound to find a field for their products.

In replying Mr. Dillon said that a division of the board is studying that and figuring whether "less essential" industries can be converted to more essential work. In doing that there will be greater production capacity in the country and greater demands for power.

Mr. Winslow—In view of that, are you making your provisions sufficiently elastic to accommodate properly those less essential industries?

Mr. Dillon—That is our intention.

Representative Winslow—Or will you have to come back and ask for a further consideration?

Mr. Dillon—I think that will have to take care of itself. At the present, as far as we can see, this bill will take care of the needs of the country immediate and throughout the coming year 1919. What the program will be after that and the demand for power depend upon what the military program is. As we see the military program to-day we hope that we have taken care of the situation with this $200,000,000.

It was explained by Mr. Dillon that the power shortage still exists when the supply has been diverted from industries whose product is not as vital as those of other industries.

LIMITS COAL STORAGE BY INDUSTRIAL PLANTS

United States Fuel Administration, to Meet Special War Demands in East, Restricts Amount of Coal to Be Stored

The tremendously increasing demand for coal for special war purposes in the eastern part of the country, particularly for the navy and transport service, is making it necessary to draw more heavily on the Eastern coal fields than was originally contemplated.

In order to decide how best to secure this coal for these purposes with the least disturbance of the coal supply moving to other industries, a meeting of all state fuel administrators east of the Mississippi and also for the states of Minnesota, North Dakota and South Dakota was held in Washington on Aug. 20.

It was decided that to accomplish the desired result it would be necessary to limit the amount of coal storage that industrial plants would be allowed to accumulate and to carry on hand and to fix a uniform amount for each state.

United States Fuel Administrator Garfield announced the basic policy of the Fuel Administration as to storage as follows:

> Coal in excess of that required for current operations shall be delivered to plants not on the preference list of the War Industries Board only when it is not in demand for use before April 1, 1919, by consumers on said list, namely, railroads, the federal government, states, counties, public utilities, retail dealers, or manufacturing plants on the preference list.
>
> In carrying out this policy, allowance shall be made for differences in distance from the mines and for differences in transportation conditions which may require more or less storage at the beginning of winter to insure uninterrupted operation until the following spring.
>
> The maximum number of days' storage for bituminous coal indicated for the several states or parts of states defined hereafter are as follows:

	Steam Coal			By-Product and Gas Coal		
	Public Utilities	Preferred Indusrties	Non-Preferred Industries	By-Product and Gas Plants	Preferred Industries	Non-Preferred Industries
Maine	120	90	30	120	90	0
Massachusetts, Vermont, New Hampshire, northern New York	90	60	30	90	60	0
Connecticut, Rhode Island	75	45	20	75	45	0
Southern New York, New Jersey, Delaware, eastern Pennsylvania	30	30	15	45	30	0
Maryland, District of Columbia, Virginia, North Carolina, South Carolina, Georgia, Florida, Western Ohio	30	30	15	45	30	0
Western Pennsylvania, West Virginia, eastern Kentucky, eastern Ohio	30	20	15	45	30	0
Lower Michigan	90	45	20	60	60	0
Illinois, Indiana, Missouri	..	..	..	60	60	0
Wisconsin, Minnesota, North Dakota, South Dakota, upper Michigan	..	..	..	90	90	0

The following report, framed by a committee of state fuel administrators aided by officials of the administration, was adopted by the conference and concurred in by Dr. Garfield:

> It is understood that these limits are mandatory, and each fuel administrator is expected to see that the different classes of consumers are not allowed to exceed these limits. At the same time, it is understood that particular cases may require special treatment by a state fuel administrator, either by way of granting more stocks of coal than are indicated by these limits or by restricting them to a less supply than indicated by these limits.
>
> Where a state administrator decides that the maximum limit should be exceeded in a special case for some special reason, he shall have authority to grant a revocable increase in writing for a specific added number of days. The administrator shall report each such specific case in writing immediately to the United States Fuel Administration at Washington, which may in writing disapprove the extension granted by him. Otherwise it shall stand subject to action of the state fuel administrator.
>
> Any company or concern which is permitted under the zoning regulations now or hereafter in force to obtain coal from Illinois, Indiana, western Kentucky, or from mines west of the Mississippi River, may retain such reserve stock of coal as it shall have on the effective date hereof on condition that such company or concern shall thereafter use screenings or mine run only for its current necessities and shall obtain such screenings or mine run for current use only from such last-mentioned fields.

WAR CONVERSION OF MANUFACTURING PLANTS

Plan Is to Develop Business of the Country as Though It Were One Enormous Concern

Charles A. Otis, chief of the Resources and Conversion Section of the War Industries Board, informed New England manufacturers in an address at Portsmouth, N. H., Aug. 24, that so far from aiming to interrupt the normal industrial life of the country, the government departments propose to do everything possible to encourage and even to increase the manufacture of ordinary materials except where such production would interfere with the successful prosecution of the war.

"Every resource of the country necessary for producing the supplies and equipment of the army, navy and other departments will be utilized," Mr. Otis said, "but beyond this point the industrial structure of the country need not fear that it will be handicapped.

"Through the war resources committee," he added, "the business men of the country become the army of industry backing up the boys at the front, while the government aids as it can in shaping the work of both to a common end. It is obvious that as we progress the government will be an enormous buyer. It is facing us now that many industries must immediately develop their organization along the line of war requirements or go out of business. To save this very serious situation is the work of the Resources and Conversion Section, and its work is dependent upon the hearty support of every business man in the country."

Mr. Otis continued:

> A careful study is being made of the fuel and power situations so that districts loaded with work will not increase beyond the limit of the power and transportation facilities of the country, but others be developed for the

work. It is plain that the whole story is to develop the business of this country as though it were one enormous concern with its various departments. There is not a man in the United States to-day, I feel sure, who has any fear as to our soldiers. I think the fear that is creeping into many of us is the enormity of the business behind them. When we consider that as our men increase abroad the supplies must increase in like proportion—the supplies right behind them, a little way behind that, on the shores of our allies, on the ocean going over, on our own shores and back to the factories—we get a picture of the stupendous operations, and everything must be so arranged that the supplies go in an orderly way.

Our soldiers must not be in want of shells yet oversupplied with food; nor must the reverse occur. The departments of the army and navy are doing wonderful work, and it is for us to see that they get all the information, all the assistance, all the development of resources and of the orderly conduct of business to help them in their great task. We must keep our people contented, we must give business every possible chance, but we will win this war, and a large part of it is up to us, the business men of our country.

Special emphasis was placed on the necessity of manufacturers who have a large share of government work subletting contracts wherever it can be done in the interest of greater speed and efficiency in production. It is the duty of such manufacturers, Mr. Otis stated, to inform the regional adviser that they are willing to give some of the details of their work to other plants which are equipped to take them in hand. It has been brought to Mr. Otis' attention that smaller manufacturers are ready and eager to engage in such co-operation, but are often unable to obtain the work. He expressed satisfaction at the work accomplished in New England. Stuart W. Webb is regional adviser for Region No. 1, embracing all New England except Connecticut and western Massachusetts, his headquarters being at the Boston Chamber of Commerce.

ATLANTA RATES INCREASED BY GEORGIA COMMISSION

Estimates Indicate that Advance Is Substantially Less than the Company Asked—City Council Will Contest Ruling

The Georgia Railroad Commission has handed down its decision regarding the application of the Georgia Railway & Power Company, Atlanta, for a general increase in lighting, power and gas rates and electric railway fares.

The report indicates that it is the commission's idea to allow a return of 6 per cent and a depreciation of 2½ per cent on the consolidated market values of the capitalization of the Georgia Railway & Power Company and the Georgia Railway & Electric Company (excluding the Atlanta Gas Light Company and Atlanta Northern Railway), approximately $39,500,000, as compared with a total outstanding of $66,250,000 stocks and bonds.

It is difficult to predict just what the effect in income will be, but rough estimates place increases per annum of $36,000 on residential lighting, $72,000 on retail power and $170,000 on wholesale power, and a decrease of $60,000 on commercial lighting.

The company asked for increases from 15 to 33⅓ per cent in the way of a surcharge, but the commission's rate expert made a number of changes in the type of rates, especially for power, which will decrease the income from commercial lighting, seasonal and municipal customers and increase the income from industrial consumers.

The Atlanta City Council has indicated that it will carry the case to the courts.

GUY E. TRIPP IS MADE A BRIGADIER GENERAL

Former Chairman of the Westinghouse Electric & Manufacturing Company Promoted to Be Assistant' Chief of Ordnance Department of Army

Col. Guy E. Tripp, recently chairman of the board of the Westinghouse Electric & Manufacturing Company, who was given leave of absence by the directors of the company in order to devote himself to the government service for the duration of the war, has been appointed brigadier general.

From chief of the production division of the Ordnance Department of the army, General Tripp has just been promoted to be assistant chief of the Ordnance Department.

COMMISSIONS DECLINE TO ORDER UTILITY EXTENSIONS

Connecticut and Massachusetts Boards Refuse to Direct Companies to Make Expansions Desired by Customers in War Time

Two New England public service commissions—Connecticut and Massachusetts—have issued three findings in which petitions for the extension of service were refused.

In the case of Hosford et al. vs. Connecticut Light & Power Company, Waterbury, five residents of a section of the town of Plainville demanded a line extension for power and lighting service into a farming district about a mile from the existing lines. At the hearing very little evidence was introduced which warranted the commission's requiring the construction of the line under present war conditions, and the petition was accordingly denied without prejudice, subject to the consideration of another of the same tenor after the war.

Another case was a petition by Spencer et al. vs. Hartford Gas Light Company. Here the estimated cost of a desired extension of mains was $3,000 and the estimated annual revenue, $220 to $285. The petitioners wanted gas for cooking and claimed that the district in question would be developed by the proposed construction. The commission declared that the company might in normal times be subjected to an order of construction, but that now only extensions absolutely necessary in the opinion of the federal authorities should be ordered. Future development of communities is an insufficient reason to order extensions at this time. After the war the situation would probably be regarded differently.

In Massachusetts the commission refused to order the Bay State Street Railway to build a thirty-five-thousand-dollar extension parallel to two lines about a mile apart. The existing service meets the need sufficiently, the commission holds.

COMMISSION'S DECISION IN INDIANAPOLIS RATE CASES

War-Time Relief Falls Chiefly on Power Customers, Domestic Customers' Rates Remaining Almost Undisturbed

The order of the Indiana Public Service Commission entered on Aug. 6 and giving war-time relief to the Indianapolis Light & Heat Company and the Merchants' Heat & Light Company was referred to in the columns of the Electrical World on Aug. 10. The complete order of the commission has since come to hand with its details. The evidence of the Merchants' Heat & Light Company showed a deficit of $238,793.66 for the year ended June 30, 1918, after including bond interest, interest on unfunded obligations and allowance for depreciation, but no return on investment.

A significant feature of the evidence was the showing of large increases in cost of operation in May and June, the deficit for the first ten months being $8,281.68 and for the last two months $16,069.08, this deficit not including any part of the company's allowance for depreciation. According to its best estimates of earnings and operating expenses for the year beginning July 1, 1918, the Merchants' Heat & Light Company's deficit will be $677,643, based on original schedules and not including any surcharges.

The testimony and exhibits of the Indianapolis Light & Heat Company indicate a net operating deficit for the year ending June 30, 1919, of $173,311.94, or a total deficit of $402,471.94, after adding interest on funded obligations, funded debt, bond discount and miscellaneous charges. This deficit does not, however, include additions to revenue from surcharges.

Steam-Heating Service Losses

The testimony revealed that the heavy deficits were caused in considerable part by the steam and hot-water heating services, the Merchants' Heat & Light Company showing that its operating expenses and taxes exceeded its revenues by $50,848.95 and the Indianapolis Light & Heat Company showing a deficit of $44,743.38. From the evidence submitted, coal was shown to have increased more than 100 per cent in cost over the year 1915, and approximately 75 cents a ton over the average for the year ended June 30, 1918.

Coal costs in generating electricity in 1915 were 3.4 mills per kilowatt-hour for the Merchants' Heat & Light Company and 3.15 mills for the Indianapolis Light & Heat Company. The coal costs for the year ended June 30, 1918 were 5.7 mills per kilowatt-hour for the Merchants' company and 4.2 mills for the Indianapolis company. The estimates for the fiscal year ended June 30, 1919, are 7.08 mills for the former and 5.74 mills for the latter.

The evidence also shows additional item of expense resulting from the necessity of keeping a large force of guards on duty to protect the power plants from damage.

The testimony indicates that the cost per kilowatt-hour for labor and materials (other than coal) used at the generating plants was 2.65 mills for the Merchants' Heat & Light Company in the year 1918 and 3.32 mills for the Indianapolis Light & Heat Company, and that these costs under the new conditions affecting labor will be raised to 3.18 mills and 4.07 mills for the year ending June 30, 1918. The bare production costs at the switchboard for the year ending June 30, 1918, were 8.35 mills for the Merchants' Heat & Light Company and 7.74 mills for the Indianapolis Light & Heat Company. Indications are that the increased cost of coal, labor and materials will raise these to 1.18 cents and 9.87 mills for the respective companies, to which must be added increased freight rates on coal for the year ending June 30, 1918, making the switchboard costs approximately 1.2 cents for the Merchants' Heat & Light Company and 1 cent for the Indianapolis Light & Heat Company.

Commenting on what might be called "the real public utility business," the service to homes and offices, the commission gives its reasons for not increasing the 7-cent primary rate. First and foremost is the reason that primarily public utilities are organized to serve, not great power-consuming industries, but the people, who, generally speaking, come under the so-called 7-cent rate. Although the cost of reading numerous meters of these consumers—there are approximately 45,000 of them—and other expenses attaching to this business constitute an expense per kilowatt-hour that is out of all proportion to the cost per kilowatt-hour of serving the large power users, there is no evidence in the record or revealed by investigation that the company's losses are attributable to what may be called the 7-cent rate business, or the residence and small consumers' rate.

Acting on the appeals from Dr. Garfield, the Federal Fuel Administrator, that electrical utilities promote economies of electrical energy consumption, the commission refused to increase the minimum charge from 50 cents a month to $1 a month. On the other hand, the so-called secondary charge was raised from 5 cents to 6 cents per kilowatt-hour for all energy consumed in excess of that used over the primary 7-cent rate.

An analysis made by the commission reveals that consumers served at a wholesale rate have been a constant source of loss. Under the original rates energy was sold to companies at 0.0057 cent, or a little less than 6 mills. The 5 mills surcharge applied to all power rates raised this rate to 1.06 cents. The commission fixed 1.65 cents per kilowatt-hour as a net minimum, no matter on what basis the charge is made below which no electrical energy shall be sold. It also increased the surcharges from 5 mills to 7 mills per kilowatt-hour, with the exception that for municipal lighting the 5 mills surcharge is undisturbed.

Indianapolis is one of the country's ammunition centers, and the public utilities move as much probably as 90 per cent of the wheels of the industry. To permit such service to become crippled or inadequate would strike both at the war effectiveness of the nation and the life of the community. The commission expresses itself as not so much concerned with the prosperity of the companies as it is in the maintenance of credit which will permit them to command funds, and while the surcharges may fall short of providing for a return on investment such as would be received in normal times, the central stations must carry their part of the burden of war. All their patrons are under the heavy obligations of winning the war, and the companies themselves are not to be freed of carrying the natural obligations of sacrifice. As a basis for saving coal, the commission urged a pooling of the competitive systems.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Interference of Telephone Line with High-Tension Transmission Line.—In a case affecting the McFaddin Telephone Company the Virginia State Corporation Commission says: "Interference with existing grounded telephone circuits by high-power transmission lines will necessarily become an increasing problem as time goes by and as electric power continues to be developed. It is highly desirable for the good of the whole community that power companies be encouraged, with due regard always to the existing prior rights of the telephone enterprises. This commission expects to pursue a policy accordingly, and will require as occasion may arise such construction of telephone lines as will enable power companies to exist and operate without being forced to bear excessive financial burdens. It will be a matter for determination in each individual case as to that part of the expense of changes from grounded to metallic lines to be borne by power companies. Under such circumstances the commission is of opinion that in this instance the McFaddin Telephone Company should be required to construct a metallic circuit between the towns of Lebanon and Honaker. The amount to be paid by the Appalachian Power Company or the Lebanon Light Company to the McFaddin Telephone Company in this instance has been agreed upon between the parties."

War Rate Surcharge in Arizona.—Acting upon a petition of the Arizona Gas, Electric Light & Power Association, the Arizona Corporation Commission has ordered "that any gas corporation or electric corporation, as defined by the laws of this state, may make application to this commission for permission to make effective a surcharge—*i.e.*, a percentage of the totals of customers' accounts to be added to such accounts—accompanied by data hereinafter to be defined. The company shall file a copy of its application for surcharge at its office in such a manner that it may be inspected by the public. If no formal protest against the proposed surcharge is received by the commission within ten days from the date of filing of said surcharge, the commission will enter an order without further proceedings, denying or granting in whole or in part the surcharge applied for. In the event that a formal objection or protest is received, such objection or protest will act as a stay until opportunity has been afforded protestant to appear at a public hearing in the matter. It is ordered that each application for permission to make effective a surcharge must show definitely the amount of surcharge desired by applicant and to what accounts it is to apply. If any class of consumers is to be exempt from the application of the surcharge, such must be stated in the application and the reasons for the exemption. Accompanying each application there must be filed, under oath, 'statements regarding income, fuel oil, pay roll and additions to property and plant account.' The corporations concerned in these proceedings," the commission says, "have purchased fuel oil for many years under contracts carrying a price of from $1.35 a barrel to $1.60, depending upon the location and size of the plant and upon the grade of fuel. As these contracts are terminated it becomes necessary for the companies to purchase their fuel in the open market at prices ranging from $2.20 upward and with no assurance that the prices will not continue to increase. Labor, particularly that applied to operation and construction, costs from 10 per cent to 25 per cent more than it did a year ago and is also likely to advance still more. Increases in the costs of materials used in operation and of the many other miscellaneous items necessary in the operation of a gas or electric plant all contribute in some degree in the general burden."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Oregon Association of Electrical Contractors and Dealers.—Secretary-treasurer J. W. Oberender, 302 Dekum Building, Portland, Ore., reports that the annual meeting of the Oregon Association of Electrical Contractors and Dealers will be held Sept. 12, 13 and 14 in Portland.

A. S. M. E., San Francisco Section.—The new executive committee of the San Francisco Section of the A. S. M. E. has met and outlined a program for the season. Elgin Stoddard of Charles B. Moore & Company will present a paper on fuel conservation at the first meeting of the year, which will be held Sept. 26 at the San Francisco Engineers' Club.

Meetings and Papers of the A. I. E. E.—Arrangements made by the meetings and papers committee of the American Institute of Electrical Engineers were approved by the board for Institute meetings to be held in Philadelphia Oct. 11 and 12, 1918, and in Toronto on Nov. 22, 1918. The programs of these meetings will be given at a later date.

National Safety Council.—The annual meeting of the National Safety Council will be held in St. Louis, Mo., on Sept. 16 to 20 inclusive at the Statler Hotel. A small safety educational exhibit will be shown in the hotel.

Portland Engineers Hold Joint Meeting.—At a joint meeting of the local engineering bodies of Portland, Ore., Alfred B. Flinn, secretary of the Engineering Council, was the guest of the evening and the chief speaker.

Joint Meeting A. I. & S. E. E. and A. I. E. E.—The electric welding committee of the Emergency Fleet Corporation will hold a joint session with the Philadelphia Section of the Association of Iron and Steel Electrical Engineers and the American Institute of Electrical Engineers and the Engineers' Club of Philadelphia at the Bellevue-Stratford Hotel, Philadelphia, on Sept. 16 at 8 p. m. The very important and timely subject of "Electric Welding in New Industries" will be discussed at this meeting.

N. E. L. A., New England Section.—The program of the annual convention of the New England Section of the National Electric Light Association, to be held in Springfield, Mass., Sept. 27-28 as previously announced in the ELECTRICAL WORLD, will be devoted to problems in the electrical industry due to the war and the utilization of all resources toward winning the war. Some of the subjects to be discussed are outlined tentatively as "Trade Acceptances," by a representative of the Federal Reserve Bank; "Finances," "Financing of Extensions," "Line Extensions in War Time," "Raising of Rates and Coal Clauses," "Interesting Your Customers in the Securities of Your Company and as Stockholders," "War Finance Corporation," by a representative of the Federal Reserve Bank; "Female Employment in Utilities Service," "Wholesale Power—How It Is Being Handled," "Interconnection and Power Requirements," etc. The coal situation will be discussed by a representative of the Fuel Administration of Washington. Other important problems to be discussed are "Increase in Wages, Bonuses, Etc.," "Standardization of Transformer Ratings," "Making Quantity and Service the Basis for Price," by John J. Gibson; "Obtaining Power from Steam Used in Bleacheries," and "Effect of Daylight Saving on Central-Station Incomes." W. L. Goodwin will give a talk on "Coöperation Between Different Branches of the Industry," and a discussion on "Stimulating Appliance Sales" will be held. On Saturday, the last day of the convention, officers will be elected. In connection with this meeting the convention bureau of the Springfield Chamber of Commerce has issued a street guide showing hotels and important places in that city, the traffic rules and regulations, rates at the various hotels and express-train schedules from Springfield. Garages are also listed

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Conservation Committee in Illinois County.—Louis Erskine, Fuel Administrator of Lake County, Ill., has named a conservation committee to look into the conservation of power and light. This committee will have authority to refuse either power or light to a store or industry when it is felt that the use of such power and light is not the best conservation.

United States Circuit Court Refuses to Halt Federal Trade Commission.—The United States Circuit Court of Appeals for the Second Circuit, sitting in New York City, has refused to interfere with the taking of testimony by the Federal Trade Commission against the Nulomoline Company, manufacturing and selling a sugar-syrup product. Contention was made that under the Federal Trade Commission act the commission has no authority to pass upon the validity of a patent, and that under the act the Circuit Court of Appeals may prevent the commission from taking testimony touching the validity of a patent. The court held, however, that the act gives it no power to prevent the commission from ordering that such testimony be taken, as it is not an order to cease and desist from unfair methods of competition, the authority to review which is given to the court by the act.

Tax Payment Settlement in Indianapolis.—The Merchants' Heat & Light Company and the city of Indianapolis have reached an agreement whereby the company will pay to the city one-half of the annual street-lighting contract tax and the city will pay the company for service given to the city since January, minus the surcharges asked by the company. The city has been holding up payments to the company because the company had not paid its contract tax of 5 per cent of the gross revenue from the street-lighting contract. These payments to the company will aggregate approximately $20,000, and the company's payments to the city will be between $4,000 and $5,000. The city contends that it is not liable to pay the surcharges which the company demands. The question of whether the company will pay its regular franchise tax is not involved in this settlement. After surrendering its franchise to the Indiana Public Service Commission, the Merchants' Heat & Light Company, as did the Indianapolis Light & Heat Company, contended that it was no longer required to pay the franchise tax, as it is now operating under an indeterminate permit from the Indiana Public Service Commission.

Rate Increase Sought by Bronx Company.—The Bronx Gas & Electric Company, which operates in Bronx Borough, has filed with the New York Public Service Commission, First District, a schedule showing a proposed increase in its electric rates from 10 to 12 cents per kilowatt-hour, with a minimum charge of $1 per month. The commission has taken no action on the company's request to put this increased charge into effect on six days' notice. The electric rates of this company were under investigation by the commission several months ago, when consumers appeared to request that the commission make no reduction in the rate for fear that the loss of revenue would prevent the company from making much-needed extensions to its transmission lines.

Rate Contest in Paris, Ky.—At Paris, Ky., a contest is in progress between the city and the Paris Gas & Electric Company. The city objected to a proposed raise in rates and refused to pay its lighting bills and the company cut off the supply. An injunction was secured by the city. The company in turn got an injunction against the city to keep it from interfering with the collection of accounts. The council then passed a resolution declaring that the franchise under which the company operates was created for the purpose of producing, distributing and selling electrical energy in Paris, and that the franchise required that the purchaser thereof should install in Paris an up-to-date plant for the purpose of producing and supplying such energy. It declared further that the company had failed and refused to comply with the conditions in that it had not produced energy in Paris. The resolution called upon the company to produce its energy in Paris. The company has been getting its power from Lexington.

Examination of Costs of Bituminous Coal Production.—Coincident with the first anniversary of Dr. H. A. Garfield's incumbency of the position of United State Fuel Administrator an order was signed by him that marks the last stage of an examination into the cost of bituminous coal production in the various coal fields of the United States. The general result as far as the cost to the public is concerned has not been materially altered, as the increases of price allowed to some mines are fully offset by decreases in other mine prices. Comparisons with former prices are not possible on account of the new classifications being entirely different from those which were heretofore in effect. Having now determined the various classifications and general basic cost of the production of coal, it will be a comparatively simple matter to tabulate and adjust the variations of the cost of production from month to month, and it will be possible to keep before the Fuel Administrator tabulations of figures showing how varying labor conditions, cost of mining, material and car service will operate to affect the cost of production.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

By-passing Meter Larceny.—A water consumer who, by false connections, caries water around his meter and consumes it on his property, without the consent of the owner and without having it registered, and with intention thus to deprive the owner thereof without payment therefor, is held guilty of larceny, in the Oklahoma case of Clark vs. State (170 P. 275), which is accompanied (L.R.A. 1918 C. 577) by a notation on the subject of water, gas and electricity as subjects of larceny.

Scope of Employment.—A trouble-man of an electric company who is furnished by his employer with a motorcycle for use in his work is held, in Keck vs. Louisville Gas & Electric Company (179 Ky. 314,200 S. W. 452), not to be acting within the scope of his employment, so as to render the master liable for the negligent operation of the machine, while riding to his home after the expiration of his working hours, although the master permits him to use the machine for that purpose. The responsibility of the owner of a motorcycle for its negligent operation by another is treated in a note that is appended to the foregoing decision (L.R.A. 1918 C. 654).

Validity of Commission's Decision.—The public utilities act providing that any party interested in an order or decision made by the Railroad Commission may petition for rehearing, and that, if such rehearing is denied, application may be made to the Supreme Court for writ of review to have the lawfulness of the order of decision determined, are valid limitations on the powers of the courts of the state according to the Supreme Court of California (173 P. 473). Where, at the time the Railroad Commission's decision was made valuing property sought to be condemned, Constitution, Article 12, 23a, had validated legislation vesting the commission with such authority, the fact that the finding was based on a proceeding instituted and testimony heard before the constitutional amendment had become valid and effective was a matter going only to the regularity and propriety of the procedure leading to the finding, rather than to the fundamental jurisdiction of the commission to make the finding itself; and defendant, by failing to ask the commission for rehearing pursuant to public utilities act, or to apply to the Supreme Court for writ of review pursuant to Section 67, waived any objection, and permitted the commission's decision to become final.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

W. A. Keating has resigned his position as superintendent of underground lines of the Duquesne Light Company of Pittsburgh, Pa.

Major C. B. Wilcox, chairman of the board of directors of the Sandusky Gas & Electric Company, Sandusky, Ohio, has been appointed director of publicity for Erie County, in connection with the drive for the fourth Liberty loan.

Ira W. Fiske, who has been a member of the electrical engineering faculty of the University of Illinois for several years, has resigned that position to become head of the electrical engineering department in the Drexel Institute of Technology, Philadelphia, Pa.

S. F. Bond, Binghamton, N. Y., electrical engineer for the Binghamton Light, Heat & Power Company, has resigned. W. B. Coudy, formerly superintendent at the plant of the New Kensington Light & Power Company, New Kensington, Pa., succeeds Mr. Bond.

Ross B. Mateer, formerly industrial engineer for the Southern Sierras Power Company with headquarters at Riverside, Cal., and more recently connected with the Philadelphia Electric Company, has been commissioned a captain in the Engineer Reserve Officers' Corps and is at present stationed at Camp Lee, Petersburg, Va.

Harry B. Joyce, who has been connected with the United Electric Light & Power Company for several years as power engineer, has received a commission as captain in the Quartermasters' Corps, U. S. A. Mr. Joyce's experience in practically every phase of engineering connected with electric lighting, and his special knowledge of refrigeration are responsible for his appointment to this important position. He will be stationed at Washington.

Capt. James P. Growdon, formerly superintendent of electrical distribution for the Northwest Electric Company, Portland, Ore., and now with the Fourth Engineers, National Army, according to reports received in Portland, was in the contingent that recently crossed the Vesle River under heavy German fire and felled trees across the stream for the construction of a passageway in advance of the bridge gang. Captain Growdon attended the civilian training camp at American Lake in 1916 and entered the first officers' training camp at San Francisco.

D. C. Black has been appointed superintendent of underground lines of the Duquesne Light Company of Pittsburgh, Pa., to take the place of W. A. Keating, who has just resigned. Mr. Black entered the employment of this company in April, 1913, serving in the underground cable division in the office of the superintendent of distribution until Jan. 1, 1917, at which time he became assistant superintendent of underground lines. Previous to this he worked for the Fulton County Gas & Electric Company, Gloversville, N. Y., and for the United Gas Improvement Company, Philadelphia.

Leo W. Hall has resigned his position with the Kentucky Utilities Company at Shelbyville, Ky., and has gone to Cape Girardeau, Mo., as district manager of the plant in that city.

W. J. GRAMBS

W. J. Grambs, formerly assistant to the president of the Puget Sound Traction, Light & Power Company, Seattle, Wash., was recently appointed supervisor of the Sea Training Bureau of the United States Shipping Board for the Pacific Northwest. Mr. Grambs entered government service on Sept. 1, 1917, since which time he has been in charge of the navigation schools of the government in Seattle, Portland, Tacoma and Bellingham and the marine engineering school at the University of Washington.

C. W. Ward, superintendent of laboratory, Duquesne Light Company, Pittsburgh, Pa., has been appointed superintendent of light and power of the Citizens' Light & Power Company of Oil City and Franklin, Pa. Mr. Ward entered the electrical industry about sixteen years ago in contracting and central-station work. He has been employed by the Duquesne Light Company for the past seven and a half years, during which time he also taught electric wiring at night at the Carnegie Institute of Technology. At one time he was president of the Duquesne Light Company N. E. L. A. section. In 1912 he was chairman of the lamp committee of the Pennsylvania Electric Association. An intensive study of rubber gloves has been made by Mr. Ward, and he designed the gloves now being manufactured by the Pittsburgh Glove Manufacturing Company.

Obituary

Eugene P. Rowell, treasurer and manager of the Plymouth (Mass.) Electric Light Company, died recently at the Jordan Hospital, Plymouth. Mr. Rowell was about sixty-one years of age and was closely associated with C. D. Parker & Company, Boston, Mass., in the management of central-station properties in southeastern Massachusetts, being a director and officer in several of the Parker companies. He was regarded as one of the best local managers in this syndicate, and had been the executive head of the Plymouth company for many years. Mr. Rowell was deservedly popular in the New England Section of the National Electric Light Association, where he had a host of friends, and was regarded as one of the most "solid" and dependable members. Although operating a small-town central-station, he was responsive to the latest advances in engineering and commercial practice and did much to promote interconnection of lines in the Cape Cod district and the tying of his own system into the large New Bedford plant through a pioneer cross-country transmission.

George William Dickie, naval architect and marine engineer, associated with engineering and shipbuilding on the Pacific Coast for nearly fifty years, died suddenly at his home in Oakland, Cal., Aug. 17, 1918, at the age of seventy-four years. Mr. Dickie was a native of Arbroath, Scotland, coming to the United States in 1869 and going to San Francisco. In 1870 Mr. Dickie erected a gas plant at North Beach for the newly organized Pacific Gas Company. This plant, owned by the Pacific Gas & Electric Company, is still in operation. Shortly afterward Mr. Dickie designed the first successful triple-expansion engine built in the United States, and a few years later he designed the first Scotch marine boiler on the Pacific Coast. He became general manager of the Union Iron Works in 1883, a position he held until 1905, when the plant was purchased by the Schwab interests. During that period he designed many privately owned ships as well as a large number of government vessels. The best known of these are the old battleships Oregon, Wisconsin and Ohio and the cruiser Olympia, which became Admiral Dewey's flagship. Mr. Dickie retired from active work about four years ago, but following this country's entry into the war he offered his services to the government and at the time of his death held the position of resident inspector for the United States Shipping Board at the Moore shipbuilding plant in Oakland. Mr. Dickie was a member of the Technical Society of the Pacific Coast, the American Society of Naval Architects and Marine Engineers and the American Society of Mechanical Engineers. He was also chairman of the machinery group of jurors at the International Panama Pacific Exposition.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

COPPER MARKET FOLLOWING THE AFTER-WAR DEPRESSION

Metal Promises Strong Recovery on Account of Increased Demand—Price Will Be Determined by Market After a Readjustment

The future expansion of telephone and telegraph lines, street railway work and the proposed construction of railroads will have considerable bearing upon the copper market directly after the depression that will probably follow the declaration of peace, according to authorities on copper conditions. Telephone and telegraph lines have been curtailed to the barest necessities. A cable company is planning a line to South America which will require several thousand miles of copper cable, the manufacture of which will require more than a year after the work is begun. Electrical machinery manufacturers are limited in their operations because sufficient copper is not obtainable at present. The war has caused the postponement of many other undertakings that will use all of the copper that can be produced.

It is not thought that the movement in copper-consuming industries to catch up with the position vacated when the mills entered on war production alone will necessarily begin with the quotation at the 26-cent level for copper and work forward as the demand expands. On the contrary, producers of the metal hold that in many cases with the cessation of hostilities there will come a period when industry rather generally will pause to establish a new basis for going ahead. The gradual concentration of American mills upon the production of war materials naturally shelved domestic commercial consumption of the metal until at the present time—after a period of a few months more than one year in which this country has been a belligerent—it is estimated that between 90 and 95 per cent of all the copper coming from the refineries is being used in war manufacture, either directly or indirectly.

The copper industry is at present beset with high costs, inadequate supply of labor, with steadily advancing wages, insufficient transportation, especially by sea, and a demand for war purposes which has thrust into the background most lines of manufacturing for purely commercial sales. That every pound of production will be needed, and more too, if certain of the less essential industries are to be supplied with a part of their normal quota, is the prediction made by men engaged in the distribution of the metal to manufacturers. Consumption in the war plants is growing daily, and the pressure for copper which comes upon the copper producers' committee from other consumers has been especially insistent since the price was fixed a few days ago to run to Nov. 1.

The National Conduit & Cable Company recently estimated that the domestic demand this year would require 1,500,000,000 lb., while the allied nations of Europe were depending on us for 1,250,000,000 lb. This would mean that 250,000,000 lb. will either have to be taken from stocks—which are meager—or produced by forced production or that consumers somewhere must be curtailed before the end of the year even below their present allotments. What may be deduced from these figures is that the mining companies will be able to sell every pound of their output in 1918, as this output may now be estimated. In spite of abnormal costs, the fixed quotation of 26 cents is permitting the larger concerns to make an excellent profit.

This curtailment means just a delaying of the needed use of copper, which is bound to come when we have defeated Germany and business as usual returns for the United States and the rest of the world.

ORIGINAL BONUS SYSTEM TO DECREASE LABOR TURNOVER

New England Electrical Manufacturer Pays $2.50 in Installments to Any Employee Bringing in Another Who Stays Six Weeks

To cut down the labor turnover as well as to add new workers to his payroll, a New England electrical manufacturer has successfully adopted a bonus plan along the following lines: When one employee succeeds in inducing a second one to join the factory workers the new arrival is credited to the former's record. At the expiration of two weeks' service the employee bringing in the new one is paid a dollar, a second dollar being given to him at the end of the fourth week of continuous employment. If the newcomer stays six weeks, a final allowance of 50 cents is given. In practice, it generally works out that the employee who brings a second one into the factory shares the bonus with the new member as a mark of appreciation. For each new employee brought in the above bonus plan applies.

WAR BULLETIN ISSUED BY NEW ENGLAND JOBBER

Points Out How War Regulations Affect the Sale of Electric Supplies, Particularly Conduit and Fittings

To assist in the coöperation of the electric trade with the government a bulletin entitled "War-Time Coöperation" has been issued by the Pettingell-Andrews Company, Boston, pointing out how war regulations affect the sale of electrical supplies and of conduit and fittings in particular. The General War Service Committee of the Electrical Manufacturing Industry met in conference with the War Industries Board in June and submitted recommendations regarding preferential listing for steel. It was recognized that a large amount of essential material and supplies can best be distributed through jobbers and dealers, but in so doing it is important to insure the proper conservation of materials and supplies in the hands of these selling agencies.

It is felt that dealers and jobbers should come within the limitations of any pledge taken by individual manufacturers, and that each individual manufacturer should exercise policing power in this respect with the dealers and jobbers. A form of pledge, based on the manufacturers' pledge in accordance with the suggestion of the War Industries Board, is now in process of preparation, and after approval by representatives of the Trade and War Industries Boards, every dealer and jobber will be called upon to sign it.

The bulletin states that, in accordance with the notice from the manufacturers, the company cannot obtain replacements of its stocks of rigid conduit, elbows and couplings from the manufacturers of iron conduit without priority numbers or detailed statements showing for what purpose the stock has been sold, under the governmental classifications. Prior to the issuing of the pledge for jobbers and dealers it became necessary to furnish on all orders for iron conduit priority order numbers obtained from customers. If these cannot be secured in any case, the order must state the purpose for which conduit is to be used, specifying the classification number as shown in the "Electrical Manufacturers' Pledge," reproduced in the bulletin for the convenience of the trade (see ELECTRICAL WORLD, July 13, page 76). Coöperation along this line is necessary in order to secure prompt service, and any orders received for rigid conduit without the priority or classification numbers will be subject to acceptance based on ability to ship from stock on hand. It appears likely that any rules and regulations which may be formulated by the joint committee with respect to rigid conduit will unquestionably be applied to other lines of electrical material later on. Further bulletins are to be issued as occasion requires.

METAL MARKET SITUATION

Copper Settles Down Following Activity After Price Setting by Government—Tin Still Declining

In so far as the supply of copper is concerned, the War Industries Board seems assured that actual requirements will be met. Refiners are said to have stocks of considerably more than 200,000,000 lb. of crude copper as well as the current production to draw from. These facts are reassuring in the face of the probability of labor shortage at copper mines due to the next draft. If the war is prosecuted vigorously over the next six-month or eight-month period, high military authorities tell us that the war will be over by the end of 1919. Activities of war industries will thus be intensified, which means that less essential industries will be given smaller consideration from the government as time goes on.

Copper is naturally one of the most essential commodities in prosecuting the war, and large amounts are necessary in the manufacture of electrical machinery, which is finding increasing favor with the war industries for saving fuel.

Fewer orders for copper have been placed by domestic consumers in the past week, following the great activity immediately resulting from the settlement of the selling price to govern shipments until Nov. 1. Some consumers, however, have placed contracts for their prospective requirements in November and December at the price established at the next conference between the War Industries Board and representatives of copper producers.

The decline in tin abroad continues, and there is a good deal less of tin in sight unsold than there was a short time ago.

There has been an active demand for spelter in the Middle West, with improving prices throughout the week. The price of zinc ore has advanced and production has fallen off.

President Wilson has approved the order continuing the base price of aluminum—$33 per lb. f.o.b. producing plants for ingots 98-99 per cent pure—from Sept. 1 to March 1, 1919. The trade was expecting a further increase to stimulate production.

NEW YORK METAL MARKET PRICES

	Aug. 21	Aug. 27
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26.00
Casting	Govt. price 26.00	Govt. price 26.00
Wire base	29.25	29.25
Lead, trust price	8.05	8.05
Antimony	14.25 to 14.37½	14.37½
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	Govt. price 15.00	Govt. price 15.00
Spelter, spot	9.35 to 9.47½	9.50 to 9.75
Tin, Chinese *	90.00	81.00 to 83.50
Aluminum, 98 to 99 per cent	Govt. price †33.00	Govt. price †33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	23.50 to 24.50	23.50 to 24.50
Brass, heavy	14.50 to 15.00	14.50 to 15.00
Brass, light	11.50 to 12.25	11.50 to 12.25
Lead, heavy	7.50 to 7.75	7.50 to 7.75
Zinc, old scrap	6.35 to 6.50	6.75 to 7.00

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* No Straits offering. † In 50-ton lots or more; carload, 33.10 cents per lb.; 1-ton to 14-ton lots, 33.20 cents per lb.

THE WEEK
IN TRADE

BUSINESS has been steady this week on account of the increased amount of government construction. The ruling of the War Industries Board declaring jobbers of electrical goods essential has brought about a feeling of relief and satisfaction on the part of the jobbers. Material is still hard to obtain, but this condition is bound to continue for the duration of the war.

The labor situation in all quarters is reported to be acute, and not a little anxiety is being experienced over the future supply of help. However, the employment of women, which seems inevitable in a great majority of places, promises to replace men called in the draft. All contracting work is being shifted to wiring industrial war plants and homes for workmen in shipbuilding and other productive industries, no rewiring being attempted by contractors. The Middle Western territory reports a lack of activity on account of almost absolute cessation of all building. Some appliance selling is mentioned.

The shortage in power, especially in the East and Southeast, has, from all indications, a tendency to depress the market. Increase in rates at Atlanta is hoped to relieve the situation somewhat, but the curtailing and actual cutting off of the power supply is certain to deaden the market. Rainfall in this region, however, will relieve the situation, but otherwise there can be no help.

NEW YORK

The fact that the order recently issued by the War Industries Board declaring electrical jobbers essential and laying down certain rules to be followed as universal has tended to stabilize the industry and indicate to the consumer that the jobber is doing the best he can when he refuses to sell material for non-essential uses. At present, however, the jobbers have not sufficiently learned all of the rules formulated by the Priorities Commission so that they are trying to find themselves in order to abide closely by them. Some customers become angry on not being able to purchase material and supplies, but are mollified when they find that all jobbers will treat them alike.

It is thought that the embargo on selling material for non-productive purposes will not weaken the demand for electrical goods for the duration of the war because of the unprecedented demands placed upon them by essential industries. All products that contain steel or brass are extremely hard to obtain at present. The scarcity of this material is shown in the order of the Industries Board to limit the production of washing machines and to stop the manufacture of curling irons, coffee percolators and chafing dishes. Aluminum is also somewhat scarce and hollow-ware utensils are likely to be prohibited if less essential.

ARMORED CABLE.—This material cannot be obtained by the dealer from the jobber except on a government order, and one concern has discontinued its manufacture.

ELECTRIC IRONS.—Despite the fact that the future production of electric irons is not certain, they are moving fast. One jobber states that the fall trade has started with a rush. The majority of jobbers have a supply of these devices on hand and can therefore supply the demand.

VACUUM CLEANERS.—The scarcity in household help is thought to be the cause of the demand for vacuum cleaners. Jobbers report the trade to be brisk, and many are able to supply the demand

WASHING MACHINES.—The demand for washing machines this week was not very great, but it is expected to pick up this fall. Washing-machine manufacturers will be allowed to produce 75 per cent of last year's output and are thus assured of keeping their product in the market.

MOTORS.—Some jobbers state that they will not sell motors except on government orders. As a matter of fact, however, motors are very scarce and there is considerable difficulty in meeting the demand even for government requirements.

FLOODLAMPS.—On account of the increased demand for floodlamps and the scarcity of material, an increase has been noted of about $1.75 apiece on units ranging from $17 to $75. The devices are being used very extensively in shipyards for protective lighting and for illumination for night work.

FITTINGS.—Government demand for fittings is maintaining an active market for this material. Jobbers report being well able to supply the demand.

LIGHTING UNITS.—In contemplation of large demands for lighting units for industrial plants, dealers are beginning to stock up. Especially important is the fact that the elimination of the daylight-saving regulation on Oct. 1, when clocks will be set back one hour, will greatly help this class of business.

CHICAGO

The last week has been an unusually quiet one for the Chicago territory, but a few features of the appliance market may be noted as follows:

BATTERIES.—There is a big market already established to replace worn-out farm-lighting battery cells. Several manufacturers in this branch of the farm-lighting business report large increases in orders.

INSULATING COMPOUNDS.—Deliveries in large lots on insulating compounds, tapes, etc., are from six weeks to two months, which is considered fair at present.

ORNAMENTAL LIGHTING FIXTURES.—Several manufacturers of lighting fixtures are now handling government contracts on machine work, having given up the fixture work during the war.

GRAPHIC METERS.—Industrial plants and central stations are realizing the benefits derived from using graphic meters for checking production, etc., and are buying many meters. Deliveries are good. Several new types of instruments will be announced shortly. One ship has recently been equipped with fourteen graphic meters.

INDUSTRIAL LIGHTING EQUIPMENT.—One prominent Middle West manufacturer has recently received a government order for 20,000 lighting standards for use in camps, etc. Large orders have also been placed by lighting equipment for shipbuilding plants. Deliveries outside of government orders are fair considering the amount of orders being filled.

PROTECTIVE DEVICES.—Several manufacturers report that orders for this type of equipment for central stations and government plants are coming in stronger than for the last three months. Deliveries good.

BOSTON

The volume of trade continues heavy along industrial lines, and the government absorption of stock and supplies is maintained at recent high levels. Collections are a little slower, and it is expected that not much change will be seen until after the next Liberty loan campaign. Transportation conditions are no more favorable, the railroads being literally swamped with traffic. Despite the sharp advances in passenger rates, trains are still well filled. Central stations are struggling to meet their power requirements, and very little solicitation of new business is to be seen. Prices are holding firm, and some observers would not be surprised to see further advances this fall. The retail trade is considerably exercised at present over the question of essential versus non-essential products. Jobbers' stocks are fairly large, on the whole, thanks to far-sighted purchasing. The labor shortage, already acute, bids fair to become still more so with the passage of the draft bill. All branches of the trade are affected by the nation's call for men. A serious attempt to utilize women on a far larger scale seems inevitable.

WASHING MACHINES.—The demand for these convenient equipments holds up so well that some dealers are beginning to wonder where they are going to obtain enough outfits to fill their fall orders. The present year will go down in electrical sales history as a remarkable one in connection with the popularizing of motor-driven washers. Prices are firm, and if railroad deliveries were better the jobbers would appreciate it, to say nothing of the retailers.

ELECTRIC RADIATORS.—Good sales of these are reported for summer camp and cottage service. Fuel Administrator Storrow of New England has issued a statement to the effect that the Boston ruling against using domestic heating coal prior to Dec. 1 was not authorized by him. Strict economy will be required, however, and in the middle fall days the use of radiators at morning and night will unquestionably be the means of extensive retail sales.

LAMPS.—Most of the factories are beginning to accumulate stocks of the more common sizes, though no excess in reserve is to be seen beyond what is desirable to meet the demand of the coming winter months; in fact, if production stopped now for commercial lamp sales, some manufacturers would soon be exhausted. Others who have gone into the matter of providing enlarged plant facilities on an immense scale have now reaped the benefit of their outlay in the establishment of a stock sufficient to meet all commercial demands of 1918 if not to go through the business of the early spring. The supply of an adequate volume of bulb glass of requisite quality is troubling some of the lamp makers.

VACUUM CLEANERS.—The approaching close of the vacation season and return of the prospective purchasers to the city or town home means that the early fall business in cleaners should take a turn for the better. The demand for these equipments has lately been rather quiet, and except where manufacturers have been concentrating their efforts on special war work there should be no shortage anticipated. Retailers have been featuring cleaners this summer in all parts of New England, but no overselling has been reported as in the vacuum-cleaner field.

IRONS.—The selection of irons is somewhat limited by a shortage in one or two of the best-advertised makes. Recent price advances have had little effect on total sales, so far as can be seen. Stocks are still fairly large, and the time apparently has not yet arrived where the buyer must be refused if he or she does not insist upon a specified make.

FIXTURES.—The fixture trade is relatively quiet, but it is not dead, as some people in the trade intimate. In the last fortnight one Connecticut jobber sold about $200 worth of fixtures—a small turnover compared with normal times, to be sure, but none the less worth handling. Manufacturers of portable lamp standards are busy on munitions work, and the makers of reflectors are occupied in like manner with government orders.

MOTORS.—The situation seems to grow better and better as regards the supply of motors of small and moderate size.

SWITCHES AND SOCKETS.—The shipping program and industrial plants are absorbing these products in great quantity. Labor, while none too plentiful, seems to be working more steadily than in some lines. The possibility of the government's forcing the manufacturers to reduce the variety of their designs is causing some anxiety. Little is heard about price changes.

DRY CELLS AND FLASHLAMPS.—For the moment the supply seems to be increasing, and the demand is being met well.

STORAGE BATTERIES.—The demand on the manufacturers is enormous, especially for batteries of the alkaline type. Too much insistence upon type, however, is sometimes the cause of delays in filling industrial truck orders. Deliveries on batteries vary considerably among makers.

ATLANTA

A depressing feature in trade is reflected by the continued drought, which is being keenly felt by many of the water-power companies in the Southeast. The plants in the lower levels have been more fortunate than those in the mountainous districts. Owing to the shortage of rainfall on its drainage area, the Georgia Railway & Power Company cut off its secondary customers several weeks ago and was compelled to discontinue power service to its primary power users beginning Aug. 12, and unless there are immediate rains this program will continue indefinitely.

Governmental construction appears to hold the center of the building stage this week, as evidenced by announcements from Washington that facilities at Camp Gordon, Atlanta, and Camp Jackson, Augusta, will practically be doubled.

In addition to the new artillery camp to be erected at Fayetteville, N. C., all of this construction is to be completed in a short space of time, and there will be a very heavy draft on jobbers for schedule material.

The various fuel administrators covering the Southeastern States have inaugurated "ginless days." Steam-driven and electrically driven gins will be put on the same basis. The effect of this order on the power companies' revenues will be negligible. All cantonments will be equipped immediately with electrically driven laundries.

The Woodward Iron Company, Woodward, Ala., will erect a plant costing $25,000,000, the product to be used principally for the construction of steel ships at the Southeastern shipyards. Steel ships will be constructed by the Brittain Shipbuilding Company of Jacksonville, Fla. This company has a capital of $1,000,000. The Jacksonville Dry Dock & Repair Company of Jacksonville, Fla., has been incorporated for $750,000. It will build and repair ships.

WIRE.—The volume of sales for both weatherproof and rubber-covered wire shows a weekly expansion, and requirements are being taken care of.

DRY BATTERIES.—The call for these has been very good this week, and arriving carload shipments are retagged for reshipment without being unloaded. Shipments seem to be very good and average around fifteen days.

RENEWABLE FUSES.—There is a very active market for refillable fuses, and contractors and dealers are realizing more every day the potentialities of this business.

CONDUIT.—Jobbers have pledged themselves not to sell any conduit or similar fittings to anybody unless orders are accompanied by sufficient information to indicate that these products will be used for essential work. There is a heavy latent demand that cannot be taken care of at this time. Estimates on good authority place Southeastern stocks at 25 to 40 per cent below normal.

SEATTLE—PORTLAND

Northwest jobbers and dealers as a whole report that the volume of business for last week shows a slight increase over the previous week. Shipyard buying continues in steady flow and government orders are materially increasing. The week's business was not featured by big orders. Portland jobbers report that it is anticipated that the new government regulations restricting the sale of electrical material of all kinds to essential industries will cause very little if any disturbance in that district. Seattle jobbers, however, are not nearly as optimistic. In Portland it is estimated that not more than 10 per cent of manufacturers' sales will be affected. Seattle jobbers report that stocks along all lines are nearing depletion.

By speeding up production the lumber manufacturers of Oregon and Washington are preparing to take care of increasing government demand. For the second consecutive week the mills actually cut more than their normal capacity. A large proportion of the cut continues to go into aeroplane stock and ship timbers.

POWER APPARATUS.—No stocks on hand, and the heavy volume of orders is filled as stock is received. Shipments are coming through comparatively well. Government buying has been heavier in the last two weeks, and orders and inquiries from mills and new industries show slight increase.

CONDUIT.—It is just as hard as ever to obtain conduit, and the demand continues heavy. Stocks can be secured only on government order and for government work.

DOMESTIC APPLIANCES.—Washing machines continue to be the leader in appliance sales, although vacuum cleaners, flatirons, ranges, etc., are moving satisfactorily.

LAMPS.—There is no noticeable change in the lamp situation, which is far from satisfactory. The larger sizes are required in heavy volumes by shipyards and are exceptionally hard to obtain. Smaller sizes move fast and are fairly easy to get. Auto lamps show no great demand, which is fortunate as they are also scarce.

LAMP CORD.—Lamp cord is being used for maintenance purposes largely and is coming through in fair shape. However, stocks are rather low.

FLASHLAMPS.—The demand for flashlamps is about the same, but considerable difficulty is encountered in securing the larger sizes.

SAN FRANCISCO

In investigating business conditions among electrical contractors it is found that jobbers in general report that the business from this source of trade holds up surprisingly well, considering that private building is discouraged and will soon be made almost impossible by reason of shortage of necessary material. On the other hand, many contractors in districts not yet listed as sites for necessary building are eagerly acquiring information on large household appliances so as to recoup themselves for loss in other classes of trade. The fine crops and the high prices for them will soon affect interior California in the same way that the distribution of large amounts of spending money by industrial workers in the coast cities and large interior towns has done.

CREDITS AND COLLECTIONS.—Collections are good and the time of payment is being shortened by wholesale houses generally. The retail trade shows an increase both in volume and in value, and collections are good from this source also.

MARINE MATERIAL.—The scores of standardized cargo boats that have been launched during the last few weeks from Pacific Coast shipyards demand an enormous amount of what may be termed marine schedule material, and many coast factories have sprung up to supply a demand with which Eastern factories are unable to cope. Labor Day will witness another wholesale launching. The Bryant Spartan line of marine schedule material has just advanced 15 per cent, and big sales are reported.

FIRE EXTINGUISHERS.—The United States government having commandeered the supply of carbon tetrachloride, which enters largely into the manufacture of fluids for one-quart extinguishers such as the "Pyrene" and the "J. M.," it will soon be impossible for any but favored and essential industries to obtain liquid renewals. There is only a small stock on hand at the factories, but one or two electrical jobbers and the automobile jobbers have fair stocks.

INSULATING MATERIAL.—The inability to secure prompt shipment of motors and the small proportion shipped on orders have created a big demand for repaired motors, and any motor that can be sent back to the firing line is sure of a prompt turnover. Motor repair firms are doing the best business, perhaps, of any class of electrical dealers and contractors. A recent thousand-dollar order for insulating material and motor-repairing material for such a firm is reported in San Francisco. Insulating cloth has recently advanced 10 per cent, and the higher grades of friction and rubber tape from 5 per cent to 20 per cent.

SCHEDULE MATERIAL.—The latest staple to become subject to priority conditions is schedule material, comprising sockets, switches and cut-outs.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List Per 1000 Ft.
No. 14 solid	$61 00
No. 12 solid	71 00
No. 10 solid	90.00
No. 8 solid	106 00
No. 6 solid	145 00
No. 10 stranded	95 00
No. 8 stranded	115 00
No. 6 stranded	160 00
No. 4 stranded	205.00
No. 2 stranded	266 00
No. 1 stranded	315 00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135 00
No. 10 solid	185 00
No. 8 stranded	235 00
No. 6 stranded	370 00
No 4 stranded	575 00

NET PRICE AND DISCOUNT PER 1000 FT NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	12½%—57 25

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	12½%—66 75

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	12½%—97 75

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	12½%—126 80

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20% to List
Coil to 1000 ft	5% to 15%

	No. 12 Solid
Less than coil	+20% to List
Coil to 1000 ft	5% to 15%

Twin-Conductor

	No. 14 Solid
Less than coil	$115 00 to $80 00
Coil to 1000 ft	98 80 to 75.00

	No. 12 Solid
Less than coil	+20% to +5%
Coil to 1000 ft	5%

ATTACHMENT PLUGS

List ranges from $0 22 to $0 30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	12%
1/5 to std. pkg.	20%
Std pkg	44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to 12%
1/5 to std. pkg	List to 20%
Std pkg	25% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 40	$0.40
12 to 50	35—.36	35—.36
50 to barrel	31—.32	32—.33
Barrel lots	.28—.289	29— 299

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No 6 Ignitor
Less than 12.	$0 40	$0 40
12 to 50	.35	.35
50 to barrel	319 to .322	329 to 332
Barrel lots	289 to 292	299 to 30

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5 00
⅜	250	7 50
½	100	10 00
¾	50	13 00
1	50	21 00
1¼	50	26 00
1½	25–50	35 00
2	25–50	45 00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00— 82 50	$69 75— 75.00
⅜-in. double strip	75.00— 82 50	72.00— 75.00
½-in. single strip	100 00—110.00	93 00—100.00
½-in. double strip	100 00—110 00	96 00—100.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75 00	$63 75 to $64 25
⅜-in. double strip	78.25 to $78.75	71.25
½-in. single strip	100.00	75.00 to 85.00
½-in. double strip	105 00	93 00 to 95 00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In	List per Foot
7/32	$0 05½	1	$0.25
¼	06	1¼	33
⅜	09	1½	40
½	12	1¾	47
⅝	15	2	55
¾	18	2¼	65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	25.00–55 00	24 00–24.45	21.50–23 00
¼-in —	30 00–60.00	27.00–27 28	23.50–26.00

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$60.00	$30 00	$26.50
¼-in.—	65 00	32 50	29 00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In	Conduit, List per Foot
¼	$0 08½
⅜	08½
½	08½
¾	11½
1	17
1¼	.23
1½	27½
2	37½
2½	.58½
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0 05	$0 19
⅜	06	19
½	07	19
¾	10	25
1	13	37
1¼	17	45
1½	21	.50
2	28	1.10
2½	40	1.80
3	60	4 80

DISCOUNT—NEW YORK

	¼ in. to ½ in	¾ in. to 3 in
Less than 2500 lb.	7% to 12%	10% to 15%
2500 to 5000 lb.	9% to 14%	12% to 17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb	1.5% to 6 8%	3.5% to 8.8%
2500 to 5000 lb.	4 5 to 10.7%	6.5% to 12.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5 00 to $6.00
Discount	30%

CHICAGO

List price	$5.00 to $7 00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg	List
3-amp. to 30-amp	100	$0 25
35-amp. to 60-amp	100	35
65-amp. to 100-amp	50	.90
110-amp. to 200-amp	25	2.00
225-amp. to 400-amp	25	3 60
450-amp. to 600-amp	10	5 50
600-Volt		
3-amp. to 30-amp	100	$0 40
35-amp. to 60-amp	100	60
65-amp. to 100-amp	50	1 50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5.50
450-amp. to 600-amp	10	8 00

DISCOUNT—NEW YORK

Less than 1/5 std pkg	30%
1/5 to std pkg	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30% to 31%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$5 00 to $5.50
1/5 to std. pkg	4.50 to 4 75

Standard packages, 500 List, each $0 07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$7 00
1/5 to std. pkg	5.75

Standard packages, 500. List, each, $0 07

LAMPS, MAZDA

105 to 125 Volts

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0 30
60-watt—B. .	100	35
100-watt—B. .	24	70
75-watt—C. .	50	70
100-watt—C. .	24	1 10
200-watt—C.	24	2 20
300-watt—C. .	24	3 25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25	50	53
25-watt—G 25	50	55
40-watt—G 25.	50	55
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30.	24	77
Round Bulbs, 4⅜-in., Frosted		
100-watt—G 35.	24	1 10

DISCOUNT—NEW YORK

Less than std. pkg. . . .	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg. . .	List
Std pkg	10%

LAMP CORD

Cotton-Covered, Type C, No 18

NEW YORK

	Per 1000 Ft Net
Less than coil (250 ft.)	$30 20—$35 90
Coil to 1000 ft.	26 95— 27 18

CHICAGO

	Per 1000 Ft Net
Less than coil (250 ft.) .	$35 00
Coil to 1000 ft . .	26 00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24 00

CHICAGO

Net per 100	$21 75 to $30 00

OUTLET BOXES

Nos.	List, Per 100
101—A, A 1½, 4 S.C., 6200, 320	$30 00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S	30 00
103—C.A., 9, 4R, B 1½. .	25 00
106—F.A., 7, C.S., 1½, 3 R. .	20 00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10 00 list	25% to 33%	20% to 27%
$10 00 to $50 00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Glavanized
Less than $10. 00 list	30% to 40%	20% to 35%
$10 00 to $50. 00 list	40% to 50%	30% to 45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg. .	20%
Std. pkg . .	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std pkg	30%

PORCELAIN CLEATS UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$21 00 to $38 00
1/5 to std. pkg. . . .	17 85 to 19 00

Standard package, 2200. List per 1000, $20

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$16 80
1/5 to std. pkg.	15 80

Standard package, 2200. List per 1000, $20 00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std Pkg 3500 5½ N C	Std Pkg 4000 Solid Nail-it—N C
Less than 1/5 std pkg	$16 00 to $20 50	$32 00
1/5 to std pkg	13 60 to 15 60	27 20

CHICAGO

Per 1000 Net	Std. Pkg. 3500 5½ N C	Std. Pkg 4000 Solid Nail-it—N C
Less than 1/5 std pkg.	$11 70 to $24 00	$32 00 to $33 85
1/5 to std pkg	10 15 to 20 40	26 60 to 27 20

SOCKETS AND RECEPTACLES

	Std Pkg	List
¼-in. cap key and push sockets	500	$0 33
¼-in cap keyless socket	500	30
¼-in. cap pull socket	250	60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+10% to 10%
1/5 to std pkg.	5% to 8%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List
1/5 std. pkg	16⅔%

SWITCHES, KNIFF

250-Volt, From Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0 80
60-amp. S. P. S. T.	1 20
100-amp S. P. S. T. .	2 25
200-amp S. P. S. T. .	3 48
300-amp S. P. S. T. .	5 34
30-amp D. P. S. T	1 20
60-amp. D. P. S. T.	1 78
100-amp D. P. S. T.	3 38
200-amp. D. P. S. T.	5 20
300-amp. D. P. S. T	8 90
30-amp. 3 P. S. T.	1 80
60-amp. 3 P. S. T.	2 68
100-amp 3 P. S. T.	5 08
200-amp. 3 P. S. T. .	7 80
300-amp. 3 P. S. T. .	12 00
Low Grade:	
30-amp S. P. S. T. .	$0 42
60-amp. S. P. S. T. .	74
100-amp. S. P. S. T.	1 50
200-amp S. P. S. T. .	2 70
30-amp. D. P. S. T.	68
60-amp D. P. S. T.	1 22
100-amp. D. P. S. T.	2 50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1 02
60-amp. 3 P. S. T.	1 84
100-amp. 3 P. S. T.	3 76
200-amp. 3 P. S. T.	6 76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+5% to Net
$10 to $25 list	11% to 15%
$25 to $50 list	14% to 20%

	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16% to 25%
$15 to $50 list	24% to 28%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+15% to +5%
$10 to $25 list	List to 11%
$25 to $50 list	5% to 14%

	Low Grade
Less than $10 list	+5% to 5%
$10 to $25 list	8% to 16%
$25 to $50 list	16% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp and 10-Amp., 125-Volt Snap Switches

	Std. Pkg	List
5-amp. single-pole	250	$0 28
5-amp. single-pole, ind	250	32
10-amp. single-pole	100	48
10-amp. single-pole, ind	100	54
5-amp. three-point	100	54
10-amp. three-point	50	76
10-amp., 250-volt, D P	100	66

10-Amp., 250-Volt Push-Button Switches

	Std Pkg.	List
10-amp. single-pole	100	$0 45
10-amp. three-way	50	70
10-amp double-pole	50	70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std pkg	+10%
1/5 to std pkg	5% to 8%
Std pkg	23% to 25%

DISCOUNT—CHICAGO

Less than 1/5 std pkg	+20% to 10%
1/5 to std pkg	List to 16⅔%
Std pkg	25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar	List Each
No 155	$0 34
No 160	60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	40% to net	30% to net
$2.00 to $10.00 list. .	10% to 50%	5% to 40%
$10 00 to $50 00 list.	20% to 60%	10% to 52%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10 00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00
Discount	30%

CHICAGO

List price	$6 35 to $7.00
Discount	25% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools. . .	$0 434—$0.4625
No. 18, full spools	384— 4425

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	$0 65 to $0 69
No 18, full spools	55 to 575

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15.00–$20 00	$12.50–$15 00	$11.00–$11 25
12. .	21.29– 27.10	19 35– 23 20	17 05– 17 42
10.	29 70– 37 80	27 00– 32 40	23.75– 24 30
8.	41 90– 53 35	38 10– 45 70	33 45– 34 29
6.	60 30– 84 40	54 27– 72 35	51 55– 53 05

CHICAGO

	Price per 1000 Ft. Net		
No	Less than 500 Ft.	500 to 2500 Ft	2500 to 5000 Ft
14	$19 00–$21 00	$16 00	$13.25
12.	28 70– 29 46	28 70– 29 46	24 50– 25 54
10.	40 10– 41 10	40 10– 41 10	34 23– 34 62
8.	56 50– 57 90	48 23– 57 90	41 34– 50 18
6.	85 31– 91 18	77 84– 85 31	66.72– 72 27

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4 0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$37 75 to $38 40
25 to 50 lb	36.40 to 37 75
50 to 100 lb	32 40 to 36 75

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$37 00 to $39 72
25 to 50 lb.	36.00 to 38.72
50 to 100 lb	35 00 to 37 72

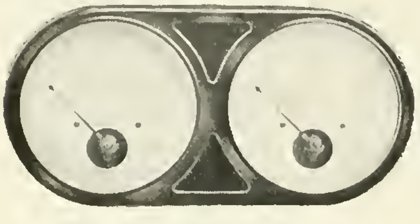
NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Duplex Instruments

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., announces two duplex instruments for battery-charging, marine, dental, telegraph, telephone, farm-lighting and other compact instrument panels where direct current is involved.

These duplex outfits consist of any two standard Westinghouse type AW or type FW instruments desired, mounted in an attractive dull-black metal case. The type AW instruments have round open faces 3 in. (7.6 cm.) in diameter, with glass cover and rear mounting studs; the type FW have 5-in. (12.7-cm.) faces.



COMPACT INSTRUMENTS FOR DIRECT-CURRENT USES

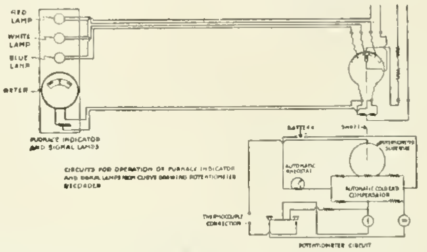
Apparatus for Controlling Furnace Temperatures

In a line of power-driven instruments for controlling, measuring and recording furnace temperatures recently developed by the Leeds & Northrup Company of Philadelphia, all adjustments are made automatically, the galvanometer merely determining in which direction the adjustment is to be made. Early attempts to use a galvanometer for this purpose were along the line of having the boom or pointer of the galvanometer close an electrical circuit. This, however, proved unsatisfactory, because with low voltages on the boom contact would not be made through particles of dust, while with a higher voltage the boom would "freeze" or fuse to the contactor. In the Leeds & Northrup apparatus the boom serves merely as a mechanical trigger.

A reciprocating part kept in constant motion by a motor is arranged so it will not strike the boom when the latter stands in the no-current position, but when the boom moves out of this position in either direction the reciprocating part pushes it against another part. This movement adjusts the bridge or potentiometer circuit, the amount of the adjustment being regulated according to the distance which the boom has swung—that is, to the unbalancing current through the galvanometer.

The power of the motor is sufficient not only for making the adjustments but also for the operation of the chart drum or roll. For this purpose, however, the motor must run at a constant speed—that is, sufficiently constant to give good time-keeping qualities—since the abscissas of the chart are laid off in hours and minutes. This necessitates the use of a special governor of the centrifugal type which opens or closes a shunt in the field circuit.

Central control stations are facilitated by the introduction of base metal thermocouples which permit the prolongation of the couple itself to the measuring instrument, where the effects of temperature upon the cold end of the couple are readily compensated for by the adoption of the potentiometer method of measurement. The central control operator is provided with switches by means of which he can light signal lamps for the guidance of the operators at the furnaces. A multiple-point recorder is generally installed to record the different temperatures automatically, one after the other.



RED LAMP
WHITE LAMP
BLUE LAMP
METER
FURNACE INDICATOR AND SIGNAL LAMPS
CIRCUITS FOR OPERATION OF FURNACE INDICATOR AND SIGNAL LAMPS FROM CURVE DRAWING POTENTIOMETER RECORDER
BATTERY
SWITCH
POTENTIOMETER SLIDE WIRE
AUTOMATIC RHEOSTAT
AUTOMATIC COLD END COMPENSATOR
THERMOCOUPLE CONNECTION
POTENTIOMETER CIRCUIT

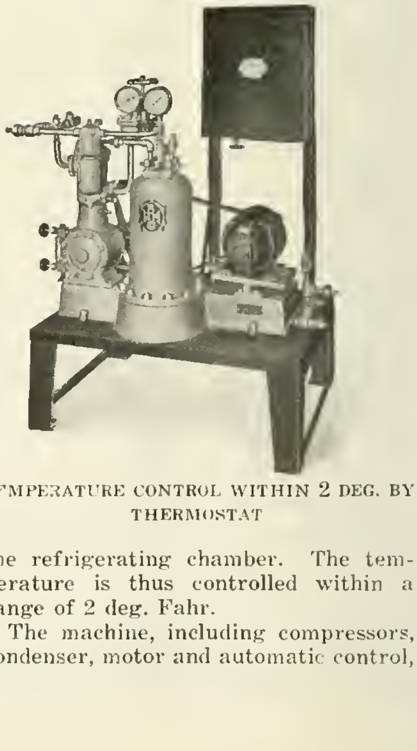
POTENTIOMETER METHOD OF MEASURING TEMPERATURES

Where it is preferred to have the signaling at the furnace done automatically, a Leeds & Northrup "single-point" or curve-drawing recorder is provided with contacts on the moving element by means of which the signal lamps will be lighted to indicate whether the temperatures in the furnace are too high, too low or correct.

A double recorder sometimes used is suitable for demonstrating uniformity of furnace temperatures or the lack of it. It shows graphically the effects of empty furnace, full furnace or part full furnace, and how distribution of heat is affected by rates of firing, location of load, door and other losses, cold hearth, etc. It is a convenient means for investigating furnaces and showing how errors may be overcome by moving burners, baffles or arches, or changing the method of introducing heat, as by the use of side burners, underfiring, overfiring, larger number of burners, position of doors, etc. It also shows definitely the effects of location of thermocouples, how the readings vary according to their placing with respect to the work and the burners, and also the number of couples to be used in a given furnace, etc. This type of equipment has been found of especial value in studying the heating of different kinds and sizes of sections or numbers of pieces, different methods of loading, speed of loading and unloading, mechanical furnacing, the heat treatment of large single pieces, such as gun forgings, etc.

Iceless Electric Refrigerating Machine

An electric refrigerator to be used in connection with any substantial and well-insulated cooling room has been placed upon the market by the Sanitary Refrigerating Machine Company, Milwaukee, Wis. It is claimed that it produces and maintains a uniform temperature for perfect refrigeration regardless of any natural temperature variation. The machine, as shown in the accompanying illustration, has a capacity of ½ ton (453 kg.), or equivalent to an ordinary ice-melting effect in twenty-four hours. It is operated by a ½-hp. motor and is automatically controlled through the medium of an accurate thermostat which is placed in the refrigerating chamber. The temperature is thus controlled within a range of 2 deg. Fahr.



TEMPERATURE CONTROL WITHIN 2 DEG. BY THERMOSTAT

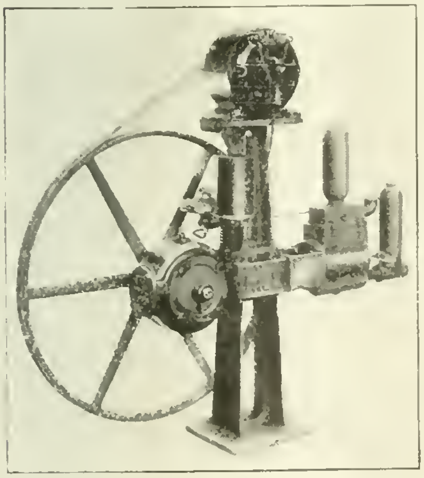
The machine, including compressors, condenser, motor and automatic control, is mounted on one base as shown. The manufacturer claims that there is absolutely no danger in operating this machine because the water is used for condensation and failure of water supply will result only in high pressure in the condenser. Should high pressure be created through water failure or any other reason, the high-pressure gage at the top of the condenser is so constructed that an electrical contact is formed, and this pressure automatically trips the electric contact, turning off the motor, which remains off until the pressure decreases and the machine is started again.

Besides cooling the temperature of the refrigerator, the "Sanitary" machine can also be used for making ice in moderate quantities. For this purpose the brine tank is constructed with an inside compartment with molds of any desirable size.

The machine is especially adaptable for use in retail meat markets, groceries, restaurants, cafés, large residences, dairy product concerns, small harbor vessels, etc.

Automatic Electric House Pump

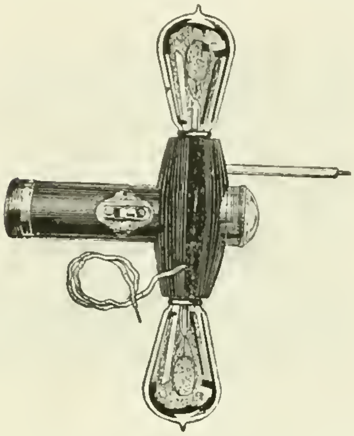
Small floor space requirements are said to be one of the features of an automatic electric house pump for pneumatic service manufactured by the Hill Pump Company, Anderson, Ind., which is so arranged that it can be mounted on a sub-base adjacent to the tank or at a distance as desired. The pump is of the horizontal double-acting type. It is held to be most successful for drawing water by suction and forcing a continuous stream against pressure. The pump is operated by a Westinghouse motor mounted on the top of the pedestal, as shown, so that it is away from dampness, oil or floor dirt and convenient for starting and stopping. The water pressure in the system is maintained at a fixed value.


USES BUT SMALL AMOUNT OF FLOOR SPACE

The motor is connected directly to the electric light circuit in the house. The pump forces water into the pneumatic tank, compressing air therein as required. The expansion of the air drives water through the house pipes to the kitchen, laundry, bath, etc., in a continuous stream. When the pressure in the tank reaches the desired maximum the motor and pump automatically stop until the water is drawn off enough to reduce the pressure to a predetermined setting of the switch. To prevent the tank from becoming waterlogged an air valve is provided which, when opened, allows air to be forced into the tank with the water.

Illuminated Fuse Tester

Unless some form of tester is available, it is common practice to replace with new fuses all the fuses of a cut-out box in which one fuse has been blown, waiting for a later opportunity to make a test to detect the blown fuse or fuses. An appliance designed to eliminate this time and money loss has been developed and is now being marketed by R. S. Blake, 230 South La Salle Street, Chicago. This device consists of an instrument to test fuses in their position with safety. The tester is held in one hand, and the light from a dry cell flashlamp illuminates the fuse. The necessary contacts are made by means of the two contact points shown in the illustration, one a stiff heavy-rubber-insulated wire and the other a rubber-insulated flexible wire. The result of the test is immediately apparent by the lighting or remaining dark of the two test lamps in series.


TESTS FUSES REMAINING IN OPERATING POSITION

This device makes it possible for one person to test fuses easily. The sockets in the "Blake fuse tester" are standard Edison base, and any standard lamp may be used in them. Any voltage up to 500 may be tested.

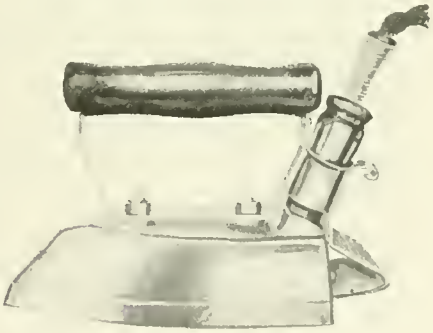
Light Portable Graphic Recording Instruments

The Esterline Company, Indianapolis, Ind., announces the model "MS" portable graphic recording instrument in which the weight has been reduced from 23 lb. to 17 lb. (10.4 kg. to 7.7 kg.). This is due to the fact that the case and many parts are made of aluminum. The meter elements are of the dynamometer type and have no pivots or jewels, and the moving element is carried on steel suspension wire. The meter has an inclosed non-spillable ink-well, a removable pen tube and an inclosed damping device. One of the advantages of this instrument is that the ink-well and damper may be filled from the outside. This model "MS" is made in direct-current voltmeters, direct-current wattmeters, alternating-current voltmeters, alternating-current ammeters and wattmeters, pressure recorders, vacuum recorders and speed recorders. They are also made in wall and switchboard types.

ENTIRE METER IS ACCESSIBLE WITHOUT DISTURBING CONNECTIONS

Evenly Heated Electric Iron

Perfect balance and even heat are two of the features claimed for a domestic electric iron manufactured by the National Electric Heating Company, Ltd., Toronto, Canada. This device, as shown in the accompanying illustration, has its sole plate and top polished and nickel-plated. The cord on this iron is securely held to take the strain off the contacts, and the terminal studs are mounted on a bracket fastened to the compression plate holding them rigid and properly aligned. The compression plate is machined flat, and when fastened down with two heavy screws the element is held in place with perfect compression. The one-piece leaf unit element, it is claimed, is very efficient and has long life.


PERFECTLY BALANCED ELECTRIC IRON

Trade Notes

Navy Department Contracts

The Bureau of Supplies and Accounts of the Navy Department has placed contracts as follows:

Aug. 8, 1918—Chesapeake & Potomac Telephone Company, Washington, D. C., telephone line; Denby Motor Truck Company, Detroit, Mich., motor trucks; Studebaker Corporation, Detroit, Mich., motor trucks; Colorado Portland Cement Company, Portland, Cal., cement; George B. Lessig Company, Pottstown, Pa., nails, beat; U. M. Selling Company, New York City, copper; General American Tank Car Company, Chicago, flat cars; Sullivan Lumber Company, Portland, Ore., box lumber; Curtiss Aeroplane & Motor Corporation, Buffalo, N. Y., boots; P. B. Yates Machine Company, Beloit, Wis., band saws.

Aug. 9, 1918—Westinghouse Electric & Manufacturing Company, Washington, D. C., radio receivers; Bayley Manufacturing Company, Milwaukee, Wis., ventilating sets; Lunkenheimer Company, Cincinnati, Ohio, grease cups; Bowen Products Company, Auburn, N. Y., grease cups; Michigan Lubricator Company, Detroit, Mich., grease cups; American Injector Company, Detroit, Mich., grease cups; Government Printing Office, supply officers' manuals; Cauldwell-Wingate Company, New York City, steel building; Hyatt Roller Bearing Company, New York City, hangers; Doehler Die Castings Company, Brooklyn, N. Y., bronze castings; Philip Carey Company, Lockland, Ohio, covering magnesia; Franklin Manufacturing Company, Franklin, Pa., felting, asbestos; National Magnesia Manufacturing Company, Redwood, Cal., blocks magnesia; Wallace & Gale, Baltimore, plaster, asbestos; Sall Mountains Company, Chicago, paper, asbestos; O. A. Dauzenbaker, Washington, cement; Ideal Electrical & Manufacturing Company, Mansfield, Ohio, electrical equipment; Carrol Electric Company, Washington, electrical equipment; Dodge Sales & Engineering Company, Philadelphia, Pa., electrical equipment; International Nickel Company, Bayonne, N. J., monel metal; Union Petroleum Company, Philadelphia, Pa., petroleum; Armour & Company, Chicago, tallow; Simplex Electric Heating Company, Cambridge, Mass., electric flatirons; H. I. Dakin, New York City, electric tool kits; Simplex Electric Heating Company, Cambridge, Mass., portable heaters; Holt Manufacturing Company, Peoria, Ill., ports; W. C. Davis Lumber Company, Chicago, Ill., oak; Ed. L. Davis Lumber Company, Louisville, Ky., ash; C. C. Mengel & Brothers Company, Louisville, Ky., mahogany; Fairbanks Company, Washington, D. C., lathes; Consolidated Car Heating Company, Albany, N. Y., foot warmers; Lawrence Sperry Aircraft Company, Brooklyn, N. Y., parachutes; Carnegie Steel Company, Washington, sheet steel.

CHANGES IN ENEMY TRADING LIST.—The War Trade Board announces several additions to the enemy trading list of date of Aug. 23, 1918.

RECLAMATION SERVICE WANTS HYDRAULIC TURBINES.—Sealed proposals will be received by the United States Reclamation Service, Department of Interior, Denver, Col., until Oct. 1, 1918, for furnishing 5000-kw. vertical hydraulic turbines and generators. The number of this proposal is 5370.

EXHIBIT OF FOREIGN ELECTRICAL GOODS AT NEW YORK.—At the district office of the Bureau of Foreign and Domestic Commerce, in room 734 of the New York Custom House, there is now on display a large collection of samples of electrical goods used in foreign countries. The exhibit includes wiring devices, heating appliances, electrical porcelain, dry cells, flashlamps, electric bells, conduit and conduit fittings, insulated wire, etc. There are several hundred articles in the exhibit, and these have been especially arranged for inspection by electrical manufacturers and exporters in order that they may make a personal study of the classes of goods with which their products come into competition abroad. Mr. Lundquist, who conducted the investigations in Australia, New Zealand and the Far East, will be in New York during the week and will discuss with visitors the various items in the exhibit and electrical practices in different countries.

GOVERNMENT TO STUDY LABOR TURNOVER.—Helping to reduce labor turnover as well as to supply unskilled labor for war production is a feature of the central war labor-supplying program conducted through the United States Employment Service of the Department of Labor. This double-barreled work of the Employment Service began recently when a representative of the Employment Service and an expert in industrial management visited one of the largest war projects in the country, which has had an excessive turnover, to see what can be done to keep the men at work. This plant, whose officials are working with the Employment Service and invited it to make the investigation, is now calling for 2000 unskilled workers a week, owing to the constant change and leaving of men. By remedying conditions which cause this instability of the unskilled working force, a part of the men now needed can be used to supply other important and short-handed war industries. A general cutting down of turnover will greatly increase the immediately available supply of unskilled workers for war production. While the institution of government control has checked the rushing of workers from one point to another by private recruiting agents and thereby reduced turnover to a considerable extent, a further cut can be made by the remedying of internal conditions in plants responsible for the quitting of employment by men after a few days or weeks. Administrative officers of the Employment Service at Washington are going into the field themselves to expedite the working of the national machinery of the service and to speed up relief for war industries.

HOW TO OBTAIN CONTRACTS FOR GOVERNMENT SUPPLIES.—In order that all manufacturers and the public generally may obtain full information regarding the needs of the War Department, the General Staff has prepared a plan for obtaining publicity of lists of all articles purchased by any supply bureau. Any manufacturer in the United States who wishes to manufacture government supplies should send his name to the supply bureau purchasing the kind of supplies which he manufactures and indicate what he is in a position to furnish. His application should be accompanied by satisfactory references from banks or reputable business concerns or from the chairman of the local regional manufacturers' organizations associated with the War Industries Board. If found satisfactory his name will be placed on the mailing lists of the bureau which handles the supply in which he is interested. Whenever the bureaus need supplies they will send circular proposals to all persons on their mailing lists interested in the desired supplies, inviting them to submit bids. These bids will be opened and given publicity at such time and place as may be specified by the bureau inviting them. There will also be full publicity of awards. Only in cases where it is decided that valuable information could be transmitted to the enemy will information about supplies and contracts be withheld. The final determination of what is of military value will be decided by the military censors and not by the officers or persons handling the supplies in the bureaus. As a further service to the public, each supply bureau will maintain one or more information desks where there will be available information as to the officers handling the articles purchased by the bureau, together with blanks for proposals and a bulletin board upon which shall be posted all circular proposals. The location of the information desks in each bureau will be published in the *Official Bulletin*. There will also be maintained a central information office at the office of the Director of Purchases and Supplies.

THE METAL & THERMIT CORPORATION announces that the Toronto (Ont.) office of the company has been removed to 15 Emily Street.

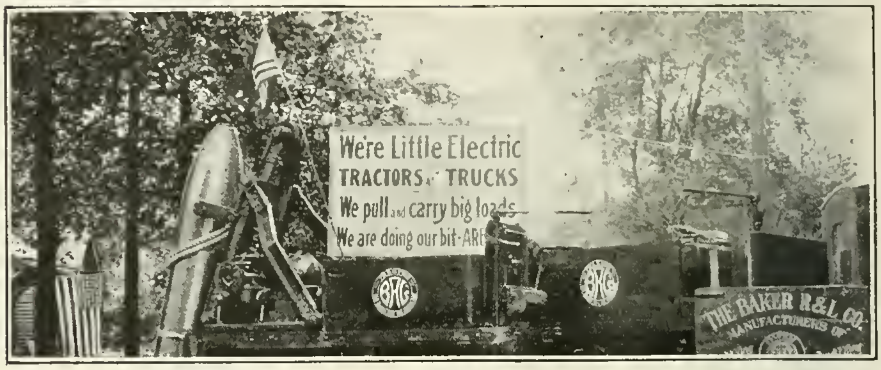
RAEBACH & ZIMPTBAUM have let the contract for the electrical work in their new plant at 16 Eckford street, Brooklyn, N. Y., to I. Stark & Company, 346 Tompkins Avenue, Brooklyn.

THE READING ELECTRIC COMPANY, Chester, Pa., has been awarded a contract for electric wiring, etc., in the office building being erected by the Sun Oil Company, Marcus Hook, Pa., at a cost of $25,000.

SMITH & HOWLEY, 250 Wyoming Avenue, Scranton, Pa., have been awarded the contract for electrical work in connection with a new fifty-thousand-dollar church to be erected on South Elmer Avenue, Sayre, Pa., and for a new school building at Throop, Pa., to cost $25,000.

THE COLORADO LIGHT MANUFACTURING COMPANY, INC., has received authorization to operate in New York for the manufacture of radio luminous compounds and allied products. E. D. Davis, 558 West 158th Street, will act as local representative.

THE BAKER R. & L. COMPANY, of Cleveland, Ohio, manufacturer of Baker and Rauch & Lang electric passenger cars and Owen Magnetic passenger cars, recently developed a comprehensive line of electric industrial trucks and tractors. The accompanying photograph illustrates two types of the Baker R & L. Company's electric industrial trucks and tractors carried on an electric commercial vehicle in the loyalty parade held in Cleveland July 4. One of the trucks is shown carrying a large projectile.



THE CYNTHIANA (KY.) PLUMBING & ELECTRICAL COMPANY, of which J. F. and S. O. Nooe were the chief owners, has filed a voluntary petition in bankruptcy. Liabilities are given at $3,200, and it is thought that the stock of the company will bring about $6,000. Business conditions are given as the cause of the failure, the unusual dearth of building operations and the inability to secure competent workmen. Judge T. E. King is in charge of the affairs of the company. J. F. Node has resumed his former position with the Kentucky Utilities Company.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., states that it is permanently discontinuing the manufacture of armored cable, armored cord and flexible steel conduit, schedules "X" and "Y." This step was taken so that it could devote its entire energy to other lines, including a large amount of government business direct and indirect, as well as the externally operated line of knife switches. The company, therefore, has found it necessary to cancel all orders for amored cable, armored cord and flexible-steel conduit in the works, and no further orders can be taken.

THE HOSKINS MANUFACTURING COMPANY, Detroit, has let contracts for the construction of two additional factory buildings. One of these is an extension to the foundry and is of the brick and steel type, 60 ft. by 185 ft. It will provide increased facilities for melting chromal alloys used in the manufacture of thermocouples and resistance wire in electric furnaces and other electrically heated devices. The other building will be used for the manufacture of electric heat-treating furnaces and pyrometers. This structure is of reinforced concrete, two stories high, 60 ft. by 195 ft.

THE MALONEY ELECTRIC COMPANY, manufacturer of transformers, announces the appointment of E. G. Howard as district manager of the Minneapolis office. Mr. Howard has been intimately connected with the electrical industry in the Northwest for many years.

THE LANCASHIRE DYNAMO & MOTOR COMPANY OF CANADA, LTD., says that on Sept. 1, 1918, its head office and works will be on the southeast corner of Niagara and Bathurst Streets, Toronto. The works will be equipped to handle repairs and rewinding of all types of electrical machinery efficiently.

THE ELECTRICAL TESTING COMPANY, 350 Knoxville Avenue, Peoria, Ill., announces that within the next two weeks it will occupy its new electrical and battery service station, which will be used for the electrical work on automobiles exclusively. The building is 60 ft. by 150 ft., one side being devoted to the office and shop and the other side to parking cars.

THE MOHAWK ELECTRICAL SUPPLY COMPANY of Syracuse, N. Y., has recently installed a home appliance department in charge of J. L. Merriott. This department handles all sales in Syracuse of home appliances such as washers, ironers, cleaners, etc. The salesmen in this department are equipped with cars for delivery and demonstration of apparatus handled by the department.

THE COLLYER INSULATED WIRE COMPANY, INC., Pawtucket, R. I., has recently been reincorporated with increased capital. The new officers are: President, H. W. Fitz; treasurer and general manager, R. C. Moeller; secretary, D. S. Davis; superintendent, George T. Jones. The first three named were associated with the American Steel & Wire Company in the electric cable division for many years.

THE AUTOMATIC RECLOSING CIRCUIT BREAKER COMPANY, Columbus, Ohio, announces the appointment of C. M. Hickle as sales manager of the company. For the last two years Mr. Hickle has been connected with the Pittsburgh sales office of the Cutler-Hammer Manufacturing Company. Previous to that time he was engaged in practical and technical work, which has given him excellent preparation for his new duties in promoting the use of automatic protective devices for direct-current equipment of railway substations.

VANCE McCARTY, for the last twelve years manager of the Pittsburgh branch of the Edw. R. Ladew Company, Inc., has been appointed general sales manager of the company, with headquarters in the New York office, 54 Franklin Street. Mr. McCarty's connection with the Ladew company covers a period of eighteen years, the first six of which were spent in the factory in the actual manufacture of Ladew leather belting. Mr. McCarty has made many notable installations of Ladew belting involving difficult and unusual transmission problems.

THE CHICAGO (ILL.) PNEUMATIC TOOL COMPANY announces that the contract has been let and work started on the erection of an up-to-date addition to its Cleveland plant, which is planned to double the present output. It is expected that work will be completed on the building itself about Nov. 1. The necessary equipment has been ordered and it is believed will be delivered and ready for installation by the time the building is completed, so that shortly thereafter the additional production contemplated will be available.

ALFRED I. DU PONT, chairman of the Allied Industries Corporation, 151 Fifth Avenue, New York, has given out the reason for obtaining the Grand Central Palace at New York for the advancement of foreign trade of the United States. Mr. du Pont says the purpose of acquiring the Grand Central Palace for the home of the Allied Publicity Corporation was and is to establish a point of contact between the commercial United States and the rest of the world in the development of foreign trade. This is essentially an after-the-war activity, and as it has now appeared that the government desires the building for hospital purposes, it will be given to the government for the duration of the war. Mr. du Pont says that foreign trade is not a one-sided matter. It does not consist solely of selling products to other countries—it consists of selling to them and buying from them reciprocally. It consists, further, in the establishment through trade relations of greater international understanding and of appreciation for permanent business alliances with other nations and other peoples which will result in closer relations. He thinks that through the plans the corporation is developing alliances made for purposes of war will be cemented and strengthened for the years that are to follow. The general plans laid down for the Allied Industries Corporation were formulated to coöperate very closely with the various domestic and foreign trade bureaus of the government and to work in harmony with various international foreign trade bureaus of allied and neutral governments.

Trade Publications

PORTABLE LAMPS.—The Retherford Brothers Company, Muncie, Ind., is circulating a folder describing and illustrating its "Reth-Flex" lamp, which can be easily moved and the light focused to any position.

HEATING APPLIANCES.—The G. E. Division of the Edison Electric Appliance Company, Chicago, has issued a bulletin describing and illustrating heating appliances. The booklet is well illustrated with reproductions of the various appliances made by this company.

ELECTRICAL SPECIALTIES.—Catalog No. 6, describing, illustrating and listing numerous electrical specialties, has been issued by the Duncan Electrical Company, Ltd., Montreal, Canada. Definitions of electrical units and other valuable information are contained in this booklet.

RUBBER GLOVES.—"A Treatise on the Testing of Rubber Gloves for Dielectric Strength" is the title of a booklet that has been published by the Pittsburgh Glove Manufacturing Company, 413 South Main Street, Pittsburgh, Pa. This company is the maker of "Free Flex" lineman's rubber gloves. A diagram of connections for a simple testing equipment is given and the apparatus that must be used for testing is produced in detail. Methods of testing and reasons for testing are also given.

INSULATION OF COMMUTATORS.—The Mica Insulator Company, 68 Church Street, New York, with works at Schenectady, N. Y., has issued a bulletin entitled "The Insulation of Commutators," containing facts relative to this subject and a discussion of insulation in general. Early methods of insulation are also discussed, and a résumé of the invention of "Micanite" is given. Mica films, cement content of micanite and the different kinds of mica plate are also treated of. The characteristics of "micanite," including its uniform thickness and density, high specific weight, extremely low compressibility, very small cement content and large area of individual mica films, are also outlined.

METERS.—Type MS ampere-hour meters are the subject of bulletin 48 that has been issued by the Sangamo Electric Company, Springfield, Ill. These meters, which can be used for farm-lighting batteries, are well described in the booklet. Various methods of battery charging are described and battery losses are discussed. The principles of the "Mercury" motor meter are given, including the elements of the meter, which are illustrated—the current indicator, contacts, etc. The reverse-current time-limit relay is also described, and the commercial application of the meter in isolated plants, electric vehicles, electric trucks and wireless outfits is given. The dimension diagrams are shown in detail.

WIRING DEVICES AND CIRCUIT BREAKERS.—Catalog 1B, on wiring devices and circuit breakers, is now being distributed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. This is a 224-page catalog listing fuses, knife switches, service switches and boxes, solderless connectors, disconnecting switches, instrument switches, safety switches, safety panelboards and carbon circuit breakers, part of which have previously been listed in catalog 3001 of this company. The carbon circuit breakers are listed in this catalog according to what they will accomplish—that is, according to the method of operation, the method of mounting and their rating—the type designation being of secondary consideration. An entirely new and complete line of knife switches of the Westinghouse company's own manufacture for both front and rear connectors occupies forty-nine pages of the catalog.

New Incorporations

THE HARTLAND (MICH.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $2,000.

THE MISSISSIPPI ELECTRIC COMPANY of Jackson, Miss., has been incorporated with a capital stock of $15,000 by J. J. Murphy and T. B. Gaddis.

THE TEAL LIGHT & POWER COMPANY of Chesterfield, S. C., has been incorporated by D. T. and E. Teal The company is capitalized at $10,000 and proposes to generate and distribute electricity.

THE WELLERSBURG ELECTRIC COMPANY of Meyersdale, Pa., has been incorporated with a capital stock of $25,000 to operate an electric lighting plant in Meyersdale. F. E. Rowe is interested in the company.

THE ELECTRIC GUN COMPANY of Seattle, Wash., has been chartered with a capital stock of $250,000 to do a manufacturing business. The incorporators are R. L. Christensen, F. A. Andrews and C. E. Winberg.

THE SOUTHPORT (N. C.) ELECTRIC LIGHT & POWER COMPANY has been chartered with a capital stock of $30,000 by Mrs. E. M. Suppleyea of Southport; G. W. Suppelyea and William M. Bellamy of Wilmington, N. C.

THE U. S. DEVICES CORPORATION, New York, has been incorporated with a capital stock of $5,000 to engage in the manufacture of electrical goods. J. H Betts, A. T. Holbrook and L. Hengerer, New York, are the incorporators.

THE THOMSON (GA.) LIGHT & WATER COMPANY has been incorporated by R. L. Hardaway, B. F. Johnson and G. W. Lokey. The company is capitalized at $70,000 and proposes to operate an electric plant in Thomson.

THE DOMESTIC ELECTRIC COMPANY of Birmingham, Ala., has been incorporated with a capital stock of $10,000 to deal in electrical specialties. William C. Knoph of Birmingham, Ala., is president, and F. K. Rungan of Atlanta, Ga., is secretary.

THE MAGNETO IGNITION COMPANY, Tulsa, Okla., has been incorporated by O R. and H. Wohlauf and J. P. O'Meara. The company is capitalized at $10,000 and proposes to engage in the manufacture of ignition specialties of various types.

THE HIGH-PRESSURE FITTING & VALVE COMPANY, INC., New York, has been incorporated with a capital stock of $25,000. The incorporators are J. W Naughton, 1385 Union Street, Brooklyn; P F. Hagan, 216 William Street, and J. A. Hardman, 27 William Street.

THE REPUBLIC LIGHT, HEAT & POWER COMPANY, Buffalo, N. Y., has filed articles of incorporation with a capital of $400,000 to operate a plant for the generation and distribution of electric power F. M. Lowry, H. R. Davis and H. D. Williams, Buffalo, are the incorporators.

THE MACFARLANE COMMUNICATIONS CORPORATION, New York, has been incorporated with a capital of $1,000,000 under Delaware laws to manufacture and operate telephone and communicating systems J. B. Lieberman and L. F. Browning, New York, and J. G. Gray, Wilmington, Del., are the incorporators.

THE SAFETY ELECTRICAL MANUFACTURING COMPANY of Sioux City, Ia., has been incorporated by C. B. Chrysler, Morton S. Nelson and H. E. Trowbridge. The company is capitalized at $100,000 and proposes to take over the plant of the Liberty Cartridge Company, which was recently dismantled.

THE VACUUM MUFFLER CORPORATION OF AMERICA, New York, has been incorporated with a capital of $200,000 to engage in the manufacture of muffler appliances, motors, autos, etc. Incorporators: E. Christopherson, 154 Nassau Street; T. L. Thompson, and L. E. Johnson, 27 William Street, New York City.

THE FURMAN-FISHER CORPORATION of New York, N. Y., has been incorporated by L. A. Watkins, G. B. Furman and W. C. Davis, Seventy-second Street and Riverside Drive, New York City. The company is capitalized at $10,000 and proposes to do a general electrical and mechanical engineering business.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

ASHLAND, N. H.—The municipal electric plant was destroyed by fire on Aug. 20, causing a loss of about $50,000. The town recently took over the property of the Ashland Electric Light Company and made extensive improvements.

DANA, MASS.—The committee appointed by the town to make investigation relative to lighting the town by electricity has asked the Gardner Electric Power Company for estimates of cost and other information in connection with the erection of the proposed extension from Petersham to Dana.

SHERBORN, MASS.—Plans, it is reported, have been prepared for the construction of a large power plant, to cost about $70,000, at the Sherborn Reformatory for Women. Mrs. Jessie D. Hodder is superintendent.

UXBRIDGE, MASS.—The contract for the construction of the extension to the power house, boiler house and other additions to the local power plant of the New England Power Company has been awarded to the E. D. Ward Company, 82 Foster Street, Worcester. The proposed improvements will cost about $1,100,000 and will include boilers, condensers and turbo-generating units to develop 17,500 kw. In addition to these improvements the New England company is planning to erect an electric transmission line from Millbury to Norwich, Conn., a distance of 60 miles, to cost approximately $350,000.

HAZARDVILLE, CONN.—Plans are being prepared by Ford, Buck & Sheldon, mill engineers, of Hartford for the construction of a new power house for Gordon & Gordon. The building will be 20 ft. by 50 ft., two stories, with gatehouse, intake and spillway. The equipment will include turbines and generators, which, it is understood, have been purchased.

NEW HAVEN, CONN.—The New York, New Haven & Hartford Railroad Company, it is reported, has decided to adopt electric headlights to replace the old oil-burning type on its locomotives. The new lamps will be put into use as soon as possible.

NEW LONDON, CONN.—Contract has been awarded to the R. R. Bill Company, Springfield, Mass., for the construction of the new boiler plant and heating system at the local navy yard.

Middle Atlantic States

CANISTEO, N. Y.—The Hornell (N. Y.) Electric Company is reported to be negotiating for the property of the Canisteo Light & Power Company.

ELLIS ISLAND, N. Y. HARBOR.—Contract has been awarded to J. A. Almirall & Company, 1 Dominick Street, New York City, by the United States government, Bureau of Immigration, for alterations and improvements to the main power plant at local hospital.

GALVAY, N. Y.—Plans are under consideration by the board of managers for the installation of extensions to the power plant, to cost about $12,000, at the Saratoga County Homestead Sanitarium.

GENEVA, N. Y.—Plans have been prepared for the construction of a new municipal boiler plant, to cost about $15,000. J. W. Brennan is city engineer.

GROTON, N. Y.—The Ovid (N. Y.) Electric Company has petitioned the Public Service Commission for permission to acquire the capital stock of the Groton Electric Light Corporation. If the petition is approved, the Ovid company will furnish electricity in the town of Lansing. A further reason for the consolidation of the companies is the erection of an electric transmission line from the plant of the Ovid company across Cayuga Lake and the town of Lansing to the Groton town line, and the construction by the Groton company of a similar line across the town of Groton to the same point.

JAMESTOWN, N. Y.—The Water and Light Commission has given Mayor Carlson authority to secure a franchise to furnish electricity in the village of Falconer from the municipal electric light plant.

JAMESTOWN, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 11, for conduit and wiring and lighting fixtures in the United States post office at Jamestown.

MALONE, N. Y.—Bids will be received by Captain John A. Coffey, secretary board of armory commissioners, 158 Capitol Street, Albany, until Sept. 18 for addition to State Armory, including construction, heating, electric and sanitary work. Drawings and specifications may be consulted at the above office, at the New York office of the Department of Architecture, Room 1224 Woolworth Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

NEW YORK, N. Y.—The Cantonment Division, War Department is planning to build an extension to the Greenhut Building, to cost about $306,000.

NEW YORK, N. Y.—The construction of a naval hospital on Ward's Island, to cost about $1,000,000, is under consideration (Specification 3338) by the Bureau of Yards and Docks, Navy Department, Washington, D. C.

ROCHESTER, N. Y.—Plans are under consideration by the Bridgeford Tool & Machine Works, Winton Road North, for the construction of a power plant at its works.

BROWN MILLS, N. J.—Negotiations have been completed by the Brown Mills Electric Light & Power Company for the plant of the Brown Mills Company, at $10,000, to be used for extensions.

CAMDEN, N. J.—The Board of Public Utility Commissioners has approved an agreement between the Public Service Railway Company and the Emergency Fleet Corporation for the construction of an electric railway between the shipyards of the New York Shipbuilding Corporation and the Yorkship Village. The new line will connect with the present system of the Public Service Railway Company at Broadway and Warren Streets, Gloucester City. The cost is estimated at $219,947.

NEWARK, N. J.—A machine shop, forge shop, electrical and other departments will be installed in connection with the new vocational school to be built by the board of education in Newark. The proposed building will be 250 by 250 ft. and will cost about $500,000.

TRENTON, N. J.—The American Steel & Wire Company, Hamilton Avenue, is contemplating the erection of a pumping plant at its works, for which plans have been prepared.

BEAVER BROOK, PA.—The installation of new electrically operating pumping machinery at its No. 5 colliery is under consideration by the C. M. Dodson Coal Company. Two units of large capacity will be installed.

BETHLEHEM, PA.—Contract has been awarded by the Philadelphia & Reading Railway Company for the erection of a new power plant and engine house, about 100 ft. by 200 ft. and 35 ft. by 75 ft. respectively, to be located on Saucon Creek in the Didur district, to the Roydhouse-Arey Company, 112 North Broad Street, Philadelphia.

COATESVILLE, PA.—Application has been made to the Public Service Commission by the Chester Valley Electric Company for permission to take over and operate the plant of the Downington Electric Company.

PHILADELPHIA, PA.—The contract for electric wiring for a light and power system for the McKean Street pier now being completed on the Delaware River has been awarded to the United States Electric Construction Company, at $40,000.

PHILADELPHIA, PA.—Contract has been awarded by the Pennsylvania Railroad Company for the construction of a new plant at Greenwich Point, South Philadelphia, Pa., consisting of a machine shop, engine house and auxiliary shops, oil houses and storage buildings, to Irwin & Leighton, Twelfth and Cherry Streets. The company has also awarded contract for construction of new shops, etc., at Morrisville, to cost about $300,000, to the Braun & Stuart Company, Commercial Trust Building.

PITTSBURGH, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept 9 for mechanical stokers, etc., in the United States post office and court house at Pittsburgh.

PITTSBURGH, PA.—Contracts have been awarded by the United States Steel Corporation, acting for the United States government, to the Westinghouse Electric & Manufacturing Company of Pittsburgh for three 15,000-kw. generators for a generating plant to cost approximately $5,000,000, which will be used in connection with the government ordnance plant now being erected in Neville Island

SCRANTON, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 12 for conduit and wiring and lighting fixtures in the United States post office at Scranton, Pa.

STEELTON, PA.—The Bethlehem Steel Company is contemplating the installation of a large turbine in its power plant near Locust Street.

HARTLAND, W. VA.—The Hartland Power Company, which is planning to erect a high-tension transmission line along the Elk River to Charleston, 5 miles, is also considering building a transmission line from its power station along the Elk River in the opposite direction, a distance of 4 miles, to serve a number of coal mines and the town of Clay. Part of the line toward Charleston is under construction. The power station of the company is located on the Elk River, 47 miles from Charleston, and at present serves several coal mines along Middle Creek. W. S. Barstow & Company, 50 Pine Street, New York, N. Y., are managers.

RIVESVILLE, W. VA.—The Monongahela Valley Traction Company is contemplating a loan of $2,500,000 to complete work under way, including the Rivesville power plant, gas-producer plant, gasoline plant, drilling gas wells, laying gas mains, extension of transmission lines, developing coal lands, sinking two shafts for mines and building twenty-five houses.

RICHMOND, VA.—The City Council has appropriated $12,000 for extensions to the municipal electric light plant. The municipal power station will supply electricity to the government boiler plant.

WASHINGTON, D. C.—The Potomac Electric Power Company, it is reported, is contemplating an issue of $2,100,000 in bonds for improvements to its electric generating and transmission systems.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 3, for five electric traveling cranes for Washington, under Specification 3309.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, is planning to install an electric distributing system at Coddington Point (Specification 3339), to cost about $75,000. Also underground wiring at Montauk Point, N. Y., to cost about $6,575, Specification 3338.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Sept. 9, for furnishing at the various navy yards and naval stations supplies as follows: Cape May, N. J., Schedule 5477½—one shaper, one portable boring bar, and one alternating-current motor. Philadelphia, Pa., Schedule 5539½—Six portable electric drills; Schedule 5604½—4000 storage batteries; Schedule 5607½—10,000 storage batteries. Newport, R. I., Schedule 5605½—150 reels of single-conductor cable; Schedule 5609½—two induction motors. Washington, D. C., Schedule 5579½—2000 ft. enamel conduit and a quantity of single-conductor and control cable; Schedule 5606½—6120 lb. brass tubing. Applications for proposal blanks should give the schedule desired by number.

North Central States

ALMA, MICH.—The City Council has authorized a contract with the Central Michigan Light & Power Company of Mount Pleasant to furnish electricity for pumping the pure well-water supply for a period of five years. Fifteen wells are being sunk to supply this service.

DETROIT, MICH.—Bids are being received by the W. J. Hartwig Company, Jefferson Avenue, for the construction of three-story and basement building, 70 ft. by 100 ft., at Jefferson Avenue and Fifteenth Street. The company manufacturers electric fire-alarm boxes.

BLOOMDALE, OHIO.—At an election held recently the proposal to issue bonds for the installation of a municipal electric light plant was carried.

CINCINNATI, OHIO. — Announcement has been made by the officials of the Columbia Gas & Electric Company that contract has been closed between the Union Gas & Electric Company, the operating subsidiary of the Columbia Company, and the United States government for supplying electricity for operating the large government nitrate plant to be erected near Cincinnati. The proposed plant has now been definitely located at Broadwell, instead of at Elizabethtown, as had been tentatively considered. The contract calls for a maximum of not less than 30,000 kw. or in excess of 40,000 kw., not later than July 1, 1919

DEFIANCE, OHIO.—The Defiance Gas & Electric Company is contemplating the installation of an additional electric generating unit of 5000-kw. rating. The plans provide for an addition to the power station.

NORWALK, OHIO.—The City Council is considering an issue of $25,000 in bonds for the installation of a 500-kw. generator for the municipal electric light plant.

RICHMOND, OHIO.—Plans are under consideration by the Chesapeake & Ohio Railroad Company for extensive additions at its local shops, including the erection of a new power plant.

MIDDLESBORO, KY.—The Middlesboro Lumber Company is reported to be considering the purchase of a 500-kw., 2200-volt Curtis generator set (second-hand).

DECATUR, IND.—An ordinance has been passed by the City Council authorizing the extension of the municipal electric lighting system to the towns of Bolo and Pleasant Mills. The lines from the city limits will be erected by the Pleasant Mills Light & Water Company.

CAMERON, ILL.—The power plant of the Rock Island Southern Traction Company was recently destroyed by fire. Arrangements, it is understood, have been made with the Galesburg Railway, Lighting & Power Company to obtain power to operate its system. The entire equipment as well as buildings was destroyed.

MAHOMET, ILL.—The installation of an electric lighting system in Mahomet is reported to be under consideration. Electricity will probably be supplied by the Illinois Traction System.

SADORUS, ILL.—Plans, it is reported, are being considered for the installation of an electric lighting system in Sadorus. Energy will probably be secured from the Illinois Traction System.

WAUKEGAN, ILL.—Work has started on the construction of an extension to the local plant of the Greiss Pflege Tanning Company, 170 ft. by 140 ft. The power plant will also be enlarged. The cost of the entire work is estimated at about $300,000.

WEST FRANKFORT, ILL.—The Peabody Coal Company is contemplating equipping its mines, Nos. 18 and 19, for electrical operation. At mine No. 19 a 450-kw. generator driven by a Corliss engine and two boilers will be installed. A similar generator, or possibly larger, will be installed at Mine No. 18.

BRODHEAD, WIS.—The purchase of equipment for the proposed hydroelectric plant is reported to be under consideration by K. Guelson, superintendent of the municipal electric light plant. Plans have been prepared by the Power Engineering Company, Corn Exchange Building, Minneapolis.

MANITOWOC, WIS.—The City Council has appropriated $57,596 for the purchase of additional equipment for the municipal electric light plant and has instructed the Utility Commission to award contracts for the work at once. Contracts for most of the equipment have been let. The new equipment will include a 1500-kw. turbine, a 300-hp. boiler, switchboard, etc.

MILWAUKEE, WIS.—Bids will be received by the Sewerage Commission, City Hall, Milwaukee, until Sept. 12 for construction and erecting in pumping station to be built on Jones Island, city of Milwaukee, machinery for an automatic electric sewage-pumping plant; including three 30-in. centrifugal pumps, vertical type, three 250-hp. variable-speed, wound-rotor motors, high-tension and electric control apparatus, switchboard and wiring, Venturi meter, cast-iron pipe and specials, gate and check valves, etc. Specifications and proposal blanks can be obtained at the office of the Sewerage Commission upon deposit of $5. John H. Fowles is secretary.

CRESTON, IOWA.—The local electric light plant was recently damaged by fire.

GREENE, IOWA.—Plans are being prepared by the Power Engineering Company, Corn Exchange Building, Minneapolis, for extensions to the power plant of the Greene Electric Light & Power Company.

HUMBOLDT, IOWA.—The Board of Railroad Commissioners has granted the Northern Iowa Gas & Electric Company a franchise to erect an electric transmission line, 6¼ miles long, over the highways of Clay County to the limits of the town of Dickens for a period of 25 years. The company was also granted a 25-year franchise to construct and operate a transmission line on the roads and highways of Palo Alto County. A. S. Harrington of Humboldt is manager of the company.

WALCOTT, IOWA.—The Farmers' Electric Line Company of Walcott has been granted a franchise by the Board of Railroad Commissioners to erect an electric transmission line, 2.6 miles, over the roads and highways of Scott County for a period of 25 years. Albert Blank of Walcott is interested in the company.

APPLETON, MO.—Bonds to the amount of $15,000 have been voted for improvements to the municipal electric lighting plant. W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., are engineers.

HOLDEN, MO.—The City Council has decided to purchase electricity from the plant at Pleasant Hill instead of rebuilding the municipal electric plant.

RICHMOND, MO.—The city of Richmond is considering the purchase of a centrifugal pump and a triplex pump, both motor-driven.

MUNICH, N. D.—The installation of an electric lighting system in Munich is reported to be under consideration.

MADISON, S. D.—The municipal electric lighting plant, recently destroyed by fire, will be rebuilt. The loss is estimated at about $100,000.

KIMBALL, NEB.—Bonds to the amount of $17,000 have been voted for the installation of a municipal electric lighting plant.

STERLING, NEB.—Arrangements are being made by the Nebraska Electric Lighting Company to rebuild its local plant, recently destroyed by fire.

Southern States

ANDERSON, S. C.—The construction of electric light, sewer and water systems for the mill village is reported to be under consideration by the officials of the Orr Mills.

CHESTERFIELD, S. C.—The Teal Light & Power Company, recently incorporated, is planning to install a power plant to develop about 300 hp. The plans include the erection of a 6-mile transmission line. J. Newton Johnson of Wilmington, N. C., is engineer.

ATLANTA, GA.—The House of Representatives has passed the bill appropriating $10,000 for the Georgia Technical School, to be used for the completion of the power plant which is already under construction.

LABELLE, FLA.—The installation of an electric light plant in Labelle is under consideration. C. W. Shaefer and others of Cleveland, Ohio, aro reported interested in the project.

TALLAHASSEE, FLA.—The installation of an electric light plant, deep well and cold storage plant on its property is contemplated by the Leon Hotel Company.

NEWPORT, ARK.—The Arkansas Light & Power Company is contemplating the erection of an electric transmission line to furnish electricity in Tuckerman. The company will also furnish electricity to the city of Newark, 14 miles distant.

MONROE, LA.—The Standard Warehouse & Compress Company is contemplating the purchase of two boilers and other power-plant equipment, to cost about $15,000.

PONCA CITY, OKLA.—Extensions to the waterworks system, to cost about $75,000, are under consideration. The plans include the installation of an engine and generator to develop about 500 hp. and the construction of a small concrete dam. Burns & McDonnell, Kansas City, Mo., are engineers.

ATLANTA, TEX.—The electric power and ice plant of the Gulf Public Service Company was recently destroyed by fire, causing a loss of about $20,000.

DALLAS, TEX.—The new contract recently awarded the Dallas Electric Company for lighting the streets of the city provides for the installation of 2500 new street lamps to be installed at once. At present there are 1250 arc lamps, which are to be replaced with the lamps rated at 250, 400 and 600 cp. The 400-cp. lamps will be placed at street intersections and the 600-cp. lamps will be used in the business section after the ornamental lamps are put out. The lamps will be put on meters, and electricity to maintain the service will be furnished the city at cost.

ELECTRA, TEX.—Improvements are contemplated to the water and lighting systems, involving an expenditure of about $25,000.

HOUSTON, TEX.—The Humble Oil & Refining Company of Houston is planning to equip its oil pumping plant in the Goose Creek field with electric motors and to install a central power station to supply the electricity. More than 800 motors will be required. Plans are also being prepared by the company for the construction of an oil refinery in Houston, to cost about $2,000,000.

SAN ANTONIO, TEX.—Contract has been awarded by the War Department to the American Construction Company of Houston for the erection of the new army machine shop at San Antonio, to be used for the repair of automobiles, motor trucks, motorcycles, wagons and other vehicles. The main building will be 500 ft. by 500 ft. The cost of the entire plant is estimated at about $1,500,000.

Pacific and Mountain States

HOQUIAM, WASH.—Improvements are being made to the plant of the Gray's Harbor Lumber Company, including an addition to the power house. New equipment, including a 750-kw. and a 1000-kw. turbine and two high-pressure boilers, will be installed. The sawmill will be equipped for electrical operation throughout.

SEATTLE, WASH.—J. D. Ross, superintendent of lighting, has asked the City Council for authority to purchase a site on Spokane Avenue, between Montana and Wyoming Streets, on which to erect a substation. It is proposed to remove transformers from Yesler station and install two new transformers.

TACOMA, WASH.—The new sawmill to be erected in Tacoma by J. T. Gregory, T. V. S. Ballantine and E. V. Wintermore will be equipped for electrical operation throughout. The plant will have a capacity of 90,000 ft. daily.

OLNEY, ORE.—The application of John Ryan of Olney for appropriation of water rights in the Clatskanie River sufficient to develop about 300 hp. has been approved by State Engineer Lewis.

BAY POINT, CAL.—The Bay Point Light & Power Company has applied to the State Railroad Commission for permission to issue 440 shares of capital stock (par value $100) to be issued at $80, the proceeds to be used for refunding outstanding indebtedness and for improvements. The company estimates that it will require $33,525 for new substations, meters, street-lighting equipment, etc.

FRESNO, CAL.—Rosenberg Brothers are contemplating the construction of a power plant at their fruit-packing plant on Cherry Avenue, to cost about $10,000.

FRESNO, CAL.—The California Associated Raisin Company is planning to erect an electric power plant at its works at East and California Avenues.

FRESNO, CAL.—Permission has been granted to the San Joaquin Light & Power Corporation to issue $113,000 in bonds, the proceeds to be used for extensions and improvements to its system.

OROVILLE, CAL.—Paul Reicker, civil engineer, of Oroville, is planning to interest the cities of the Sacramento Valley from Sacramento to Red Bluff in a project to construct a large power plant on the middle fork of the Feather River for the purpose of furnishing the municipalities with electricity for lamps and motors. Mr. Reicker claims that a dam 650 ft. high in Bald Rock Canyon would store sufficient water for the irrigation of a large acreage after using the water for power development. The cost of the project is estimated at between $5,000,000 and $6,000,000.

PROVO, UTAH.—Plans are being considered by the Knight Woolen Mills for rebuilding the local plant, recently destroyed by fire, causing a loss of about $350,000.

MESA, ARIZ.—The installation of cluster lamps on streets that are now being paved is under consideration.

LIBBY, MONT.—Extensive improvements are contemplated by the Lukens-Hazel Mining Company, involving an expenditure of about $150,000, which will include the construction of a hydroelectric power plant, installation of mining machinery and a concentrating plant.

STERLING, COL.—The Colorado Power Company is reported to be considering the construction of a large steam-driven electric power plant, to cost about $150,000, on a site recently acquired in Sterling.

ROSWELL, N. M.—The Southern Pacific Company contemplates the erection of new shops in Roswell, to cost between $75,000 and $100,000. W. Hood is chief engineer

Record of Electrical Patents

Notes on United States Patents

1,271,558. Thermostatic Time Cut-Out, John C. Francis, Boston, Mass. App. filed June 16, 1916. May be easily reset to normal position without the necessity of replacement of parts.

1,273,385. Rotating Field Magnet; Birger Ljungstrom, Stockholm, and Frederick Ljungstrom, Brevik, Lidingon, Sweden. App. filed Jan. 19, 1918. One object of the invention is to obtain the same creep-length by means of a thin bottom insulation as may be obtained by a thicker one and, further, to increase the sectional area of the rotating field-magnet and thus to increase its capacity.

1,273,786. Automatically Reclosing Circuit Breaker; Estell C. Raney, Columbus, Ohio. App. filed Aug. 17, 1916. Effective in the protection of motor circuits and particularly desirable in individual motor circuits.

1,273,789. Wireless Signaling System; William C. White, Schenectady, N. Y. App. filed March 2, 1915. Means for modulating or varying the amplitude of continuous electrical waves, especially of such waves in accordance with variations in sound waves.

1,273,798. Automatic Starter and Controller; Ralph D. Ernest, Ann Arbor, Mich. App. filed Oct. 19, 1916. To operate the generating sets in such a way as to provide current at the proper voltage when there is a demand for the same, and immediately to stop the generating of current when there is no demand for power.

1,273,812. Cross-Bridge X-Ray Machine; Paul Berlin, Hoboken, N. J. App. filed July 14, 1916. To produce high-potential and unidirectional as well as oscillatory electric currents for therapeutic use.

1,273,820. Electric Counter; Clarence N. Cahusca, Jersey City, N. J. App. filed March 7, 1917. A novel manner of mounting the armature of the magnet, which is energized to impart the electric counting impulse positively and with a minimum of current.

1,273,821. Electrically Heated Cooking Vessel; Howard C. Causton, Vancouver, B. C., Canada. App. filed May 4, 1917. The provision of a receptacle within which the heating unit may be removably placed.

1,273,835. Track Instrument; Charles M. Dunham, Edgewood Borough, Pa. App. filed Dec. 14, 1916. Adapted to be operated by the vertical motion of a rail or track when a car or train is passing thereover.

1,273,850. Selector Circuit for Automatic and Semi-Automatic Telephone Systems; Chas. L. Goodrum, New York, N. Y. App. filed April 27, 1916. To prevent the sending of false impulses through careless removal of the receiver from its hook.

1,273,851. Portable Electric Lantern; William Grether, Dayton, Ohio. App. filed Jan. 26, 1918. The handle and casing are so constructed and connected that the batteries may be removed from the latter without disturbing the handle.

,273,870. Engine-Starting Device; Charles F. Kettering and William A. Chryst, Dayton, Ohio. App. filed July 14, 1913. Relates to a system of devices adapted for supplying power to start an engine, and the engine, when thus started, is arranged to store up power for similar future starting operations.

.273,871. Engine-Starting System; Charles F. Kettering and William A. Chryst, Dayton, Ohio. App. filed Sept 13, 1913. A system of devices adapted to be combined with combustion or explosion engines.

1,273,880. Engine-Starting Device; Lawrence Langner, Whitestone Landing, N. Y. App. filed July 21, 1913. To prevent the improper actuation of the starting device and the consequent injury to the apparatus, and to avoid the possibility of accidents.

1,273,915. Electrode Holder for Electric Arc Lamps; Harry N. Ott, Buffalo, N. Y. App. filed Sept 15, 1915. Will securely hold the carbon or electrode and can be readily adapted for holding carbons or electrodes which differ considerably in size.

1,273,920. Electric Furnace; Carl A. Pfanstiehl, Waukegan, Ill. App. filed Nov. 19, 1914. A furnace adaptable for use in sintering ingots of tungsten metal in the process of producing ductile tungsten.

1,273,940. Relay; Benjamin H. Smith, Turtle Creek, Pa. App. filed Dec. 29, 1914. To provide a relay having means for compensating for the torque thereof, under predetermined conditions of operation, and in so doing, to constitute a definite time-limit relay.

1,273,973. Automobile Rear Signal; Richard N. Woodman, Chicago, Ill. App. filed July 15, 1916. For attachment on vehicles operated electrically, when the proper circuit is closed, to signal a right-hand or left-hand turn to be made or to indicate stopping or backing of the vehicle to drivers of other vehicles following.

1,274,035. Differential Microphone; Paul J. Hackett, Seattle, Wash. App. filed Oct. 23, 1916. A carbon cup is provided which is non-packing, air-tight and therefore does not deteriorate.

1724,066. Heat Regulator; Harry C. Mallory, Bellport, N. Y. App. filed March 4, 1915. Electric power is positively applied and controlled for operating valves which in turn control the flow of steam, hot water or other heating fluids through heating systems.

1,274,076. Electric Railway System; Erich J. Patelski, Chicago, Ill. App. filed March 8, 1915. Relates to electric railway systems of that kind in which the current is not conveyed to the moving cars through the medium of a continuous conductor, but simply through the medium of current-feeding contacts disposed along the track.

1,274,094. Electric Switch; James R. Sloan and George H. Liebegott, Altoona, Pa. App. filed July 18, 1916. Device whereby the train operator may signal desired information to the motorman or engineer.

1,274,115. Electric Generators; Robert M. Warren, Sumter, N. C. App. filed April 21, 1917. Relates to an electric generator which is formed as a part of the flywheel of an engine.

1,274,128. Telephone Attachment; Joel E. Williamson, Evansville, Ind. App. filed Oct. 8, 1917. Will prevent the telephone cord from wrapping around the instrument or becoming tangled

1,274,186. Method of Cleaning Metal Articles; Charles B. Morey and Charles J. Huber, Buffalo, N. Y. App. filed June 23, 1917. Improvements.

1,274,202. Electric-Lamp-Supporting Device; Robert H. Ruth, New York, N. Y. App. filed Nov. 24, 1913. Relates to sockets which are provided with an extension plug adapted to be inserted into a wall fixture, ceiling fixture or the like.

1,274,248. Thermostatic Circuit-Controlling Device; John H. Derby and Ernest S. Clayton, New York, N. Y. App. filed Aug. 10, 1916. Relates to devices of the type employed to indicate marked rises in temperature; for example, in fire alarm signal systems.

1,274,263. Combination Headlamp and Flashlight; Cameron G. Hamilton, Seattle Wash. App. filed June 7, 1917. To provide a battery lamp for the head, easily convertible into a pocket flashlight of standard form.

1,274,264. Method of Selective Electric-Wave Signaling; John Hays Hammond, Jr., Gloucester, Mass. App. filed April 27, 1912. Selective signaling with undamped waves of periodically varying amplitude at receiving station with means which shall be non-responsive to any vibrations except those having predetermined amplitude variations.

1,274,301. Elevator Signal System; Alvin C. McNabb, Dallas, Tex. App. filed Jan. 10, 1917. The floor position signal is set up in each car so that the operator knows just where he is by merely glancing at his indicator and at the same glance observes the floor positions of the other cars in his bank.

1,273,347. Automatic Telephone-Exchange System; Herbert L. Fish, Bakersfield, Cal. App. filed May 19, 1906. The object of invention is the provision of an improved and highly efficient common-battery automatic telephone exchange system.

1,274,348. Car Truck; John Taylor, Albany, N. Y. App. filed Jan. 23, 1918. To produce a "low-down" truck having a swing-motion bolster and spiral springs over the journal boxes and elliptic springs on the bolster to support the car body.

1,274,360. Manufacture of Shaped Castings of Ferrosilicide; Napoleon G. Petinot, New York, N. Y. App. filed July 19, 1916. An iron and silicon alloy with a content of silicon approximating from 10 per cent to 16 per cent.

1,274,367. Signal System; Clarence E. Beach, Binghamton, N. Y. App. filed Oct. 1, 1915. Adapted for use in connection with receiving and recording devices which have polarized magnetic mechanisms.

1,274,368. Fuse; Harry L. Beck, Pittsburgh, Pa., John Weible, Coraopolis, and Jerry J. Houlahen, Millvale, Pa. App. filed Oct. 4, 1915. Parts are so arranged that a careless person cannot close up the shell or casing without all the parts being assembled in their proper position.

1,274,380. Socket Transformer; Leo F. Brislin, Ashland, Ky. App. filed Oct. 13, 1917. Detachable transformer-voltage-reducing device for electric light sockets in which the transformer and the conductors between the transformer and the plug and receptacle of the device are entirely inclosed within the insulating body of the device.

1,274,399. Locomotive-Driving Mechanism; George M. Eaton, Pittsburgh, Pa. App. filed Dec. 14, 1916. The motors are so disposed relative to the driving wheels that the weight of the driving connections may be greatly reduced and smooth-running characteristics insured when operating at high speeds.

,274,400. Locomotive-Driving Mechanism; George M. Eaton, Pittsburgh, Pa. App. filed Dec. 14, 1916. Connecting means between the propelling motors and the driving wheels of electric locomotives.

1,274,411. Commutator and the Method of Manufacturing the Same; Edward A. Halbleib and Thomas L. Lee, Rochester, N. Y. App. filed June 26, 1915. Improvements in the structure and the manufacture of the commutators of electric motors, generators or other machines.

1,274,420. Signal; Ferdinand G. Henry, Philadelphia, Pa. App. filed March 13, 1916. For use with automobiles to indicate from the rear or other parts of the automobile the direction in which it is to turn.

1,274,428. Induction Coil; Thomas L. Lee, Rochester, N. Y. App. filed Nov. 1, 1917. Improved construction for connecting the insulated terminal of the secondary winding with a conductor external to the casing in which the windings are inclosed.

1,274,451. Clamping Mechanism for Welders; Archer W. Richards, Lakewood, Ohio. App. filed May 18, 1917. Designed to replace the heavy manually operable clamps and quickly and accurately clamp ends of metal in abutment for the operation known as butt-welding.

1,274,479. Manufacture of Phosphorus; Harry O. H. Wenman, Bishop's Castle, England. App. filed Dec. 7, 1917. Running molten slag direct from a steel furnace into an electric furnace, supplying silicate and carbon to the electric furnace, and maintaining the furnace at the temperature required to vaporize the phosphorus.

1,274,489. Motor-Control System; Reuben I. Wright, Wickliffe-on-the-Lake, Ohio. App. filed April 18, 1917. Two or more motors are mechanically connected to the same load.

1,274,492. Connector; Frederick Zenker, Highland Park, Mich. App. filed March 29, 1917. To secure a pair of pivoted knife-blade contacts to the cross-head or connecting member of an electric switch.

1,274,493. Electric Conductor; Charles W. Adams, Saginaw, Mich. App. filed Feb. 13, 1918. Carbon brushes and a means for attaching flexible conductors or pigtails to carbon brushes, and an improved method of making the connection between the brush and the pigtail.

1,274,514. Signal System; Nathaniel B. Creglier, Chicago, Ill. App. filed Jan. 5, 1911. A pair of metallic conductors may be used for each box or substation, the system being thus operable when desired by a completed metallic circuit.

1,274,519. Telegraphy; Patrick B. Delan South Orange, N. J. App. filed June 1917. Improved means for forming and transmitting telegraphic signals over telephone circuits or other circuits operated through microphone contacts.

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Our National Program for War Power

AS A WAR MEASURE the national government authorities ask Congress to appropriate $200,000,000 for plants to meet the emergency need for power. It is specifically a war-time need, it is clearly so expressed by heads of the government departments most concerned. To meet it is a step in our large war program. A vital element in the war industry mobilization, power must be supplied in the quantity, at the time, in the place required for the production of munitions and supplies for armed and other national forces. Existing sources of available manufactured power in the so-called congested production districts are in full demand from present consumers. While the elimination of the less essential uses will release some energy it does not appear likely that much can be anticipated from this margin; the less essential users in many cases will pass by easy transition to the essential class by simply converting their factories for government work.

The particular reasons why the government should carry out the large extension of power resources rest upon the economic disturbances of the times. It has control of the raw materials, it can command the apparatus or supplies necessary. It can furnish the labor for either construction or operation, going so far, if required, as to put khaki-clad men on the job. Furthermore, it has the capital unlimited, costs do not figure in the war program. Testimony of the government representatives, published in the Electrical World last week, shows that they appreciate the financial risk which would be run if a plant in a local community expanded its facilities on a great scale under present high-cost conditions for a government power requirement of uncertain duration. The government plan at once levels the difficulties and clears the way for rapid construction which is the most important thing at this juncture in the war.

The government authorities say that the issue of public or private ownership is not involved in the proposed legislation, it is purely a war emergency measure. There is no reason to question the attitude or sincerity of the government in this regard. This is not the time to haggle, and we hope that Congress will give the authority under which abundant power may be supplied. In the interest of conservation it is to be hoped that the new power facilities will be provided on the approved economic principle that concentration of units is desirable. So far as possible in meeting the government exigency, facilities of existing well-located and well-operated plants should be expanded, but of course the government will be right in subordinating every other consideration to the first aim of winning the war.

Squandering the Nation's Coal

NATIONAL squandering is no more to be condoned than individual profligacy. If we use irreplaceable raw material such as coal to produce electricity which might just as well be generated from an ever-renewed source such as water power, are we not acting against the best interests of the country and of mankind in general? Our natural resources are our greatest asset, and we should extract from them the greatest possible wealth and protection. That is to say, we should not part with iron, for instance, as iron ore or even as plates and rods—but as machines, watch springs, or any other manufactured article representing the work of skilled industries. Nor should we use one ounce more of coal than is absolutely essential, because, aside from the fact that its loss is irreparable, its production requires a large amount of unskilled labor. Therefore by developing our water powers, which are unfailing, we shall be enabled to cut down on the production of coal and thereby conserve the nation's wealth and have more labor available for skilled productive industries.

Coal and iron are not in the same category as wheat or beef. We can renew our stocks of the latter by tilling the soil and by proper breeding; but we cannot reproduce coal and iron, we cannot restore to Mother Earth what we have taken away. Hence the necessity of husbanding what we have while there is yet time. Demosthenes in that greatest of orations, "The Oration on the Crown," likened Æschines to a physician who when called to patients in a sinking state gave no advice and prescribed no course by which the disease might be cured—but after the patient had died and the last offices had been performed follows the corpse to the grave and expounded how the poor man never would have died had such and such things only been done. Foresight is what we need, not hindsight. We cannot save coal when we no longer have it; but, by using our water powers, and that quickly, we can make what coal we have last much longer. At present we are not only wasting millions of horsepower yearly in our streams—but millions of tons of precious coal and much needed labor as well. Shall this continue, or shall horse sense at last prevail?

The Meaning of Liberty Loans

WE BUY Liberty bonds for two reasons. We want to put the fifty dollars or the thousand dollars at the immediate disposal of our government to help finance the war; and, many a hundred-dollar bond is bought as a first step toward a savings plan.

Liberty bonds are helping to put every man on a better business basis by helping him to save. Thousands of liberty bonds have, for example, opened an account to secure the boy or the girl of the family a better home or a better education. Many a liberty bond buyer has said: "I want my children and their children's children to live in a world with the highest ideals of civilization. I want the world free so that their lives may flower in at least as good a world as that in which mine is being lived. I want to see a world in which men and nations dominate by giving, not by taking."

Men and women of the nation are giving their sons, their brothers, all who are dear to them. Thousands of clear-skinned, wide-eyed young men may sacrifice their lives to carry forward the high purposes of our fight. Fathers and mothers are giving their sons and their money, because in that giving they see the hope of the world—to-day's children living in a free land to-morrow—with a clearer conception of their responsibilities in carrying on the ideals for which our nation stands.

No one is too high or too low to buy a share in that future for themselves and for others. In every business house in the United States this message will come home to every individual. A plan to help each electrical manufacturer, each central station, each business and professional man in the industry to promote the sale of the Fourth Liberty Loan is outlined on pages 130 and 131 of this issue. The electrical industry has set high quotas in the earlier loans. The men of the industry will undertake the Fourth Loan in that same spirit.

Fuses for 2500-Volt Circuits

WE HAVE OFTEN had occasion of late to refer to the bearings of mere station capacity on engineering problems; in some instances they are rendered far easier, in others much more difficult. To the latter category belongs the question of fuses and other protective devices. The cheapness and simplicity of the fuse, its adaptability for the numerous cases where circuits have to be opened by protective devices only at rare intervals have made it practically essential in electrical installations. It was a long step from the old-fashioned fuse strips to the non-arcing fuse of the present time, but as capacities have increased and the possibility of short-circuits have rapidly developed, even these fuses require great modification, particularly in cases where the voltage behind the fuse is great with corresponding capacity for arcing and holding a short-circuit.

Mr. Cole gives an interesting résumé of the struggles of one inclosed fuse maker in overcoming the difficulties of the situation and producing a safe and reliable fuse for circuits as high as 2500 volts. The design of an inclosed fuse to meet severe requirements is no easy matter. It has long been known that a proper fuse metal, the vapor of which will not readily support arcing, is a prime necessity, that the filler must be able to endure high temperature without itself fusing and causing trouble; and that it is wise to subdivide the metal of the fuse so that no considerable amount of vapor will have to be taken care of by the filler at one particular spot. The experiments which have led up to the present high-voltage fuse have included all of these things, and in addition the development of a filler with exceptional resistance against holding the arc and many details in connection of the fuse to the terminals. It has taken a good many years to bring the inclosed fuse up to its present point of efficiency, and the requirements of dealing with large currents and high voltages has been a very severe one, progressively more serious as time has gone on during the period of evolution. It is certainly satisfactory to realize that the manifold difficulties have now been sufficiently overcome to permit the production of a thoroughly dependable fuse for the primary voltages now in general use on circuits of large capacity.

Starting Induction Motors

PROFESSOR CLEWELL has an instructive tale to tell this week regarding the control of induction motors. It is a subject which is of very direct practical importance on account of the almost universal use of the induction motor for a very large variety of work. It is only in cases involving for the most part delicate speed control that the direct-current motor has intrinsically any special reason for being, although, of course, it is in many localities the only form of motor for which power can be obtained and is now, as it always will be, extremely useful. In starting induction motors practice has been very widely modified since the early days of the art. In the beginning the induction motor had to make its way against the most violent, not to say abusive, kind of competition, during which period all kinds of absurd things were required of it, things which no man contemporaneously dreamed of asking of a direct-current machine in regular service. The average central station twenty-five years ago was small in output and had meager copper in its distributing system. A high call for current at starting, particularly current very badly out of phase, was so serious a matter that early designers of induction motors were put to it to deal with the starting load in such manner as not to offend the delicate sensibility of the central-station men, stirred up to hypercritical caution by salesmen of direct-current apparatus. All that has, of course, now gone by with the overwhelmingly great use of alternating current, and the huge increase in station capacities makes a starting load of well-designed motors a relatively trivial matter. So it has come about that simple and effective automatic starting apparatus has come into use for induction motors of a kind which could not have obtained a hearing, much less commercial acceptance during the unnecessarily fussy period referred to. Small motors,, unless they have to deal with exceptionally great starting torques, are almost universally slammed on the lines with no more ceremony than one would exercise in turning on a bank of lamps. For larger motors some reasonable precautions are still in order. The larger squirrel-cage motors are customarily started at reduced transformer voltage by the use either of dead resistance or of the "autotransformer" or "compensator" device. As Professor Clewell notes, the resistance type of starter, very simple and cheap, is commonly employed with resistance in two only of the three leads. In good old times the very suggestion of this would have shocked the manufacturer and produced long and violent discussion in the columns of electrical papers. However, it works admirably with small loss of efficiency and great convenience. When the starting current is dropped below a predetermined point the automatic starter cuts the motor squarely over on to the supply mains, and that is the end of the matter. Starting at reduced voltage from some variety of auto-transformer is the method very commonly applied to the larger squirrel-cage machines. In its original form the motor was started on the low voltage and thrown over at somewhere near the proper point by a manual double-throw switch. This left rather too much to te discretion of the operator, and automatic controllers have in considerable measure come into use.

It has been found desirable to introduce certain devices to protect the insulation by disconnecting the low-voltage connection entirely after the motor is up to speed and by keeping the motor in circuit during the passage from low to high voltage by the use of a protective inductance or resistance to save the transformer. Very excellent automatic starters of such type are in use and have been evolved for convenient push-button control in which the operator can start the train of operations from one or several points distant from the motor. The slip-ring motor with wound rotor is the form widely used in cases where the starting torque is great and the motor of considerable size. Here, too, unbalanced secondaries are not infrequently used except in extreme cases of demand for torque, inasmuch as the apparatus is thereby simplified, and the operation appears to be entirely satisfactory. A well-designed controller, operating automatically on the secondary resistance, brings the motor up to speed with ample torque and great smoothness, although for certain special cases manual control still holds an important place. Altogether, the problem of easy and convenient starting for induction motors has been admirably solved, so that in point of fact nobody thinks seriously about it at all, but simply installs the type of starter which seems most convenient for the case in hand.

The New Wisconsin Lighting Code

THE Industrial Commission in the State of Wisconsin, which has been long conspicuous for its efficient work, has adopted a new code for the illumination of workshops which makes an important advance in that it actually puts measured limits on conditions likely to cause glare and specifies that reasonable illumination in foot-candles which is desirable for doing the work. The previous code was a good and useful one, but not sufficiently specific, and as the result of co-operation with the sub-committee of the Illuminating Engineering Society the new code was adopted.

The provisions of the earlier code were not sufficiently definite, and the Illuminating Engineering Society specification itself, that lamps "shall be suitably shaded to minimize glare," fails in being specific to the point which enables an inspector to determine whether the requirement is properly fulfilled. The rules now adopted require for all lamps hung under 20 feet 6 in. in height a maximum brilliancy at the visible source not exceeding 75 cp. for the brightest square inch. This is reduced to 3 cp. for local lighting. Here at last is a definite statement of reasonable requirements, and if it is enforced properly we shall say good-by to the unshaded lamp which has long been an eyesore in industrial lighting.

It is not altogether easy to measure up the candle-power per square-inch requirement, but it can be done, and the immediate effect of the rule will be that those installing lamps will play safe, as they can very readily do, and get rid of serious glare at the start. There are also very excellent foot-candle requirements for the amount of artificial light provided. The minimum permitted is a little below first-class current practice, but high enough to insure good illumination if an honest endeavor is made to conform to the regulations. The illumination thus required runs from 1.25 foot-candles for rough machining and assembling to 5 foot-candles for fine mechanical work. The code specifies that installations should be designed to provide initial values at least 25 per cent higher than the minimum, which takes fair account of the matter of ordinary maintenance. A study of the requirements as presented in the issue of the Electrical World for Aug. 31 will well repay the illuminating engineer, for the Wisconsin regulations are very much to the point and, also, they are a long step in the right direction.

The Coming Issues

IN CHOOSING the size of wire for motor loads it has always been sufficient to base this choice on the horse-power rating of the motor. In the light of a more critical examination of the problem, however, it appears that great economy in the use of copper may be effected by taking into consideration the short time or intermittent character of the load. In a short series of articles to appear in the Electrical World it will be shown how this economy may be realized. A résumé of what has been accomplished in the field of industrial applications of electricity, indicating the great future usefulness of electrical heating methods, will also appear. How a large company serving a great munitions center has met increased energy requirements, without additional generating equipment, by raising the power factor of the load should be a valuable example for the hard-pressed utilities. Uniform interpretation of service rules as developed by a state commission will be discussed and an important inter-connection of power systems will be described in the coming issues. The issue dated Sept. 21 will be devoted largely to problems connected with winning the war.

The Development of 2500-Volt Fuses

Experimental Investigations Leading to the Development of a Fuse That Is Not Destroyed by Modern High-Power Short Circuits—Essential Industries Are Effective Only When the Energy Supply Is Reliable

BY ROBERT CHARLES COLE, E. E.
The Johns-Pratt Company, Hartford, Conn.

ONE of the most important links between the industrial consumer and the central station is the 2500-volt fuse. The failure of a fuse to quench promptly an arc following short circuit may commonly result in the destruction of the whole fuse block and may involve a serious shut-down of machinery of vital importance to the industry and thus to the government. With the increase in generating capacity feeding short circuits, fuse manufacturers have found it necessary to develop their product to a considerable degree in order to meet the new conditions.

Analysis of Fuse Functions

But few persons realize how carefully the elements must be selected and adjusted to secure satisfactory operation under severe conditions. The function of the fusible element is to permit the passage of a predetermined amount of current, yet immediately open the circuit when this maximum limit is exceeded. The function of the filling material, on the other hand, is to assist in extinguishing the arc formed upon the disruption of the fusible element. It will be appreciated that there is the necessity for the closest coöperation between these elements in order that the desired result may be obtained.

Being in the nature of a thermal protective device, an inclosed fuse depends for its operation upon the conversion of a certain number of watts into heat units, which, when imposed upon the metal of the fusible element, raises its temperature to the melting point and causes the circuit to open. In parting, an arc is drawn between the severed ends of the element, which rapidly converts the molten metal of the link into vapor. Upon the relative conductivity of this vapor and the ease with which it may be condensed and rendered non-conducting by the filling material depends the successful or unsuccessful operation of the device.

It is apparent that those metals whose conductivity is high are preferable on account of the fact that a smaller mass is required for a given capacity, reducing the volume of metallic vapor to be condensed. The ideal metal also should have a fairly low melting point, reducing as much as possible the heat transmitted by conduction to the inclosing cartridge and its terminals. The vapors of some metals sustain the arc with great vehemence, while by the vapors of others it is maintained with difficulty. The latter are to be desired, as it is most advantageous to quench the arc immediately upon its formation.

Pure zinc has been found to embody all the essential characteristics which are necessary in a fusible element and hence has been quite generally adopted for this purpose by engineers. The vapor formed upon the volatilization of the metal rapidly oxidizes, and when condensed loses entirely any conducting property which it possessed in the gaseous state. Further, molten zinc is converted into vapor without explosive effect, although a rise in pressure owing to the difference in volume is to be expected.

The filling material selected must be a highly refractory substance, since if it becomes molten under the influence of the arc a conducting path will still be maintained between the ends of the severed fuse strip. Even a small amount of current passing through such a high-resistance path will generate a sufficient amount of heat to result ultimately in the destruction of the cartridge.

Inclosed fuses for the protection of 2500-volt circuits have been on the market since about 1900. At that time engineers had only to deal with the protection of single-phase systems of comparatively small capacity, few generators being larger than 500 kw. For several years, or until 1905, this line of apparatus was found to be very satisfactory, complaints of failure to operate properly being seldom if ever heard.

Standardizing Inclosed Fuses

However, with the tremendous growth of central-station capacity and the introduction of two-phase and three-phase systems it was soon discovered that the existing protective devices were unequal to the task of opening heavy overloads and short circuits.

After a careful investigation of the subject, in which the writer and the engineers of the various fuse manufacturers coöperated, standardizing dimensions for a new and improved line of fuses, their efforts culminated in the adoption, on April 7, 1909, of the present dimensions. Although the dimensions of the 2500-volt fuses made by the company with which the writer is connected, with one exception, have not been changed since their adoption in 1909, a great many improvements have been found necessary in the fusible elements and in the character of the filling material. An account thereof will be given to indicate what one company has done to develop such fuses.

The early fuses of 1900 to 1909 were provided with fusible elements consisting of a single strip of thin zinc surrounded by a granular filling of plaster of paris and whiting, calcium sulphate and calcium carbonate. This filling contains, under normal conditions, about 12 per cent water. The strips were of relatively compact cross-section with a minimum of surface in contact with the filling. The arcs resulting from the rupture of these elements were extinguished with difficulty by the filler. The ratio between the amount of fusible metal and heat-dissipating material was small.

These early fuses failed under the more severe conditions primarily because there was an insufficient amount of filling material to condense the metallic vapor before the temperature had risen to a point where the filler became molten. Often the circuit would be broken but a conducting path still maintained between the ends of the severed strip, which resulted in a gradual leakage of current and caused the ultimate destruction of the inclosing tube. In some instances also, even where the fuses operated satisfactorily, the large percentage of moisture in the filling made it possible for the potential impressed across the break to force a little current through the filling.

Before the improved fuses were designed in 1909, it had been determined by experiment that a certain volume ratio between the strip and filling material was necessary for successful operation. It was also discovered that if the fusible element were made of a thin wide strip, or its equivalent, a large number of thin and narrower strips, which had the result of bringing a greater extent of surface in contact with the heat-dissipating material, the quenching of the arc was greatly facilitated.

Multiple Fusible Strip Construction

The fusible elements in the first fuses produced after the standardization of sizes in 1909 consisted of thin wide strips formed with longitudinal corrugations, having calibration holes in each of the faces and soldered to rigid terminals. The filling employed was the calcium carbonate-sulphate combination referred to previously. After a brief field experience it was discovered that these rigid corrugated strips were quite apt to break at the calibration holes owing to the expansion and contraction of the fiber cartridge when heated and cooled. Sometimes only one or two of the solid portions between the holes would break, but the carrying capacity of the strip was interfered with and the fuse would blow below its rating, which caused much annoyance. The fact that the arc established upon the disruption of the fuse was confined to one path militated against the operation of the device.

Before giving up the corrugated strip construction, however, the experiment was tried of supplying one end of the strip with a flexible terminal consisting of a short length of stranded cable opened up in the form of a basket. This expedient did not produce desired results on account of the fact that the flexibility of the strands was destroyed by the solder with which the terminal was connected to the ferrule and by the filling material which closely surrounded it. It was seen that a multiple strip construction must be resorted to in order that the element could be broken up into the number of paths, resulting upon the operation of the fuse in the establishment of several low-capacity arcs, each in juxtaposition to its share of filling material. Short-circuit tests on such fuses indicated that most excellent results might be expected in practice, as very large-capacity circuits were opened without any exterior manifestation. Owing to the paucity of materials capable of withstanding the temperature of the arc, resort was had to the calcium carbonate-sulphate combination, as at that time a more satisfactory material had not been discovered. Fuses of the construction just described have demonstrated in use the absolute necessity for an improved heat-dissipating material.

There has been trouble with fuses of the multiple-strip construction blowing at their rated current. This trouble has been due to two causes—first, the breaking of the strips by the contraction and expansion of the cartridge; second, the corrosion of the strips where they were attached to the star-shaped terminals. In addition to these mechanical defects, it was found that the filling material was capable of permitting a leak between the severed ends of the fusible element, which caused the destruction of the fuse after it apparently had operated satisfactorily.

This problem was attacked and thousands of experiments were conducted—first, to determine a method of preventing strip corrosion and breakage; second, to discover a heat-dissipating material embodying all of the essential characteristics required, and, third, to determine the proper arrangement of the strips composing the fusible element.

The investigators were finally fortunate in discovering a material most admirably adapted to quench the arc. Owing, however, to the fact that its behavior under short-circuit conditions was not all that could be desired, a double-filling material scheme was determined upon, placing the material best adapted to quench the arc in the center of the tube and using the calcium carbonate-sulphate combination at either end.

New fluxes were compounded to prevent any corrosion of the strips in soldering, and a special low-melting-point alloy was devised to solder the strips to the star-shaped terminals. In addition, steps were taken to prevent any possibility of burning off the ends of the strips during the soldering operation, this being accomplished by the use of a soldering iron with a fixed maximum temperature far below the melting point of zinc.

Methods of Testing Fuses

The overload tests were made at 150 per cent current on hot fuses, this being recognized as the most severe condition under which a fuse could be called upon to operate. The fuses were heated by a low-voltage current for a sufficient length of time to bring them up to the maximum temperature and immediately thereafter were subjected to the overload at 2400 volts. Current for the test was obtained from a bank of two 200-kv.a. transformers fed from a 2000-kw. turbine used exclusively for this purpose, the current being regulated by means of large water resistance in the secondaries of the transformers. The closest regulation was possible and the test conditions were ideal.

The short-circuit tests were made across a 2000-kw. rotary converter, the circuit being closed by means of a non-automatic circuit breaker.

The final fuses resulting from the foregoing experiments operated without the slightest exterior manifestation under these extreme conditions of overload and short circuit. Surprising to state, the amount of metal dissipated as a result of the short-circuit condition is only very little more than that under the overload condition. This is accounted for by the fact that the new filling material is capable of condensing instantaneously the metallic vapor formed upon the disruption of the link before the arc has an opportunity to extend more than three-quarters of an inch.

It is not too much to say that these devices have now been developed to a point where they may be used under any condition of service and be expected to perform satisfactorily. Their use insures continuity of service except in cases where the circuit should be opened.

Control of Induction Motors

Fundamental Methods Outlined and Explained—Resistance-Type Starter, Auto-Transformer Method, the Use of the Choke-Coil Feature and of So-Called Preventive Resistance—Automatic Compensator

BY C. E. CLEWELL
Assistant Professor of Electrical Engineering, University of Pennsylvania

IN PRECEDING articles various references have been made to the highly developed state of standard controller equipments, both for direct-current and alternating-current motors, and in certain cases specific examples have been cited where the control apparatus has been designed to meet given conditions of the driven machinery. In the present article it is proposed to emphasize mainly the fundamental features of induction-motor starters and to point to some of the types which have been designed to cover special requirements of such motors during the starting interval.

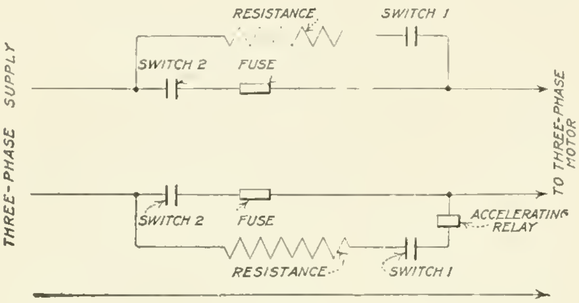

FIG. 1—CONNECTION DIAGRAM FOR RESISTANCE-TYPE INDUCTION-MOTOR-STARTING DEVICE

The operation of the outfit in Fig. 1 is as follows: Switch marked 1 in each case is first closed in the usual manner, thus connecting the primary of the motor to the supply through two of the three leads and through given resistances in these two leads. In closing the switch marked 1, below, the series-accelerating relay compression head is operated, the relay being held in an open position by means of a series coil in the relay. This coil, however, allows the plunger of the relay to drop as soon as the current falls to a prescribed value, after which the switches marked 2 in each case are closed and the motor is then connected directly to the supply mains.

Among the special requirements just referred to there may be mentioned the difficulty experienced due to the static discharge from the open end of an auto-transformer and the gradual breakdown of insulation when one terminal of the common auto-starter is left connected to the line after starting has been accomplished. This has led to the practice of disconnecting both terminals of the auto-starter after starting has been effected.

Another feature is the practice of keeping the motor connected to the line at the so-called transition period when starting, which has led to the use of a part of the transformer itself as a choke coil in the maintenance of the supply connection to the motor and of short-circuiting this part of the winding as soon as the motor is thrown directly on to the line. Again, this same general feature may be accomplished by the use of a preventive resistance so arranged as to prevent a short circuit of the transformer if the running point is reached before the starting point is disconnected. These features are discussed more in detail below in conjunction with Figs. 1 to 4 inclusive.

It will be noted that the foregoing points relate primarily to the starting of squirrel-cage induction motors. With the slip-ring type the common method of reducing the auxiliary secondary resistance is subject to the limitation that too great a reduction of this resistance will produce a decrease in the torque available and an increase in the current drawn from the line. Leading motor manufacturers operate the slip-ring type with unbalanced secondaries, the extra power taken for a given torque being small and there being a considerable saving in resistance. Moreover, the controller is rendered simpler by this practice.

Another point of considerable importance in the control of wound-rotor motors is the necessity of opening the primary circuit before the rotor circuit is opened. This is, of course, due to the high self-induction of such motors, which is manifested by an unduly high secondary voltage—as high as five to six times the normal value where the secondary circuit is opened before the primary—and hence in standard practice the secondary circuits are usually left closed in the controller off position.

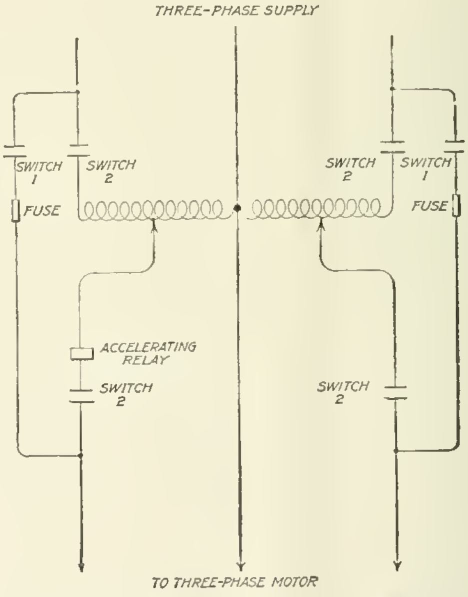

FIG. 2—INDUCTION-MOTOR STARTER USING AUTO-TRANSFORMERS; A COMMON METHOD

The accelerating series relay shown to the left in Fig. 2 is operated by the starting switch, the relay closing when the current drops to a prescribed value and automatically operating a "transfer" relay (not shown), which then connects the motor directly to the line. A convenience in the actual operation of such starters is the possibility of the use of a push-button for starting the motor.

It is important to make due allowances in the design or arrangements of the secondary resistance where the primary is reversed at the normal operating speed of the motor for the purpose of increasing the rotor slip, so as to insure the required torque with this higher slip. All such features should enter into the induction-motor control problem where they apply, and items of this kind have naturally been the basis for many of the refinements which have accompanied developments of alternating-current controllers in the past. The following paragraphs take up some of these details on a basis of actual equipment which is now on the market.

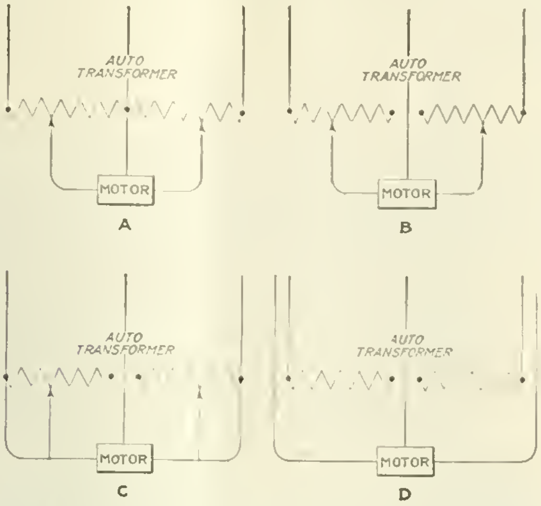

FIG. 3—SUCCESSIVE CONNECTIONS EMPLOYED IN THE AUTO-STARTER FOR INDUCTION MOTORS WITH CHOKE-COIL FEATURE

THE RESISTANCE-TYPE STARTER

The term "resistance type" as here used refers to the simple placing of resistance in series with the primary as indicated in Fig. 1. This scheme is both simple and cheap as the basis of an automatic starter and is adaptable to small motors in particular, although the scheme is not so good in point of efficiency as that of the auto-starter, which is shown in Fig. 2.

The so-called "resistance" starter for wound-rotor motors should not to be confused with that explained in Fig. 1, the former type referring, of course, to the auxiliary resistance placed in the secondary circuit and which is automatically or otherwise reduced as the motor starts up. In this case the primary is usually connected to the full voltage of the supply mains at the start, and the rotor resistance also serves in some cases as a means for speed adjustment during the normal motor operation.

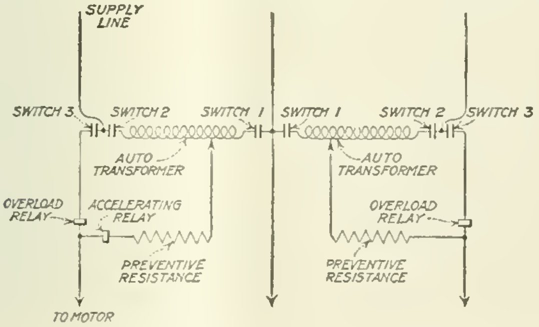

FIG. 4—PREVENTIVE-RESISTANCE FEATURE INCORPORATED IN AUTO-STARTER FOR INDUCTION MOTOR

The sequence of switch closure in Fig. 4 is as follows: For starting, switch No. 1 is first closed, then No. 2 is also closed. Finally No. 3 is closed That is to say, switch No. 1 is first; next, both No. 1 and No. 2 are in a closed position; then switches 1, 2 and 3 are all in the closed position simultaneously. For the running position of the controller switches No. 1 and 2 drop open, but not until No. 3 has been closed.

THE AUTO-TRANSFORMER STARTER[1]

The common method for induction-motor starting is by the use of the auto-transformer connection as illustrated in Fig. 2 for a three-phase motor. Similar connections may be made for two-phase motors. The scheme illustrated by Fig. 2 is that of the automatic starting with the auto-transformers through the medium of regular contactor switches. By the use of a three-pole starting switch both sides of the auto-coils are connected to the supply mains in such a way that a voltage lower than normal is applied to the motor.

For reasons stated before it may be desirable, especially in starting large motors by this auto-transformer method, to use a small portion of the transformer winding as a choke coil when changing from the starting to the running point of the controller, which serves as a means for passing from the starting to the running conditions without taking the motor from the line. The successive connections in this method are shown in Fig. 3, from which it will be noted that the voltage applied to the motor will be reduced just at the point where the part of the transformer winding is used as a choke coil. This reduced voltage, however, holds for a short interval only.

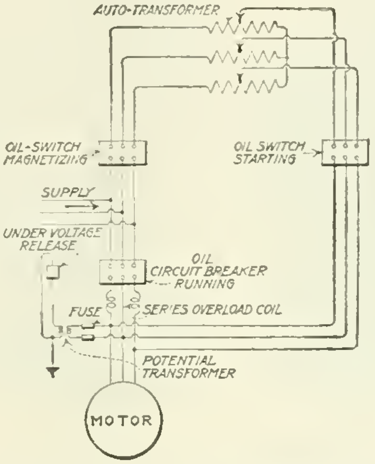

FIG. 5—DIAGRAM FOR THREE-PHASE, THREE-WIRE, SERIES-TRIPPING INDUCTION-MOTOR PANEL

This panel consists of one magnetizing switch, one starting switch, one face plate and tandem connection, one main circuit breaker, with series trip, three-pole, single-throw, and with time-limit attachments, one undervoltage attachment wound for the proper voltage and one mechanical interlock.

An interesting modification of the straight auto-transformer starter is shown in Fig. 4, in which a preventive resistance is employed so as to make it possible to connect the motor to the full supply voltage before the starting connection is broken, the auxiliary resistance in such cases simply serving to prevent a short circuit of the auto-transformer when switch 3 is closed, before switches 1 and 2 are opened.

Another function of this preventive resistance is to avoid the surges of current sometimes experienced owing to an interruption of the primary circuit when making the transfer from the starting to the running point of the controller. These possible surges are explained as being due to the connection of the motor to the line at a moment when the residual magnetism of the motor is reversed from what it should be. The resistances shown in Fig. 4 constitute one scheme for avoiding these effects.

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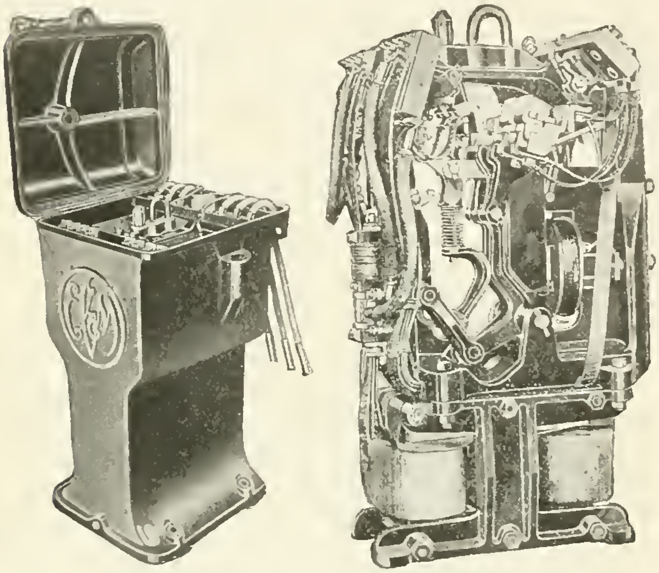
[1] The terms "auto-starter" and "compensator" are trade names adopted by competing companies, and both refer to the same apparatus in which the connections are the same. The term "auto-starter" was presumably derived from the term "auto-transformer starter," since the transformer used is the form commonly known as the "auto-transformer." The term "auto-starter" is used by the Westinghouse Electric & Manufacturing Company, and the term "compensator" by the General Electric Company.

An Automatic Starter

An interesting development of automatic induction-motor starter equipment is the compensator illustrated in Figs. 6 and 7, this device being designed for squirrel-cage motor starting and being of special value for plants which have no electrical department. This apparatus is actuated by a pushbutton station, which may be placed at a point most convenient for the operator, whereas the compensator may be installed at or near the motor, thus minimizing the expense for wiring between the motor and the compensator. By its use the personal element of an operator is removed and the motor started in the briefest time consistent with the good of the equipment, and the acceleration period is lengthened automatically with the heavier loads. Furthermore, several push-buttons may be used, each for starting and stopping. It is possible to lock these buttons in the stop position so as to prevent starting from any other button stations until the given button lock is released.



FIGS. 6 AND 7—AUTOMATIC COMPENSATOR WITH COVER REMOVED; MECHANISM OF AN AUTOMATIC COMPENSATOR

This type of compensator consists of an iron case with a removable cover, shown in Fig. 6.[2] The compensator itself is submerged in oil in this case. When the push-button is pressed, an operating magnet in the compensator closes the contactor switches, which start the motor by throwing it on the reduced voltage of the auto-transformer connection.

As the motor speeds up the decreasing value of the current allows the transition relay to open the starting contacts and the running contacts to close. Pushing the button again merely de-energizes the operating magnet, thus throwing the compensator to its off position and stopping the motor. The appearance of the interior of this device is clearly shown in Fig. 7. Instead of a push-button, a master switch, as shown in Fig. 11, may be employed, the latter furnishing remote control as well as automatic starting and no-voltage protection.

Protective Panel

The automatic compensator just referred to may be used in conjunction with a protective panel (Fig. 12) to give time-element overload protection, or in another form to give phase failure as well as overload protection. Note in Fig. 12 that this panel is in the form of a compact case in which there are two inverse time-element overload relays that are in circuit both during starting and running, and which may be adjusted so as to trip at any current over a considerable range, the usual practice being to adjust them to trip somewhat above the full-load value. Because of the large starting current, the relays start to operate, but the time element prevents the relays from opening the circuit except in cases where the compensator is left on the starting notch too long or where the motor fails to start. The plungers in these relays are so designed that the pull remains the same; hence, although the plunger may be half way up, a reduction of the current below the relay operating point means that the relay will return to its normal position. By a special instantaneous tripping feature which is independent in its operation from the time-limit feature, the motor is instantly disconnected from the line if the load exceeds some given prescribed value for which the tripping device is set.

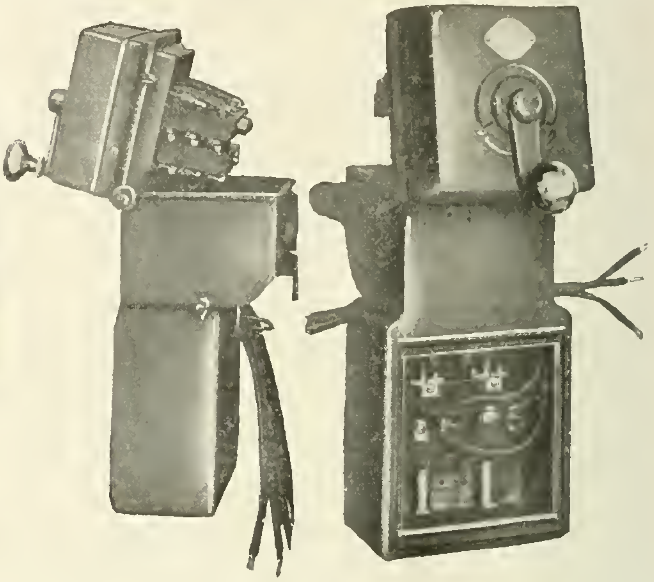


FIG. 8—STAR-DELTA STARTER, (A) SIDE VIEW AND POSITIONS OF LEADS, (B) COVER OFF, SWITCH PARTLY OUT OF TANK

The overload panel shown in Fig. 12 is reset by the push-button seen in the front of the case, but remote control may also be made a part of the equipment. This means that after an overload it is merely necessary to press the push-button to reset for operation. The ordinary compensator of Fig. 6, without auxiliary equipment, can be secured either for no-voltage release or for no-voltage protection. With the former the motor starts up again automatically after voltage failure when the line is again alive, while with the latter the motor will not start after voltage failure until the start push-button is pressed again. Two control wires are required with the former and three with the latter method.

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[2] Figs. 6, 7, 11 and 12 are due to the Electric Controller & Manufacturing Company, Fig. 5 to the Condit Electric Manufacturing Company. Figs. 8 and 9 to the Crocker-Wheeler Company, and Fig. 10 to the Westinghouse Electric & Manufacturing Company. Figs. 1, 2, 3 and 4 have been drawn up on a basis of diagrams found in the data referred to in the bibliography at the end of this article.

The contacts of the automatic compensator may readily be taken out since they are fastened on the contact seat by a bolt with slotted head. A tongue in the contact seat corresponds with the groove in the contact itself, while the bolt simply passes through the open slot. To remove the contact the bolt is turned several times, and the contact, if lifted so as to clear the tongue, may then be moved so as to free itself from the bolt. The advantage of this plan is apparent because of the avoidance of taking out the bolt when the contact is removed. This form of slotted contact, however, has not been considered good practice by certain motor users, with the result that there has been a tendency to substitute a hole for a slot in the contacts for magnetic contactors in some cases.

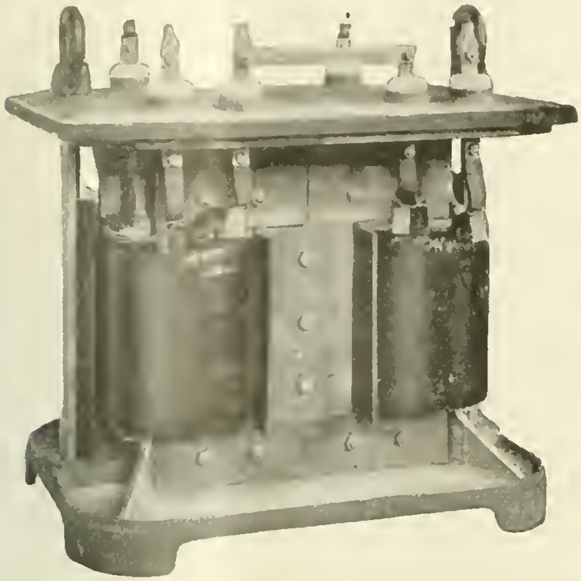


FIG. 9—AUTO-TRANSFORMER FOR STARTING A 900-HP. ALTERNATING-CURRENT MOTOR

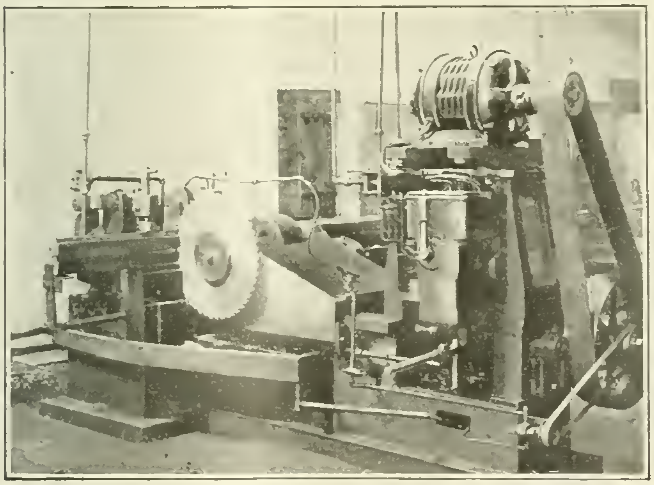
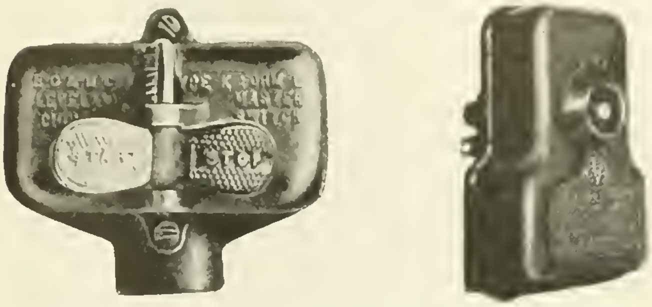


FIG. 10—INDUCTION-MOTOR APPLICATION WITH STARTER MOUNTED ON SIDE OF MACHINE

The features described in the above notes, and more particularly those cases typified by Figs. 1 to 4, may be accommodated on regular starting panels, which naturally differ to some extent with the various manufacturers. In Fig. 5 a diagram of the connections for one form of panel is shown.[3]

Bibliography.—Article by S. Q. Hayes on "Motor Starters," "Handbook for Electrical Engineers," John Wiley & Sons, New York, p. 1368; data, bulletins and other information from the Electric Controller & Manufacturing Company and the Westinghouse Electric & Manufacturing Company, together with comments by H. D. James of the latter company.



FIGS. 11 AND 12—MASTER SWITCH USED WITH AUTOMATIC COMPENSATORS FOR NO-VOLTAGE RELEASE; PROTECTIVE PANEL FOR USE WITH AUTOMATIC COMPENSATOR. NOTE THE PUSH-BUTTON RE-SET

STORAGE OF COAL FOR THE WINTER MONTHS

Coal in Demand for Such Storage by Preferred Consumers Shall Not Be Available for Storage by Non-Preferred Consumers

Evans Woollen, acting director of the Bureau of State Organizations of the United States Fuel Administration, and Federal Fuel Administrator for Indiana, addressing the conference of county fuel chairmen for New York State, in session in New York City, said in part:

> Notwithstanding whatsoever increase is within the possibilities, no assurance can be given against a serious coal shortage. The reason, of course, is that the war-made demand keeps bounding on beyond reach. Let me give a single instance. The allotment to the navy at the beginning of the coal year was 3,500,000 tons. It is now estimated that the requirement for the year will be 8,000,000 tons. Having in mind a multitude of such instances, we do not hesitate in the assertion that the Fuel Administration's problem as of April 1, the beginning of the coal year, has been solved. It is the problem caused since April 1 by the enlarging war program that has not been solved.
>
> In view of this enlarging program and consequent fuel problem, there is necessity for a modification of the Fuel Administration's policy in the matter of storage. We are, as you know, well informed about storage by the reports we now have weekly from nearly 100,000 industries, utilities and retailers. From these reports it is evident that storage by non-preferred consumers must be checked. The administration's policy, as modified under existing conditions, is based on the assumption that the hazards of winter delivery should be borne by the non-preferred consumers. Accordingly it is being provided that coal in demand for winter storage by preferred consumers shall not be available for such storage by non-preferred consumers. You will find yourselves much engaged during the ensuing weeks in carrying out that policy.

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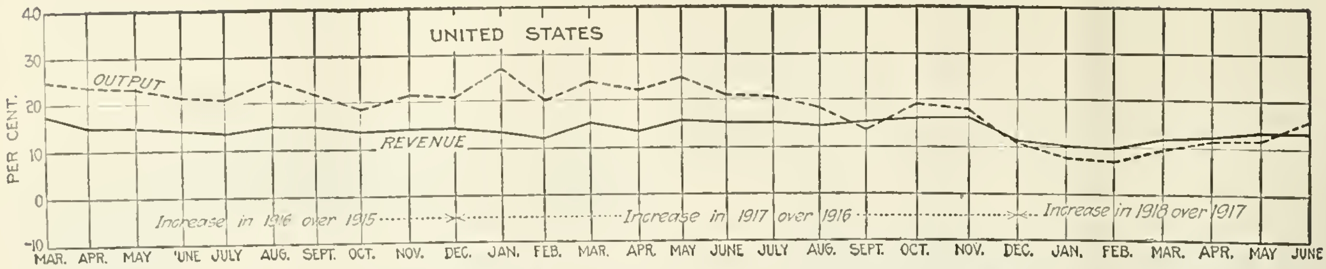
[3] Condit Electrical Manufacturing Company, bulletin 416, p. 8.

Central Station June Operations



CONTINUED INCREASE IS SHOWN IN THE VOLUME OF POWER PRODUCED

PRELIMINARY statistics of central-station operations in June indicate more sharply a tendency which has been developing slowly but surely in recent months. This is, that the percentage gain in output has again become larger than the percentage gain in revenue. This condition is reported for 54 per cent of the industry, and of course it may be altered when belated returns are received from the other properties which report regularly for the ELECTRICAL WORLD compilation. In the review of the April statistics, published in the issue of July 6, attention was called to the narrowing margin between the percentage increase in revenue and the percentage increase in output. Previously it had appeared, though the complicating conditions of war made accurate inference difficult, that the properties were feeling the effect of rate advances and that the period in which the percentage gain in output exceeded the percentage gain in revenue might be succeeded by a period in which the pendulum would swing to the other side for a time.

The June returns, covering as stated 54 per cent of the industry, show an increase in revenue, as compared with June, 1917, of 14.2 per cent, and in kilowatt-hour output of 15.9 per cent. Based on these data the ELECTRICAL WORLD estimate for June for the entire industry is: Revenue, $399,633,000; output, 2,380,583,000 kw.hr.

Outside of the apparent change in the relative revenue gain and output gain, the chief interest in the returns lies in the continued enlargement in power production which they show. And it is indicative of our tremendous war industrial activities that the increase of 15.9 per cent over June, 1917, follows an increase of 20.8 per cent in June, 1917, as compared with June, 1916.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Industry Represented	Revenue from the Sale of Energy			Kw.-Hr. Output		
		1917	1916	Per Cent Increase	1917	1916	Per Cent Increase
July.	63	$22,768,000	$19,680,000	15.8	1,397,482,000	1,159,410,000	20.8
Aug.	63	22,718,000	19,972,000	13.8	1,451,928,000	1,223,373,000	18.7
Sept.	63	23,861,000	20,896,000	14.3	1,376,370,000	1,219,117,000	13.8
Oct.	62	25,748,000	22,334,000	15.4	1,522,149,000	1,279,140,000	19.5
Nov.	62	26,665,000	23,183,000	17.0	1,485,370,000	1,292,113,000	15.7
Dec.	58	28,144,000	25,026,000	12.4	1,517,001,000	1,362,299,000	11.0
		1918	1917		1918	1917	
Jan.	62	27,035,000	24,977,000	8.2	1,508,353,000	1,422,121,000	6.3
Feb.	60	24,690,000	22,307,000	10.6	1,254,217,000	1,168,288,000	7.1
Mar.	60	25,396,000	22,702,000	12.3	1,418,222,000	1,294,561,000	9.4
Apr.	60	25,864,000	22,966,000	12.6	1,450,221,000	1,297,843,000	11.5
May.	62	25,365,000	22,426,000	13.1	1,537,527,000	1,372,935,000	11.9
June	54	21,402,000	18,732,000	14.2	1,285,515,000	1,108,966,000	15.9

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

		New England States				Atlantic States				Central States				Pacific and Mountain States			
	Month	Percentage of Industry Represented	1917	1916	Per Cent Increase	Percentage of Industry Represented	1917	1916	Per Cent Increase	Percentage of Industry Represented	1917	1916	Per Cent Increase	Percentage of Industry Represented	1917	1916	Per Cent Increase
REVENUE	July	64	$2,634,000	$2,205,000	19.4	65	$8,919,000	$7,687,000	16.1	53	$6,690,000	$5,643,000	18.6	86	$4,482,000	$4,110,000	9.2
	August	64	2,352,000	2,025,000	16.2	65	9,021,000	7,881,000	14.5	53	6,910,000	5,718,000	20.9	87	4,819,000	4,270,000	21.9
	Sept.	64	2,811,000	2,362,000	19.0	64	9,139,000	7,963,000	14.7	53	7,232,000	6,177,000	17.1	87	4,636,000	4,355,000	6.4
	Oct.	64	3,057,000	2,530,000	20.7	66	10,683,000	9,173,000	16.5	52	7,422,000	6,304,000	17.8	85	4,586,000	4,327,000	6.1
	Nov.	64	3,391,000	2,834,000	19.7	65	10,159,000	8,873,000	14.5	52	8,454,000	7,063,000	19.7	84	4,661,000	4,410,000	5.9
	Dec.	64	3,483,000	2,999,000	16.1	58	10,834,000	9,949,000	8.8	48	8,935,000	7,464,000	19.7	82	4,892,000	4,614,000	0.6
			1918	1917			1918	1917			1918	1917			1918	1917	
	Jan.	63	3,393,000	2,990,000	13.8	64	9,677,000	9,517,000	1.6	53	8,862,000	7,639,000	16.8	86	5,113,000	4,831,000	5.8
	Feb.	62	2,995,000	2,272,000	8.0	57	9,473,000	8,658,000	8.6	53	7,779,000	6,746,000	15.3	84	4,443,000	4,131,000	9.5
	March	62	2,985,000	2,724,000	9.2	59	9,904,000	8,922,000	11.0	53	7,947,000	6,735,000	18.0	84	4,560,000	4,321,000	5.5
	April	62	2,890,000	2,578,000	12.1	59	10,054,000	8,946,000	12.4	53	8,431,000	7,103,000	18.7	84	4,489,000	4,339,000	3.5
	May	62	2,810,000	2,530,000	11.5	64	9,929,000	8,613,000	15.3	53	8,217,000	6,956,000	18.1	83	4,805,000	4,327,000	12.0
	June	53	2,506,000	2,204,000	13.7	50	7,646,000	6,759,000	15.3	46	7,139,000	5,998 000	19.0	76	4,111,000	3,671,000	12.0
KW.-HR OUTPUT			1917	1916			1917	1916			1917	1916			1917	1916	
	July	64	109,399,000	83,451,000	31.4	65	494,965,000	396,538,000	24.8	53	379,087,000	311,931,000	21.5	86	412,635,000	366,237,000	12.7
	August	64	105,848,000	85,113,000	24.5	65	514,254,000	420,806,000	22.3	53	415,966,000	333,549,000	24.7	87	413,462,000	381,353,000	8.3
	Sept.	64	114,339,000	92,319,000	24.0	64	482,112,000	405,070,000	19.0	53	399,480,000	345,953,000	15.5	87	379,221,000	374,685,000	1.4
	Oct.	64	121,666,000	94,853,000	28.5	66	589,242,000	472,619,000	24.5	52	417,018,000	351,713,000	17.0	85	394,223,000	359,955,000	9.6
	Nov.	64	130,311,000	108,561,000	20.0	65	532,301,000	445,537,000	19.6	52	443,374,000	384,480,000	15.2	84	379,384,000	357,535,000	6.1
	Dec.	64	135,703,000	111,342,000	21.8	58	548,316,000	486,368,000	12.7	48	437,264,000	367,534,000	12.8	82	395,518,000	377,058,000	4.8
			1918	1917			1918	1917			1918	1917			1918	1917	
	Jan.	63	125,212,000	111,339,000	12.4	64	477,200,000	466,158,000	2.3	53	486,291,000	453,009,000	7.3	86	419,651,000	391,624,000	7.3
	Feb.	62	110,454,000	102,562,000	7.7	57	438,721,000	403,122,000	8.3	53	358,276,000	342,257,000	4.5	84	346,766,000	320,025,000	8.4
	March	62	121,518,000	111,576,000	8.9	59	501,320,000	452,250,000	10.8	53	398,166,000	356,860,000	11.5	84	397,218,000	373,875,000	6.2
	April	62	117,416,000	101,888,000	15.2	59	497,460,000	431,786,000	15.2	53	437,054,000	392,304,000	11.4	84	399,126,000	372,465,000	7.1
	May	62	121,751,000	105,601,000	15.3	64	512,202,000	455,977,000	12.3	53	441,202,000	404,560,000	9.0	83	462,372,000	406,797,000	13.6
	June	53	109,719,000	89,695,000	21.9	50	408,057,000	358,114,000	13.9	46	388,017,000	335,802,000	15.5	76	379,722,000	325,075,000	16.8

Cost Versus Value of Service in Rate Making—II

Differences in Classes of Service Involve Varying Methods of Determining Basis for Rates to Avoid Actual Loss in Carrying Certain Customers —The Public Policy Involved

BY PROF. JOHN BAUER
Princeton University

TO WHAT extent may cost rates be applied to electric companies for the control of return on investment? As electric companies are usually organized, costs may be readily separated by localities. There are, of course, many joint locality costs, and rates often do merge into each other between localities; still, this factor is usually not serious in fixing a rate schedule. At least the operating units are usually restricted to individual places, so that the bulk of the investment and operating expense can be directly assigned to each.

But as to the different classes of service, there is considerable difficulty. It is hard to define just what constitutes a single class of electric service. Strictly speaking, there are hundreds of classes, but practically they must be brought into ten or at most a dozen groups. Usually, most of the costs are joint, and none can be directly assigned to any particular unit of service. But perhaps half of the costs can, nevertheless, be fairly definitely apportioned between classes of service. For our purpose, the total costs, including operating expenses, taxes and return on investment, may be divided into four groups: (1) Costs that vary almost directly with the quantity of current used; (2) those that vary with the number of consumers; (3) those that vary with the maximum demand upon the investment, and (4) joint and fixed costs that practically do not vary either with the quantity of current, number of consumers or class of service. While, in general, this classification is clear, the actual separation into the four groups is often a difficult matter, requiring many arbitrary dispositions.

Any schedule of rates must provide for the first three classes of costs, otherwise service would be furnished at outright loss. These may be called out-of-pocket costs, and they fix the minimum rates at which current can be delivered. The first two, those varying with the quantity of current and number of consumers, can usually be fairly definitely determined, though not absolutely. But the third, the so-called maximum demand costs, usually present difficulties and require rough approximations. Obviously, if any class of service calls for a particular investment, it ought to bear the necessary return paid, or it will be furnished at a loss. For this purpose, the maximum demand charge is made. This proposes to distribute the investment or interest costs among the different classes of consumers in proportion to the amount of investment that they require.

This purpose is scientifically sound, but is beset by very grave difficulties. First, by no means all investment costs vary with the maximum demand upon the utility. A large proportion of the investment is practically constant, whatever the maximum demand may be —for example, the underground and overhead transmission and distribution costs. In the second place, while additional investment is required with the increase in maximum demand, this applies to the company as a whole, but does not show at all the contribution to the total maximum by each individual or class of consumers. For the company, the maximum is fixed by the peak load, and there should always be at least a 25 per cent margin of capacity above the peak. But the contribution of any consumer to the peak is hard to determine.

Obviously, a consumer or a class of consumers may have a large individual maximum demand, and yet not contribute at all to the company's peak load, and consequently may not cause any out-of-pocket cost for investment. While, then, the maximum demand factor should be computed, it is an indefinite quantity and at best can only be roughly determined.

When the out-of-pocket costs have been computed and are used as minimum rates, there is left, then, a large proportion of the total costs which cannot be considered due to any particular class of service, but which, nevertheless, must be borne by the consumers if the company is to get a fair return on the investment. Just how the apportionment is to be made must be carefully studied for each particular case. The costs are joint and fixed; consequently, no one particular method of distribution is correct. One method may be satisfactory in one case but not in another. These joint or overhead costs include some of the production expenses, a large proportion of the transmission and distribution expenses, practically all the general expenses, and a considerable proportion of the depreciation, taxes and return on investment. In most cases they probably constitute 50 per cent or more of the costs placed upon the consumers.

COMMERCIAL AND DOMESTIC RATES

Whatever rule be used for the apportionment of these joint costs, it must properly take into consideration what the traffic will bear for each class of service. As already stated, the service may be divided into an indefinite number of classes. For our present purpose, however, we may content ourselves with the following very simple classification: (1) domestic lighting, (2) commercial lighting, (3) municipal lighting, (4) commercial power—small and moderate consumers, and (5) commercial power—large consumers. Each of these classes may be further subdivided, or some other major classification may be used. But, just as to these five groups, how should the joint costs be apportioned? Usually only a small proportion can be placed upon large commercial power consumers. They must be granted low rates if they are to use current at all, because of competition in production. Moreover, since they have a very favorable load factor, they can produce current cheaply for themselves, or they can use steam or other substitutes for electricity. In fixing power rates, therefore, care must be taken that the out-of-pocket cost be provided; then the addition for the joint overhead must be according to what the traffic will bear. If a rule-of-thumb method of apportionment be used blindly, on the basis of some average cost consideration, it may place a smaller burden upon the large power consumers than they can bear; but if it attempts to place a larger burden upon them, it will result in diminished consumption and finally in larger overhead costs for other classes.

The same consideration of what the traffic will bear applies to the smaller commercial power consumers and to commercial lighting, except that they usually have little choice of alternatives; they simply either take current or do not at given rates. But the demand of such consumers is usually within certain limits very elastic, so that relatively a small change in rates will result either in a large increase or decrease in consumption. This scale must be carefully studied in each case, and it obviously determines what the traffic will bear. The rates, then, should include all out-of-pocket costs, including the maximum demand factor, but must not overreach what the traffic will bear as to the joint overhead costs of the company.

Municipal rates, unfortunately, are usually made on a political rather than commercial basis. According to the latter, the rates should follow the same principles that apply to power and commercial lighting. The out-of-pocket costs are usually very low, because of the favorable load factor, and because of the long night service when all other service is at a minimum. The apportionment of joint overhead is usually large, because the municipality does not actively seek alternative service. Under the political circumstances, the traffic usually bears an unnecessarily large addition to the out-of-pocket costs.

Finally, domestic lighting really follows the same principle: the rates must provide for out-of-pocket costs, including the maximum demand charge, and include so much of the joint costs as the traffic will bear. But several special considerations must be kept in mind. First, the out-of-pocket costs are usually much higher per kilowatt-hour than for any of the other classes, so that at best the service is restricted to the more comfortable economic groups. There seems to be little chance, without direct loss, to make rates so low as to make electric lighting available to the working classes in place of gas or kerosene. Second, within the fairly limited economic group for which electric lighting is feasible, what the traffic will bear appears relatively much higher above the out-of-pocket costs than for other classes of consumers. The result is that when as much as possible of the joint overhead has been placed upon the other classes, the remainder may usually be placed upon domestic lighting without reaching what the traffic will bear. But, of course, there are instances when this is not true, when total joint costs simply cannot be recouped from total service and are an inevitable loss.

The usual procedure in fixing an electric rate schedule amounts to this, especially when scientific methods are used: (1) the total costs are computed, including operating expenses, taxes and return on investment; (2) an analysis is made of the classes of consumers; (3) the out-of-pocket costs are determined for each class to fix the minimum rates; (4) for power and commercial lighting, an addition is made for joint overhead costs according to what the traffic will bear; usually this step is not an avowed one, but the methods of apportionment used are so selected as to achieve the same result; (5) the residual overhead is then placed upon domestic lighting, and may result in a reduction in rates.

It would be blind procedure to apportion the joint costs on any arbitrary rule. The fundamental guide in the distribution must be what the traffic will bear, but the company must not obtain excessive returns on investment. The common procedure as just outlined, even though it is not avowedly so determined, usually relieves only the domestic lighting rates, or in addition also the commercial lighting, placing on the other classes of service what the traffic will bear. On the whole, this is probably a sensible policy. There is no very good reason why power consumers, or even commercial lighting, should not pay what the traffic will bear, since the rates form only a part of such consumers' production costs, and any lower rates than what the traffic will bear might not benefit the ultimate consumers, but would simply secure for the persons concerned higher business profits. If any group is to be benefited, it would sensibly be domestic lighting; for any reduction below what the traffic will bear would go directly to the ultimate consumer.

In conclusion, however, the final question may be raised, why should rates be fixed below what the traffic will bear even for domestic consumers? What important public policy is there involved? As already stated, the domestic consumers are largely moderately well-to-do people; the poorer classes cannot afford electricity even at rates covering only out-of-pocket costs. The electric users pay for luxuries and conveniences of all sorts, whose prices are fixed according to what the traffic will bear. Is there any really compelling reason why they should not pay on the same basis for electricity? In raising this question, the purpose is not to defend any particular view, but merely to raise the issue as to desirable policy. The reason for relief, however, would be greater if the domestic consumers consisted more largely of poorer people, as is true of gas and water consumers and users of the electric railways.

PUBLIC POLICY INVOLVED

As a matter of public policy, it is a question for fair consideration whether the return on investment to electric companies may better be restricted through rates to domestic consumers, or whether rates might better be fixed throughout according to the value of service and the excess earnings be taken for public purposes. While the latter would be a departure from the almost generally established policy, it would make rate control less difficult and would furnish an important source of public revenues without causing greater economic hardships than the payment of other prices that are determined according to general market conditions. It would be in line with the New York City subway contracts, the Chicago street railway agreement, and the street railway settlements in several cities, which provide for division of profits between companies and the city. And it would agree more particularly with the new national railway policy, which will pay the railroads a fixed return on investment, has ordered extensive increases in rates, and will retain the earnings above the payments to the companies for the general benefit of the public. At any rate, just how the return on investment shall be controlled is a matter of policy, and not fundamental law, and should be considered from this viewpoint by the legislatures and commissions in dealing with rate control.

Attitude of Central Stations on Rates

Economic Changes in Rate Making Policies and Practice to Be Anticipated as a Result of the War-Time Upheaval in Operating Costs and Conditions

In recent issues the ELECTRICAL WORLD has printed facts and opinions obtained from state public service commissions on the effect of changed operating costs on rates. It will publish also the views of a number of operating officials of central-station companies. The attention of readers is called to the discussion, not only of present extraordinary conditions, but also of the strong influence of these conditions upon future rate-making policies. Other articles will appear in early issues.

AS IN the case of the public service commissions, those to whom the ELECTRICAL WORLD sent inquiries on this subject were asked for general information on the changes in rates under their individual jurisdiction.

As the replies are in part from the officials of holding companies controlling large numbers of operating companies, they include a presentation of conditions in all sections of the country and cover both hydroelectric and steam stations as well as properties of all sizes.

EXPECTS MODIFIED POLICY AND PRACTICE

S. C. Moore, general manager, New England Power Company, writes:

"Replying to your letter requesting an expression of opinion on the subject of whether the economic changes due to the war would cause a permanent change, or a change lasting for many years, in the central-station policies, there is no doubt that we have learned many lessons due to the economic changes brought on by the war, and that these lessons will materially modify the policy and practice of power companies.

"The most important change will, I think, be in the making of power contracts in such a manner that any material increase in the cost of power will (as in the case of every other commodity) be borne by the consumer. This will apply to all elements of cost, and conversely the consumer must profit by the decrease. In other words, we must more nearly approach the principle that a power company is nothing more or less than a collection of power houses of the various industries it serves, and that the industries receive their power at a price which includes all the costs and a reasonable margin of profit to the power company.

"So far there has been no economic change brought about by the war which would tend to show that the basic economic principles ('specialization' and 'quantity production') underlying the distribution of power from a large central source or sources are unsound, but rather the reverse is true. These principles have been accentuated, and the unprecedented demand for additional power is evidence that the industries of the country have come to realize more and more that their power supply can not only be obtained at a lower cost, but that the quality and continuity of this supply is better insured from such a large central source or sources.

"If this supply is to be maintained and every method employed to guarantee uninterrupted and satisfactory service, a living rate must be obtained by the power companies."

UTILITIES NEED INCREASED REVENUES

The president of a large holding company expresses the following opinions:

"All of the electric utilities in which this company is interested are seeking increases in rates in one form or another, to overcome higher costs of operation and costs of service.

"The general public recognizes that the costs of service have been increased. They are more impressed with the increases in the cost of coal and with the increases in labor than with any other of the factors that have resulted in increased costs of service. There is, as always an element in the public that protests against increases in rates or contemplated increases, either from a desire to achieve political distinction or from the carrying out of some pet theory of politics or economic philosophy. The expressed views of this element led to delay.

"I am unable to give you any information concerning average rates of increase. When a simple analysis of costs is made, it discloses that the increases may b generally grouped into two principal components, on varying with the customers and the other varying with the amount of energy consumed. The one varying with the customers is, under present conditions, something on the order of an increase of 30 cents per month per customer, and the one varying with the amount of energy consumed is on the order of 0.5 cent to 0.9 cent per kilowatt-hour sold, depending upon character of plant and source of fuel supply, if fuel is burned. Different conditions will produce different results, and further rises in operating expenses will change the magnitude of these increases and probably their relative proportion.

"Commissions are generally sympathetic with the view that the electric utilities should receive higher rates; so far as I know, no commission has yet worked out a general solution of the problem of increasing rates. Every commission is confronted, in considering increased rates, with the following problems:

"(a) The large user of energy for power service admits that the cost of coal has increased very largely. Such a customer does not as a rule object to increases in rates, provided that all customers are similarly increased. He naturally prefers a percentage increase applied to all rates rather than the addition of a specified rate per kilowatt-hour. He objects to the exemption of residence customers:

"(b) The small customer, as exemplified in the residence and small-store classes, claims that the rate being paid by him is five to ten times the rate paid by the large power user; therefore his rate should not be increased, but the burden of increased expenses should be carried by the large power customer, who heretofore, he claims, has enjoyed a distinct advantage. The small customer, of course, loses sight of the higher unit cost, even during normal times, of serving him, because of the influence in cost of service of the distribution or spread factor and customer's costs:

"(c) When a commission is confronted with the two viewpoints just described, it has to determine whether or not the old rates were equitable as between the different classes of customers. If they were equitable, then customers should bear an increase in proportion to the increases in costs. These increases cannot be determined by either a uniform percentage addition to the old rates or by a uniform additional rate per kilowatt-hour of energy consumed; they take the form previously indicated. If the commission determines that the old rates were not equitable as between different classes of customers, it will have to determine what the equitable rates would have been and then recompute the schedules on the basis of the increased costs. This is a very complicated problem and one not susceptible of uniform analysis. There are many opportunities for the exercise of opinion, judgment and experience, and different people of equal mental capacity are likely to arrive at widely varying results, depending upon their original viewpoint.

"There is a good deal of hesitancy on the part of commissions to grant the needed increases upon the basis of increased costs experienced during a few months, or upon estimates of costs likely to be incurred. Some commissions seem to be of the opinion that a whole year's experience is necessary. Commissions are generally inclined in many states to waive the necessity of a valuation of the utility property, while other commissions, seeking possibly to punish a utility for what they believed to be either conservative financing, economical operation or excessive earnings, are inclined to require a valuation. This is one of the causes contributing to delay. In none of our companies that have obtained increases in rates have the increases fully offset the higher operating costs.

"Rate making has been in very large part in the past an individual operation. The work of the National Electric Light Association in attempting to standardize rate schedules has borne fruit. Commissions have done something in this respect in their respective states. While the fundamental principles of rate making have been pretty generally agreed upon, the methods of applying these principles vary greatly. I hesitate to predict whether the present increased costs of operation are likely to change in important respects the structure of existing rate schedules. What the utilities need is increased revenues, and, for the time being at least, they are far more interested in the substance than they are in the form."

HIGHER RATES FOR MANY YEARS

W. G. Vincent, Jr., valuation engineer, Pacific Gas & Electric Company, expresses the following opinion:

"I believe it is inevitable that electric central-station rates will in general be higher for many years in the future than they have been in recently past years.

"There are two basic conditions that fix the general level of rates, namely, the cost of supplying the service and the cost of obtaining the service from other sources, and inasmuch as the changes in recent years in both of these conditions have been of the same general nature—that is, increasing costs—central-station rates are being increased and will continue to be increased until they are sufficient to cover fully the increased costs of supplying the service or until any further increase will raise them above the cost of service from other sources. This latter point may be reached in certain classes of service before the rates are sufficient to cover fully the costs, and in such cases the other classes of service will have to be increased beyond the cost of service of those classes.

"The changes that have brought about this condition are of such a nature that they may be expected to be more or less permanent, *i.e.*, increased wages, materials, fuel, taxes, etc., and while after the period of the war reductions may be expected in some of these items, it seems hardly possible that they will return to their pre-war standards for many years, if at all.

"Up to the present there has been a tendency to place the burden of the increase largely upon the power users, and while this practice may offer a temporary solution of the difficulty, it is doubtful if in the long run it will prove to be the best way out for all concerned. Lighting rates, which in general are not being increased, have been much lower than was justifiable on either the cost of service or the value of service theories, and by retaining them at the same level under the present condition they are relatively lower than they were before. If, in the future readjustments of conditions, cost of competitive power is lowered more rapidly than central-station costs, central-station power rates will have to meet the competitive costs, and lighting rates may have to then be raised during a period of falling prices, which will bring about a situation very difficult to meet."

PUBLIC AND COMMISSIONS APPRECIATE THE SITUATION

W. S. Barstow, W. S. Barstow & Co., Inc., New York, states to the ELECTRICAL WORLD:

"Almost all of our properties have secured rate increases which overcome to a large extent the high cost of operation.

"We find that the general public and commissions appreciate the present situation, and thus far we have been successful in all of our rate adjustments.

"The rate increases apply to electrical railroads and power companies, but no attempt has been made to increase the base price, which applies principally to residences and small consumers."

TOO EARLY TO SEE TENDENCIES

The electrical engineer, an authority on rates, of a large company writes that he feels that it is rather too early to make any statement "as to what the tendency of the central-station policies in regard to rates will be due to the war.

"As you well know," he continues, "the current prices of labor and material are forcing increases in rates and no safe prediction can be made as to whether the prevailing rates will hold at the close of the war, or be subject to decreases. The utilities must of necessity get a return sufficient to allow them to meet their expenses and secure capital, and I do not doubt that if conditions warrant, rates will be lowered as soon as it is reasonably possible."

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

LARGE-SIZED DUCTS FOR VENTILATING MANHOLES

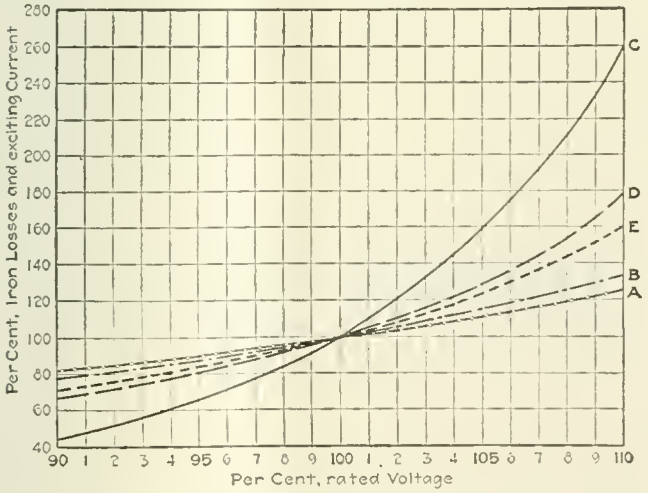
All Manholes with Transformers Rated at 25 Kw. or Larger Are Ventilated by Means of Two 8-In. Openings

Every manhole built by a certain Middle Western company is fitted with at least one opening for ventilation. The smallest manholes measure 5 ft. by 7 ft. by 6 ft. high (1.5 by 2.1 by 1.8 m.). Holes of this type in which there are no transformers or which contain units of small size are equipped with a 10-in. (25.4-cm.) tile running to the nearest pole, and an 8-in. (20.3-cm.) pipe is then extended from the tile up the pole. For manholes containing transformers rated at 25 kw. or more two such ventilating openings are installed. In this case one vent opens near the top of the hole and one near the bottom, and on the pole the openings are at different levels to create a temperature difference and cause circulation of air.

CARRYING OVERLOADS BY INCREASING PRIMARY VOLTAGE

By Raising the Primary Voltage Greater Power May Be Transmitted Over the Same Conductors—Losses in Transformers Must Be Observed

It is often possible to increase the load without adding copper to the primary lines of distribution systems by raising the voltage, provided, of course, that the secondary voltage is held at its normal value. Too great an increase in primary voltage, however, would seriously increase iron losses of transformers on the lines. Voltages may usually be raised economically as much as 10 per cent. Curves of iron loss and exciting current as affected by the impressed voltage are shown in the accompanying illustration, from which it is seen that the power losses in transformers increase very rapidly with primary voltage.



VARIATION OF IRON LOSS AND EXCITING CURRENT WITH VOLTAGE

Curves B and C show iron loss and exciting current respectively for large units. Curves A and D give corresponding values for small units. Curve E gives iron-loss variation from a number of tests.

For this suggestion, as well as for the curves reproduced here, the ELECTRICAL WORLD is indebted to W. B. Stelzner, Fayetteville, Ark.

OHIO MEN RECOMMEND UNDERGROUND PRACTICE

Suggestions as to Laying Out and Building Lines Cover Routing, Conduit, Manholes, Cables, and Cable Trouble

Condensed information valuable to the distribution engineer was contained in the 1918 annual report of the transmission and distribution committee of the Ohio Electric Light Association. The following section of the report referred to deals with underground systems:

The high-tension underground systems should conform to the straightest and shortest route and terminate in substations. Low-voltage systems (0-6600 volts) should be routed to permit feeding in from different points and sectionalizing to eliminate service interruptions. Paved streets should be avoided wherever possible. All other underground systems, such as telephone, telegraph, fire alarm, water and gas, should be avoided. All the available data should be collected from the files of the city engineer, this to learn what obstacles might be expected. Further, series of test holes should be made to learn the real existing underground construction. Great care in locating a line will amply repay during the construction period. Sewer connections are necessary to drain ducts and manholes.

Single, multiple, fiber and tile ducts are used in all systems. Single is preferable to multiple duct because a greater separation of conductors can be obtained. Further, a better barrier can be placed between conductors, which is quite a factor in isolating failures. The single duct is more flexible and therefore more easily installed. The single duct permits of the fanning out of the ducts in a manhole; that is, as they enter. The single duct is necessary in high-tension systems because there is required a greater dissipation of heat, and this radiation is possible by separating the duct lines. Often it is necessary to increase this radiation by external means. Fiber duct is somewhat easier to handle, and it permits of a continuous joint. The selection of the duct size should be carefully made, in that this often limits the capacity of the system after years of growth.

Concrete and brick are the types of manholes usually installed. Each material is attractive at different locations. The concrete manhole might be made, using a standard knock-down form. Further, it does not require skilled labor to install. Concrete prevents seepage. Manholes should be properly graded so as to permit drainage to the system. They should be located at street intersections, away from traffic wherever possible. The manhole should also be located at alley intersections with streets. Best practice would dictate a separation of high-tension from low-tension manholes. In this way transformers would be placed only in low-tension manholes; this in turn would avoid raising the temperature of the high-tension cables. Sewer connections, with traps, should be provided for each manhole for drainage. When this is impossible a barrel of gravel or stone should be inserted in the manhole floor to aid drainage into the soil. Manholes of ample size should be installed, for rarely has any manhole been pronounced too large. Transformer manholes should be provided with a means of ventilation either through the cover or by forced draft.

Difficulty on a great number of systems developed because of the duct size installed in the original system. The cable became larger as the capacity of the underground was forced until it was limited by the size duct. This placed a demand on the cable manufacturer which developed the sector cable, a cable of larger capacity with ample insulation. With the usual distribution cable the manufacturer's guarantee gives ample protection. Overheating of cables is a serious factor in the permanence of the installation.

The loading of the system cannot be crowded if continuity of service is a vital factor. Cable joints should receive the greatest amount of attention in the installation because of the human factor which enters here. A joint, if properly made, should be the strongest point of the cable. Fireproofing of cables is resorted to in manholes through which a great number of underground cables run. Various forms of fireproofing are used, but attention is called to placing a stiff sand cement all around the sheath about 1 in. (2.54 cm.) thick and then binding this with a 3-in. (7.6-cm.) cheesecloth tape.

Cable troubles will occur. High-tension cable failures are very serious. Each fault should be carefully analyzed in order that all weaknesses may be eliminated. Speed in underground work should be avoided. It is far better to consume time than it is to repair a fault during an interruption.

POINTS TO CONSIDER IN CHOOSING FLOW METERS

Principal Advantages and Difficulties of the More Common Types Are Pointed Out by Operating Engineer—Suitable for Steam or Air

There are three principal types of flow meters on the market, namely, the Pitot tube, the Venturi tube, and the orifice type. Of the Pitot-tube type there are a number of designs, but they all operate on the same principle. The main trouble which arises in operation, this type, if the indicating and recording mechanism is not taken into consideration, is that which comes from scale. If the water is such that there is the least tendency to scale, the tube will fill up, causing the meter to become inaccurate.

Only one make of Venturi type meter can be secured. This meter is open to the objection that considerable space for the tube is required in the steam main. Moreover, in order to condense enough water to operate the meter successfully very large radiators must be installed at the tube. Scale also affects this meter, but this can be cleaned out when the boiler is down for cleaning.

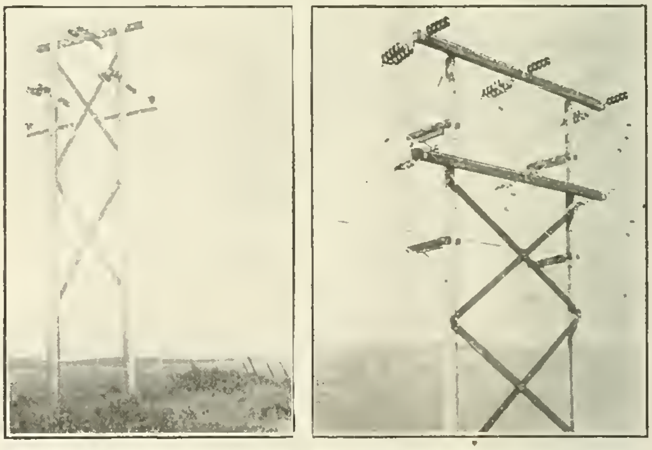
The various makes of orifice meters differ in the style of indicating and recording mechanism and also differ somewhat in the kind of orifice employed. These meters can be installed wherever there is a flange joint in the steam line. Scale does not affect their operation much, those with the flat-type orifice being particularly free from this trouble. The indicating and recording mechanisms on meters of the orifice type are operated by a float on mercury, contact being made with small rods of different resistance or a ball immersed in mercury. The chief disadvantage of most of these instruments is that the actuating forces are comparatively small and the amount of friction to be overcome is large. Another disadvantage is that the scale on the charts is not uniform and a special planimeter is required if averages are to be taken from the charts. There are some good meters in this class, however, that will operate with such accuracy that any error will be less than 2 per cent.

These opinions on flow meters were expressed before the station operating committee of the Ohio Electric Light Association by C. E. Lewis of Toledo. Mr. Lewis also stated that the central station at Toledo is using with good results a recording type of boiler meter which may be used for steam flow, air flow, flue-gas temperature, superheat temperature and draft over the fire. On this meter the air-flow and steam-flow recording mechanisms are arranged so that with the boiler operating at its highest efficiency these two pens are together. This makes a chart that is easy for the firemen to understand.

LONG-SPAN TOWERS FOR NARROW RIGHT-OF-WAY

Special Tower Construction Where Standard Two-Pole Towers Could Not Be Used for Lack of Space

A power company operating on the Pacific Coast has adopted the wishbone cross-arm on a wooden pole for standard transmission line construction. On certain long spans, however, it is necessary to use a two-pole construction. Where possible the standard two-pole tower with the three line wires in a horizontal plane is used, but this construction requires a right-of-way 20 ft. (6.1 m.) wide. On some lines where the right-of-way is 10 ft. (3m.) a special two-pole tower has been adopted in which the wires are arranged in triangular order as shown at the left in the illustration.


LONG-SPAN-TOWER CONSTRUCTION THAT IS FOUND ADVANTAGEOUS ON THE PACIFIC COAST FOR NARROW RIGHT-OF-WAY

This note is printed in further explanation of an article which appeared in the Electrical World for July 6, 1918, page 17.

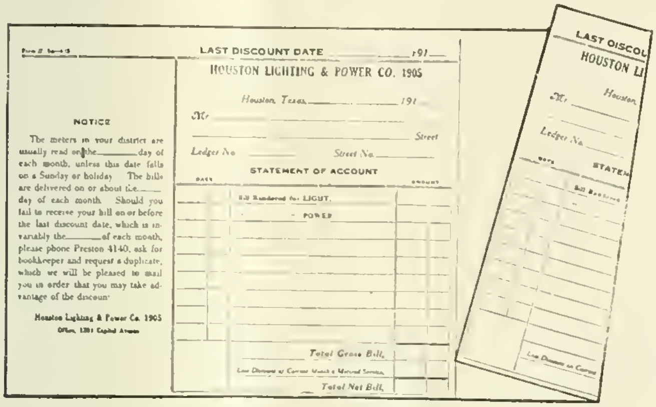
CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

NEW HOUSTON BILL SAVES LOTS OF TROUBLE

Duplicate Statement, No Meter Readings, Provision for Itemized Information Are Features of the New Form Adopted

A new form of monthly bill, which has a number of interesting advantages, has recently been adopted by the Houston (Tex.) Lighting & Power Company. As shown in the reproduction, this form provides space for the statement of account, a notice to the consumer and a duplicate bill, all in one sheet. The duplicate bill folds over so that the customer receives a carbon copy and the original is held in the office. This is very desirable in view of the large number of requests that are received each month for duplicate bills.



NOTICE

The meters in your district are usually read on the ____ day of each month, unless this date falls on a Sunday or holiday. The bills are delivered on or about the ____ day of each month. Should you fail to receive your bill on or before the last discount date, which is invariably the ____ of each month, please phone Preston 4140, ask for bookkeeper and request a duplicate, which we will be pleased to mail you in order that you may take advantage of the discount.

Houston Lighting & Power Co. 1905
Office, 1201 Capitol Avenue

LAST DISCOUNT DATE ____ 191__

HOUSTON LIGHTING & POWER CO. 1905

Houston, Texas ____ 191__
Mr. ____
____ Street
Ledger No. ____ Street No. ____

STATEMENT OF ACCOUNT

DATE		AMOUNT
	Bill Rendered for LIGHT	
	" " POWER	
	Total Gross Bill	
	Less Discount on Current Month's Metered Service	
	Total Net Bill	

ELECTRIC LIGHT BILL THAT DOES NOT CONTAIN METER READINGS

It was felt that the amount of labor involved in handling consumer accounts could be relieved considerably if the customer could be kept advised as to when to expect the meter reader and the date on which his bill may be paid in order to secure the discount. By the use of the new form this has been accomplished. Also, this form automatically provides a duplicate bill which can be held in the office, ready when the consumer calls and says the bill has been mislaid or not received.

It has been the experience in Houston that about 90 per cent of the customers who apply for duplicates have either misplaced their bills or failed to bring them along. As a check on the bill deliveries, however, the bookkeeper asks each customer if he receives his bills regularly, and there is an investigation of all cases where trouble is reported. Very frequently the customer knows the amount of his bill and all he wants is a receipt for the amount and the last date of reading. Under the present system this is now ready for him. As a rule the customer is not interested in the actual figures of the meter reading and, therefore, this information has been left off of the new Houston bill.

By the use of an indelible pencil the bill need only be filled but once, and the form provides itemized information so that it is not necessary to again refer to the ledgers in case of inquiry, and the customer is advised definitely as to the date of meter reading and the discount day.

ELECTRICITY RAISES RICE TO SAVE WHEAT

Arkansas Company Builds High-Tension Line 40 Miles Into Rice Fields to Supply Seasonal Water Pumping Load

In the rice fields of Arkansas near Pine Bluff the Arkansas Public Service Company is supplying electricity for water pumping to forty-eight rice farmers. From the time rice is a few inches high until it is ready to harvest it must be supplied with water. In Arkansas this means that irrigation is necessary during a season of from ninety days to 120 days. Sufficient water is obtainable from deep wells, so the proposition becomes one of pumping water almost continuously from these wells during the rice-growing season.

After making a trial installation for "rice pumping," as it is called, last year the Arkansas company decided to go into the business on a larger scale. Power is supplied from Pine Bluff, a distance of about 40 miles over a 33,000-volt, three-phase transmission line. It is distributed at 6600 volts to the installations where it is again stepped down to 220 volts at the motors. The motor sizes vary from 50 hp. to 75 hp. the average being slightly above 60 hp. Estimates based on results from the test installation which ran last year indicate that the average consumption will be from 40,000 kw.-hr. to 50,000 kw.-hr. per season. The ninety-day to 120-day season usually begins some time in June and ends in September. On this basis the average revenue per customer would be $1,500 a season, and the total revenue from the business would be $72,000. The average acreage per customer is about 150.

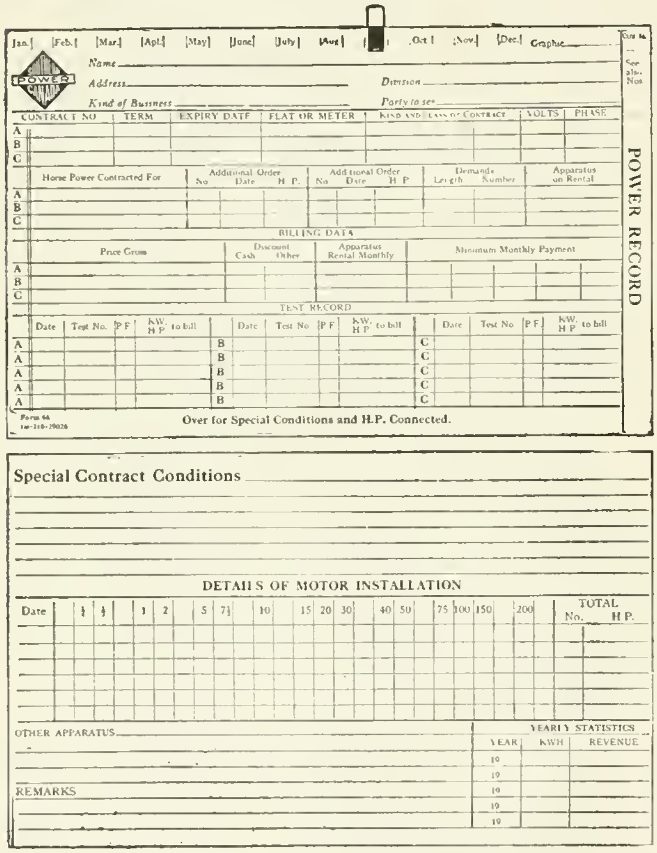
According to the terms of the contract, energy is sold on peak at 3.675 cents per kilowatt-hour and off peak for 3.5 cents per kilowatt-hour less a discount of 5 per cent for prompt payment. In addition to this the customer pays the company 8 per cent interest and 7 per cent depreciation per annum on distribution line equipment and apparatus. An interesting provision of the contract is the company's guarantee that the energy cost alone shall not exceed $10 per acre per season if the customer's pump does not fall below 60 per cent in efficiency. This establishes a maximum charge that assists in making sales and keeps manufacturers of inefficient pumps from selling their products to the farmers.

In commenting on the attitude of rice farmers toward electricity for pumping, William F. Moody, commercial manager of the Arkansas company, said: "When we first connected these customers, we had considerable trouble with our lines, power-plant equipment, etc., and at first the farmers were inclined to feel skeptical and to become dissatisfied with the service, but within a week or ten days we had everything working very successfully. Now all of the farmers are well pleased with the service and state that they would not go back to the old method of pumping under any consideration. It saves them labor, fuel, belting and many other things, and just at this time, when fuel and labor are both very scarce, an electrically operated pump is especially to be desired by the rice growing farmers."

SYSTEM FOR RECORDING POWER INSTALLATIONS

By Printing the Names of the Months at the Top of File Cards Tests Can Be Made at the Proper Times According to Local Conditions

A convenient power record system is being used by the Southern Canada Power Company, Montreal, Canada, whereby all data relating to a power installation is recorded on a 5-in. by 8 in. card, the front and back of which are here shown. An interesting feature of the card is the printing of the months at the top for testing purposes. Thus if an installation is to be tested say in September, a tab as shown is placed over that month. In August therefore a clerk running through the files can take out all of the September test cards. In this way the tests come in the right months. The testing date is determined of course by the local conditions, as most users of electricity are busier some parts of the year than others.



Jan. Feb. Mar. Apl. May June July Aug. Oct. Nov. Dec. Graphic

See also Nos

Name

Address

Division

Kind of Business

Party to see

	CONTRACT NO	TERM	EXPIRY DATE	FLAT OR METER	KIND AND CLASS OF CONTRACT	VOLTS	PHASE
A							
B							
C							

	Horse Power Contracted For	Additional Order No	Additional Order Date	Additional Order H. P.	Additional Order No	Additional Order Date	Additional Order H P	Demands Length	Demands Number	Apparatus on Rental
A										
B										
C										

BILLING DATA

	Price Group	Discount Cash	Discount Other	Apparatus Rental Monthly	Minimum Monthly Payment
A					
B					
C					

TEST RECORD

	Date	Test No.	P F	KW. H P to bill		Date	Test No	P F	KW. H P to bill		Date	Test No	P F	KW. H P to bill
A					B					C				
A					B					C				
A					B					C				
A					B					C				
A					B					C				

Form 44
[illegible]

Over for Special Conditions and H.P. Connected.

POWER RECORD

Special Contract Conditions

DETAILS OF MOTOR INSTALLATION

Date		½	½		1	2		5	7½		10		15	20	30		40	50		75	100	150		200		TOTAL No.	TOTAL H P.

OTHER APPARATUS

REMARKS

YEARLY STATISTICS

YEAR	KWH	REVENUE
19		
19		
19		
19		
19		

THE TWO SIDES OF POWER RECORD CARD

ADVICE ON HANDLING CASES BEFORE COMMISSION

Plan by Which Manager Handles His Own Case Rather Than Secure Services of Attorney Finds Favor

Discussions which have taken place at several state associations in the Central West this year seem to indicate a well-defined trend toward the elimination of the lawyer in rate cases before public service commissions. In one case a public service commissioner openly declared before an association of central station men that the commission did not favor the use of attorneys in rate cases. The objection to the lawyer in this instance is that he usually takes up a great deal of the commission's time unnecessarily in presenting a mass of testimony which has no bearing on the case and in general befogging the issue. This commissioner explained his commission's preference for a simple presentation of the facts, which it is necessary for the commission to have before it can decide whether or not an increase in rates is justified.

That central station men are commencing to realize the situation also is made clear by the discussion of E. J. Condon of Angola, Ind., before the Indiana Electric Light Association at Indianapolis on Aug. 7. Mr. Condon emphasized the fact that there are very few lawyers in Indiana who are competent to try rate cases before the public service commission. He urged that each manager try his own case on the facts. He did advise, however, that a competent certified public accountant should be employed, and that in hiring this man, care should be taken to be sure that he understood utility accounting. With this extra man, and the company's own engineers, the engineers and accountants of the public service commission can be apprised of all the necessary facts, and the manager can then be placed in a position to present his case in a logical fashion before the commission without legal aid.

DAYLIGHT SAVING HELPS SALE OF ELECTRIC FANS

New Orleans Utility Sold 297 Units in June at a Profit of Approximately $2,500

The sale of electric fans in New Orleans this year has broken all previous records, and Commercial Manager W. E. Clement of the New Orleans Railway and Light Company attributes it to a considerable degree to the influence of the daylight saving law.

The result of this change in clock time has meant, of course, that the business man has returned to his home earlier by the sun, with an extra hour to sit around the house before the coming of darkness makes him think about bed, and transition from a fan-cooled office to a home that is not provided with an electric breeze has made the need of a fan particularly conspicuous. The result has been a very great increase in fan sales to residence customers.

In the month of June, for instance, this New Orleans central station sold 297 fans as compared with 189 sold in the same month the year before. The merchandising profit on these fans totaled approximately $2,500 against which there was practically no expense.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Speed Characteristics of Small Direct-Current Motors.—B. H. CHATTO.—The effect of windings of fractional horse-power motors on the speed and torque characteristics are discussed in this article. The author points out the effect of the ratio of ampere turns in the armature to ampere turns in the field upon the speed load characteristics of such motors. The production of high starting torques is also discussed in its relation to the armature and field windings. These characteristics are then applied to specific services such as for washing machines.—*Power Plant Engineering*, Aug. 1, 1918.

Radiator Tank Transformers.—H. O. STEPHENS and A. PALME.—The demand for increased capacities in transformers and the desirability of having this equipment entirely self-contained brought about the development of the radiator type of transformer. The need of having the radiators oil-tight required an all-welded steel construction, as cast iron was too heavy, and various space requirements necessitated a great variety and flexibility of radiator arrangement. The article describes the construction of some of the latest forms of radiator transformers.—*General Electric Review*, August, 1918.

Turbine-Plant Operation.—J. G. OTLEY and V. PICKLES.—In this paper some of the salient points connected with the efficient operation of turbine plants and their attendant auxiliaries are discussed. The paper has particular reference to the plant installed in the power stations of the Victoria Falls & Transvaal Power Company and the Rand Mines Company, Limited, a subsidiary company of the Victoria Falls Company. The problem is discussed under the headings "Definitions of Turbine and Steam Efficiencies," "Condenser Plant" and "Condenser Efficiencies."—*Transactions of the South African Institute of Electrical Engineers*, May, 1918.

Direct-Current Generator for Constant Potential at Variable Speed.—S. R. BERGMAN.—The standing of this problem in the past is briefly reviewed. As far as is known to the author the type of machine described presents a new solution, the advantages of which are shown to be: (1) The machine is self-excited, *i.e.*, is regulated independent of any other source of potential; (2) the machine is regulated independent of speed and load and may be compounded; (3) the regulation is inherent, *i.e.*, no external regulating device is used; (4) the regulation is instantaneous; (5) the regulation is approximately independent of the heating. The theory of the machine is described, and diagrams of connections are given. Performance curves obtained from tests are shown. A method is described whereby instantaneous regulation of the voltage is obtained, which method also secures approximately a constant voltage independent of the heating. Finally there follows a discussion of the efficiency of the new machine as compared with a standard machine of the same speed and output.—*Proceedings A.I.E.E.*, August, 1918.

Lamps and Lighting

Fundamentals of Illumination Design—Part IV—WARD HARRISON.—This installment, which concludes the series, shows how the principles and data of the previous installments are applied to the solution of actual lighting installations. Four problems are worked out, covering the lighting requirements of an office building, a store, a furniture factory and a metal machine shop. A careful study of this series should be of considerable assistance to any one designing illumination layouts.—*General Electric Review*, August, 1918.

War Conservation of Power and Light.—CHARLES E. STUART.—The problem is discussed under the following headings: (1) Elimination of uneconomical isolated plants; (2) application of the "skip-stop" to railways and the regulation of car heating and lighting; (3) economy in the utilization of power and light in factories; (4) utilization of excess water power and interconnection of power systems; (5) limiting the production of power to the most efficient plants available; (6) economy in the refrigerating and ice manufacturing industry.—*Journal of Engineers' Club of Philadelphia*, August, 1918.

Generation, Transmission and Distribution

Coal Saving by the Scientific Control of Steam Boiler Plants.—D. BROWNLIE.—The author is of the opinion that the 250 boiler plants dealt with in this article are really representative of all the boiler plants of the country, and that the results of such a very large number of exhaustive scientific investigations carried on continuously during the last eight years will enable one to judge with very considerable accuracy as to the saving that can be obtained by improving present methods in burning 75,000,000 tons to 100,000,000 tons of coal per annum for steam generation. The tests are discussed as follows: (1) Weight of fuel used; (2) analysis of fuel; (3) water evaporated; (4) analysis of feed water; (5) temperature of feed water; (6) draft measurements; (7) temperature of the flue gases; (8) percentage of CO_2 in the flue gases; (9) steam pressure; (10) temperature of superheated steam; (11) auxiliary steam.—London *Engineering*, July 12, 1918.

Considerations Relating to Large Power-Station Switchgear.—H. W. CLOTHIER.—The author deals particularly with oil switches for large powers. There are a number of controlling factors in design, such as the length and velocity of break, head and volume of oil, strength of container, lag and ventilation. These are considered, and diagrams are given illustrating the conditions found in practice. Drawings are reproduced showing a form of switchgear in successful operation and suitable for use in a power station of 60,000 kw., and the possibilities for larger power-station gear on armored lines are implied. In conclusion, emphasis is laid upon the desirability of research on the conditions to which switchgear is subject.—London *Electrician*, June 28, 1918.

New Theory of the Steam Turbine.—Harold M. Martin.—This paper includes a discussion of the possibility of condensation of steam in turbines and the difficulty of determination of temperature and saturation. Diagrams giving the gain in efficiency due to superheat are shown.—London *Engineering*, July 5, 1918.

Traction

Meeting the Nation's Transportation Needs.—In this paper is discussed the problem of serving soldiers at cantonments and workers at shipyards. It is said that in the case of the Jacksonville (Fla.) Traction Company it was hard to compete with the tremendous wages paid in the shipyard and other war industries in the vicinity. Matters actually reached the point where the employment agent of the shipbuilders promised to take no more railway men, for he realized that this would simply hurt shipbuilding interests more than it would aid them. In the vicinity of San Antonio, Tex., traffic was increased as much as 50 per cent due to the flying field and other war activities in the vicinity. It was also shown how Tacoma handles the 8000 shipbuilders there.—*Electric Railway Journal*, Aug. 10, 1918.

Installations, Systems and Appliances

Arc Welding of Mild Steel.—O. H. Eschholz.—The maintenance of a short arc length and proper control of the arc flame insure minimum oxidation of the arc vapors and deposit surface and, therefore, reduce porosity and slag. Weld scarfing and the arc current and manipulation are essential factors in the production of reliable welds. The development of an electrode which generates a protecting envelope of inert gases will greatly facilitate arc welding. The practice of examining weld sections should be encouraged as a means of developing and indicating the operator's welding ability. In passing through the arc stream the electrode material is refined to such an extent that the deposited metal is comparable to commercially pure iron. Thermal disturbances which are produced by the welding operation do not appear to have any appreciable effect upon the characteristics of mild-steel welds.—*Electric Journal*, July, 1918.

Electrical Installation at Camp Curry.—This camp is situated in the Yosemite Valley, California, about 4000 ft. (1220 m.) above sea level. About two or three miles below the valley is situated a government power house with present capacity of 1000 kw., but with 2000 kw. capacity in prospect. The camp is almost entirely operated by electric power, and it is said that the cooking load alone amounts to about 125 kw. The streets, as well as some 600 tents, are electrically lighted, and electric heaters are being quite generally installed for use in the spring and autumn. In addition to the electric ranges in the kitchen, there are also three electric dishwashers which are very useful in consideration of the fact that the dining room seats over 500. For such additions as are necessary from time to time in building construction an electrically operated sawmill is useful in furnishing cut lumber.—*Journal of Electricity*, Aug. 1, 1918.

Units, Measurements and Instruments

Instruments and Methods Used in Radiometry.—W. W. Coblentz.—This paper deals with the application of certain special physical and chemical properties of matter as a means of quantitively measuring radiant energy. The sensitivity of the selenium cell varies not only with the wave length but also with the intensity of the light stimulus, and it recovers but slowly from the effects of the light stimulus. It therefore fails to meet the requirements of a radiometer, except that of high sensitivity. The application of the photochemical action upon a photographic plate, as a means of making quantitative radiometric measurements, is considered. While this method of radiometry has been used successfully, its applications seem to be rather limited. A third application to radiometry considered in this paper is based upon the fact that some substances, when charged to a negative potential, lose their charge when exposed to light, especially violet and ultra-violet rays. In this respect the alkali metals, and especially their hydrides, are very sensitive to light stimuli. The photoelectric cells made of these substances can be constructed and operated so that the response (photoelectric current) is directly proportional to the intensity of the stimulus. This meets one of the principal requirements of a satisfactory radiometer. Details of the construction, operation and characteristics of the photoelectric cell are given. Attention is called to the importance of making the proportionality test of the photoelectric outfit as used, especially of cells with spherical bulbs. A satisfactory high-resistance ironclad Thomson galvanometer is described which may be used successfully with a photoelectric cell. The advantages of the photoelectric cell over the thermophile are considered, and the application of the former is suggested for measurements of radiant energy (especially ratios of intensities) in the violet and ultraviolet parts of the spectrum, where the photoelectric cell greatly exceeds the thermophile and the bolometer in sensitivity.—*Scientific Paper No. 319,* Bureau of Standards.

Education and Training of Engineering Apprentices.—P. H. S. Kempton.—In a discussion of the technical training of young men for engineering purposes recommendations are made for young men classified as follows: (1) Those whose exceptional ability and "staying powers" will enable them to reach very high positions in their professions; (2) those whose ability is something above the average and who will become the foremen and draftsmen of their trades; (3) those who are unlikely to rise beyond the level of the journeyman artisan. The first must be given a straight road to the completion of a university course without financial anxiety; the second must receive that special training which will result in a broad outlook and an initiative such as is required of those who are in actual charge of workshops and shipyards; the third must be given as sound a training as is possible in view of their restricted abilities, special care being taken to remedy any defects in their early or fundamental instruction.—London *Electrical Review*, July 19, 1918.

Readers' Views and Comments

War Time Costs of Service

To the Editor of ELECTRICAL WORLD:

Sir: The ELECTRICAL WORLD, I know, has repeatedly spoken regarding the seriousness of the fuel situation and of the other factors in the rapidly rising cost of electric supply, but the facts cannot be reiterated too often. Electric supply companies have endured patiently the constant pressure from the public service commissions, and the average price obtained for the product steadily diminished all through the era of rising prices that preceded the war and even up to the moment when the United States stood on the brink of hostilities. Even then, with prices of all commodities, and particularly necessities, rising at an unprecedented rate, and with the transportation companies of every kind screeching for increased fares and frequently getting them, the central stations stood pat. Only in the face of actual war have they been able to obtain even the meager concession of a coal clause in future contracts giving an all-insufficient defence against the fuel famine from which they are now suffering. Even companies which thought themselves protected by long-term contracts have suffered from commandeering of coal by the government and the failure of contractors to live up to their obligations, and have been obliged to buy coal in the open market wherever they could get it. To their credit be it said that one has yet to hear of a single case of ostentatious shutting down to impress upon the public the gravity of the issue.

The cost of fuel, although the largest single item in increased expense, is barely more than half of the total sum which the first year of war will wring from the central stations of the country. The abnormal demand for labor has compelled the payment of greatly increased rates all along the line. The increase for the last year has been something like twice what it was in the preceding decade. Thousands of trained and valued employees have gone to the front. To replace them the companies have been forced to get labor where they could and at what price the market demanded. All the innumerable materials which go into the building up and maintenance of electric service have risen about 75 per cent.

The lighting business is suffering from the restrictions of the Fuel Administration, and the calls for power service, from which alone the companies can expect to keep up their earnings, demand extensions of service and increase of equipment, all at enhanced cost, especially since such increase is largely rush work, which always carries with it exceptional costs. Money needed for extensions must be borrowed at war rates, and to make a bad matter worse greatly increased taxes must be cheerfully borne. The extra expense forced upon the electric companies owing to the war conditions have been estimated as approximately $116,000,000 per annum. This huge sum amounts to a quarter of the normal estimated gross revenue for the last year, and wipes out two-thirds of the sum available for interest charges, dividends and surplus applicable to maintenance and contingencies. The situation is an exceedingly grave one, the more so since costs of every kind are still rising and there is at yet no adequate relief in sight. It is time to regulate rates upward.

PUBLIC UTILITY EXECUTIVE.

Grounding Secondaries

To the Editor of ELECTRICAL WORLD:

Sir: On page 16 of the July 6 issue of the ELECTRICAL WORLD appear views in regard to grounding secondaries expressed by Mr. Chapin of the Memphis (Tenn.) Gas & Electric Company which seem to require further discussion in order that false inferences may not be drawn from them by the electrical public.

In Mr. Chapin's method of grounding a single ground connection of rather high resistance (20 ohms) is used on each secondary. These grounds, coupled with protective devices, as indicated by Mr. Chapin's remarks before the Western Society of Electrical Inspectors, serve mainly to give warning at the central station of the appearance of leaks to ground from the high-voltage lines, and steps are then immediately taken to make repairs. In the interim between the appearance of the leak and the making of repairs it is easily possible for the potential difference between secondary and ground to reach a value approximating the full voltage of the primary line. According to Mr. Chapin, values as great as 500 volts have been observed, although the circumstances under which these observations were made are not described. Such potential differences are to be regarded as dangerous, even though they exist for but a short time.

It seems, therefore, that a great amount of discretion should be used in the employment of such a system, the success of which in Memphis is without doubt due to the high degree of vigilance exercised in its application rather than to the efficacy of the ground connections used. In fact, under the conditions of earth resistivity existing in most of the cities of the country it is out of the question to expect grounds of the type described by Mr. Chapin—viz., a zinc plate 12 in. square buried 7 ft. or 8 ft. in the ground—to give the requisite amount of protection to consumers without recourse to additional safety measures, and even here, in the event of an accident to insulation, periods of time of greater or less length must elapse during which the only protection existing against electric shock would be a ground connection of too high resistance to be of much value. Full reliance should be placed only on grounds of low resistance, preferably those made to water pipes, although, if water pipes are not available, multiple grounds to driven pipes or plates may be used instead.

I shall greatly appreciate it if you will kindly direct the attention of your readers, either editorially or by publication of this letter, to the substance of the foregoing remarks, emphasizing the fact that, although good success has apparently attended the use of ground connections of rather high resistance under the particular conditions existing in Memphis, it does not necessarily follow that similar success will result from their use elsewhere under different conditions. In fact, in many places, with the varying degrees of vigilance to be expected, their indiscriminate application may constitute a menace to life and property.

S. PETUS,
Associate Physicist, Bureau of Standards, Washington, D. C.

Good Lighting Helps in Winning the War

To the Editor of ELECTRICAL WORLD:

Sir: Our attention has been called to an article in the June 8 issue of the ELECTRICAL WORLD entitled "Good Lighting Helps in Winning the War." In one paragraph there is this statement: "Another frequent change noticed was from arc lamps to tungsten incandescent lamps. There were also a number of instances of change from mercury-arc to tungsten lamps."

It does not seem that this statement does the mercury-vapor lamp justice, as during the past year the mercury-arc business in industrial lighting has increased nearly 40 per cent, which would indicate that Cooper Hewitt mercury lamps are being utilized to a great extent for the finer classes of industrial work. Numerous ordnance shops, automobile plants and textile plants throughout the country have adopted this type of lamp as the standard, and we feel that the impression created by the article cited above is that Cooper Hewitt lamps are in the same class as arc lamps, which are being replaced by tungsten lamps.

We feel that if the writer of the article would make a careful analysis of the subject he would find that the statement made was not justified by facts, and we therefore feel that you will be willing to publish this letter as a correction.

COOPER HEWITT ELECTRIC COMPANY,
R. D. Mailey, Chief Engineer.
Hoboken, N. J.

[We regret if any reader should infer from the article in question that the mercury-vapor lamp is losing ground. On the contrary, its employment, particularly in industrial plants, is constantly increasing.—EDITOR.]

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

SEARCHLIGHT PROBLEMS OF MILITARY IMPORTANCE

Solutions Desired for Several Immediate Problems Which Will Help in the Great Battle for Liberty Against Kaiserism

Solutions of the following searchlight problems will be of great military value at the present time, and should be sent under confidential cover to the Officer in Charge, Searchlight Investigations, General Engineer Depot, Corps of Engineers, United States Army, Washington, D. C.

(a) Means for determining the finding power of a searchlight which will take into account the color of the light, the nature and color of the target, the condition of the atmosphere, and the distance between the searchlight, the target, and the observer.

(b) Means for *rapidly* determining the intrinsic brilliancy of a searchlight light source.

(c) A *simple* system of remotely controlling the operation of a searchlight in azimuth and elevation. The present or proposed systems require from five to fifteen or more wires, and are too complicated.

(d) A mirror design which shall be more efficient for anti-aircraft service than the standard parabolic mirror.

(e) A light source which shall be more efficient than a high-intensity carbon arc. A thallium arc has been suggested because it has only one line (green) in the spectrum.

(f) A mirror material which shall have the reflecting and longevity properties of silver-backed glass, without the fragility of glass mirrors.

The foregoing statement of problems was received from Capt. Chester Lichtenberg, Washington, D. C.

COAL MINES PUT FIRST ON POWER PRIORITY LIST

War Industries Board Directs West Penn Power Company to Give Coal Mines First Call on Electrical Energy

Coal comes first, under an order of the War Industries Board covering the distribution of power by the West Penn Power Company in the Pittsburgh district. The order will give coal mines a full supply of power, although other war industries served by the West Penn company are now working a restricted number of hours.

Under the tremendous increase of war industry in the Pittsburgh district, the West Penn company was overloaded. A breakdown in generating machinery added to the shortage. Under a previous plan it was proposed to meet the shortage by dividing the power among all the essential war industries in the district, restricting lesser essential plants to night operation. Under this plan the coal mines, numbering about 150 in the Pittsburgh district, would have been forced to accept their pro rata share of the curtailment.

The vital importance of maintaining the increased production of coal, and the necessities of industries served by the mines in the Pittsburgh district, presented to the War Industries Board by the Fuel Administration, prompted the order giving the mines first call on the available power.

KEEP DAYLIGHT SAVING, SAY INDIANA COMPANIES

Through Indiana Electric Light Association They Urge Federal Fuel Administration to Continue the Present Plan

The following letter has been sent to P. B. Noyes, Director of Conservation of the United States Fuel Administration, by Thomas A. Wynne, president of the Indiana Electric Light Association:

At the annual meeting of the Indiana Electric Light Association held under date of Aug. 7, 1918, at Indianapolis, Ind., a resolution was passed urging the continuance of the present daylight saving plan.

The members of the Indiana Electric Light Association were unanimous in the opinion that the clock should remain as it is at present with a view of reducing the usual winter peak loads and the consequent very uneconomical consumption of coal on those peaks.

The reduction of the peak also would create a corresponding reduction in the amount of machinery necessary to carry central stations over their winter loads, thus relieving the manufacturers to a considerable extent, enabling them to devote their energy more directly to war work, etc.

NEW LINE EXTENSION FROM LOUISVILLE TO ARMY CAMPS

Louisville Gas & Electric Company to Furnish Energy for Camps in Its Vicinity—Cost Estimated at $270,000

Work on the extension of transmission lines from Louisville to the Army camps at West Point and Stithton, Ky., has begun, according to a statement by L. S. Streng, superintendent of construction of the Louisville Gas & Electric Company. The cost of the work is estimated at $270,000, which will be borne by the government. It will require three months to complete the work. Mr. Streng said:

Arrangements have been completed and the material has been ordered for the construction of a transmission line and the necessary substations. In the outskirts of the city of Louisville there will be erected a transformer substation to increase the voltage for the transmission line. This voltage will be again reduced in a substation that will be erected within the camp grounds at Stithton.

Between these two substations there will be built about 30 miles of double-circuit transmission line, to be operated at 33,000 volts.

We will supply about 1700 kw. for lighting and about 1200 hp. for motors, the larger part of the motor load consisting of pumps for water supply.

STUDY OF ELECTRIC WELDING AIDS IN OUR SHIPBUILDING

Review of the Comprehensive Report of Capt. James Caldwell of England Covering Experience and General State of the Art

BY PROF. COMFORT A. ADAMS
Chairman Electric Welding Committee, United States Shipping Board Emergency Fleet Corporation

A review of Capt. James Caldwell's report on electric welding, published by the Emergency Fleet Corporation, shows what great progress is being made in this direction.

The report comprises by far the largest and most comprehensive collection of data and discussion in this field ever before included in one publication. Moreover, the information was thoroughly up to date when ready for the printer in May. The delay in publication is to be regretted as there has been an enormous demand for just this kind of information.

At the time of his visit to this country Captain Caldwell was deputy assistant director of materials and priority for the British Admiralty, London. For the three months of his stay he was loaned to the Emergency Fleet Corporation in order to give to the United States shipbuilding industy the benefit of the considerabe experience already had in the application of electric welding to shipbuilding and to other war industries in Great Britain. He was immediately made a member of the electric welding committee of the Emergency Fleet Corporation and co-operated cordially therewith during his stay in this country.

CAPT. JAMES CALDWELL, R. E.

The report includes an enormous amount of data relating to the experience and general state of the art in this country as well as in Great Britain; detailed reports of the application being made of electric welding in both Great Britain and the United States in shipbuilding and elsewhere; a description of the electrically welded cross channel barge, much heralded in the daily press; discussions of the merits of the several systems of welding by various authorities here and in Great Britain; comparative costs of various systems of electric and gas welding; the repair of the interned German ships by electric welding; a description of several proposed designs for welded ships; a proposed momenclature for electric welding; the work of the electric welding committee of the Emergency Fleet Corporation; the attitude of the classification societies, of the British Admiralty and of the United States Navy on the subject of electric welding in shipbuilding; and the author's own conclusions as to the use of electric welding in shipbuilding.

Before discussion of Captain Caldwell's report, a brief review of the state of the art before the war will be of interest. All of the following classes of electric welding are great time and labor savers and their applications are increasing at a rapid rate. The field is almost unlimited.

STATE OF THE ART

Resistance Welding, accomplished by passing a heavy current between the two parts to be welded, the latter being forced together under a considerable pressure, is the oldest type of electric welding and has been employed in this country for about thirty years. Recently this has been extended to relatively large parts involving the use of hundreds of thousands of amperes.

Spot Welding, a special form of resistance welding adapted to the welding of overlapping plates, is also of many years standing; but it has been confined almost wholly to relatively thin plates ¼ in. or less. Only within the past year have machines been developed for the welding of plates up to 1 in. thickness or even more. However, through the activities of the electric welding committee it has been thoroughly established that heavy plate spot welding can be done in an eminently satisfactory manner.

Arc Welding. As this is the variety almost exclusively used in England, most of Captain Caldwell's report refers thereto. Unless otherwise specified the following discussion will refer to arc welding. This type of electric welding has been in use for nearly twenty years although its rapid growth is not of long standing.

OPERATOR'S SKILL IMPORTANT

Apparatus for controlling the energy is chiefly supplied by about fifteen manufacturers, each making special claims for his particular method of control. In some cases these claims have been absurdly exclusive. It has been demonstrated by the electric welding committee that a skilled operator can produce good results with any of the systems, the quality of the work depending much more on the skill of the operator, the choice of electrode and current, than upon the system of control.

It is interesting to note that, as a rule, the more difficult it is to hold the arc with a proper electrode, the better the weld when the arc is held. Other interesting points demonstrated by the committee are:

Eminently satisfactory welds can be made with alternating current, which requires a much lighter and less expensive apparatus than that ordinarily used. This, it will be noted from perusal of the full repot, is contrary to Captain Caldwell's conclusions.

Captain Caldwell's statements on pages 1 and 2 of his report No. 1 regarding bare and flux-covered electrodes seem to be borne out by the work of the committee, but evidence is now in hand that much less expensive types of flux-covered electrodes than those used largely in England will be available shortly in this country and that they produce equally good results. This is an important point as the cost of the flux-covered electrode used in England is a serious handicap to arc welding in shipbuilding.

In brief the essential idfference in the results obtained by the bare and flux-covered electrodes is that the former yield more brittle welds, although usually of equal tensile strength.

ATTITUDE OF CLASSIFICATION SOCIETIES

The attitude of the classification societies (Lloyd's and American Bureau of Shipping) with regard to electric welding on ships has materially changed since Captain Caldwell's report was written. They now allow much more welding than given in their list of approved parts, whenever they are satisfied that the work is well done. Lloyd's Register of Shipping in England has taken a very active and progressive attitude toward electric welding and has spent large sums of money in experimental work. Recently they have issued provisional regulations under which they will classify wholly welded ships.

In addition to the cross channel barge described in Captain Caldwell's report, a 1000-ton power ship is now being built in England.

The cross channel barge has already made several trips fully loaded in bad weather with no evidence of leaks or other trouble.

The 42-ft. welded section of a 9600-ton merchant ship to be built at the Federal yard, Kearny, N. J., is now awaiting the completion of the large portable spot welder with which the plates are to be assembled and tacked. This welder is nearing completion and the work will proceed very shortly. The foundation and all other preparations are completed and the steel is on the spot.

It has been recently discovered that a 60-ft. tug all welded has been in service at Ashtabula Harbor, Lake Erie, for several years and is giving excellent satisfaction.

As soon as the Mason section at the Federal yard (mentioned herein) is under way and the success of the method demonstrated, it is probable that a sizable ship will be designed for welding and built.

A design of a welded ship of 9300 tons has already been prepared, but it is probable that a smaller one will be built first.

Referring to Captain Caldwell's full reports of the welding work being done at the United States shipyards, it is interesting to note that since that time considerable additions to the welding equipments and programs of the various yards have been made.

The Hog Island program alone covers several hundred thousand minor parts with an average saving of between 60 and 70 per cent in labor.

In considering the comparative costs of arc and oxy-acetylene welding as given by Captain Caldwell's report No. 17, it should be noted that the electrodes used for the arc welding were of the most expensive flux-covered variety. With entirely satisfactory electrodes, the cost of the arc welding in this country is not more than half that of gas welding.

Referring to report No. 16 of the full report, giving tensile strengths of arc welds, recent tests of fifteen different types of arc welds on ship plates, show an average tensile strength of 58,800 lb. per square inch and about 94 per cent of the plate strength. Some broke entirely outside of the weld. These were butt welds; when used with a light butt strap, joints of more than 100 per cent strength can be assured as against 75 per cent for a double row of rivets, watertight spacing. These results are in accord with the latest results from England.

Since Captain Caldwell's report was written, both the work and the personnel of the electric welding committee have been largely expanded. There are now eighty-two members including the best talent of the country in this field, not only in the electrical but in the metallurgical end. Moreover, the committee is now reorganizing in such a way as to include the gas welding as well as the electric welding industry and there is good reason to hope that there will result a rational definition of the proper fields for each of these types. On the whole, the present opportunities for autogenous welding are almost unlimited not only in the shipbuilding field, but throughout practically every other field of manufacture, and the work is expanding so rapidly that it is difficult to keep track of it.

Captain Caldwell's personality, coupled with the weight which his connection with the British Admiralty added, has served as a very considerable stimulus to the electric welding art in this country and we are certainly to be congratulated on having had the benefit of his visit as well as his most comprehensive report. Captain Caldwell is still retained as a member of the electric welding committee, is keeping the committee in close touch with his work, and is being kept in close touch with the work on this side.

In addition, the electric welding committee is also exchanging information with France and Italy.

Since Captain Caldwell's departure several months ago, the very heavy work of preparing the report for printing, first undertaken by the Industial Training Department of the Emergency Fleet Corporation under E. E. MacNary and H. A. Hornor, has been handled under the new organization by the Educational and Training Section of the Emergency Fleet Corporation of which Dean L. E. Reber is the director, E. E. MacNary superintendent of training and H. A. Hornor head of the electric welding branch.

Much credit is due to the unfailing energy and patience of these men as well as to H. M. Hobart, who gave Captain Caldwell invaluable assistance from the beginning and has followed the work to the end. To numerous others who wrote the component reports much appreciation is also due.

PREFERRED INDUSTRIES ARE TO BE RELISTED

Amplification Is to Be Made, Due to the Widely Expanded War Needs and to Allow for Pressing Civilian Demands

The War Industries Board, under the direction of Bernard M. Baruch, Chairman, working through the Priorities Board, headed by E. B. Parker, is formulating a new list of preferred industries.

The amplification has been due to the widely expanded war needs and, at the same time, to allow for the pressing demands of civilian origin.

Lamp Policy of the Fuel Administration

Program of the Federal Authorities, by Eliminating Inefficient Types of Incandescent Lamps, Is Expected to Save More Than 1,000,000 Tons of Coal a Year

THE United States Fuel Administration, which for some time has been considering the possibility of saving a large amount of coal by discouraging the use of inefficient incandescent lamps by consumers of electrical energy, has officially announced its policy in this matter.

Carbon filament lamps are still in use to a considerable extent and metallized carbon filament "gem" lamps are also being used in notable quantities, these types of carbon lamps together representing about 13 per cent of the total number of lamps manufactured in 1917.

VOLUNTARY AGREEMENT

Announcement was made by the Fuel Administration on Aug. 29 that the lamp manufacturers, at a meeting in Washington on the previous day, "voluntarily agreed to abandon the manufacture of certain types of the inefficient carbon filament lamp in accordance with the program which practically calls for the discontinuance of their manufacture and sale." The official statement adds:

> There are still a few isolated cases where the carbon lamp is required, such as on battleships where excessive vibration or shock calls for a lamp of the sturdy type. But with few exceptions, and these are confined to essential war industries, the program is expected to gradually eliminate the carbon lamp in favor of the more efficient tungsten lamp.
>
> Central stations, public service corporations, municipal plants and others who may be using carbon filament lamps are being asked to assist the manufacturers as well as the Fuel Administration in working out this program, inasmuch as sweeping conservation measures are imperative if the war industries and essential public needs are to be supplied.
>
> The importance of this radical step may be judged from the fact that the program as formally adopted at yesterday's meeting will mean the saving of more than 1,000,000 tons of coal.

The conference of last week followed earlier conferences, the first of which was held in Washington on July 15. At that meeting the manufacturers of incandescent lamps, called together by the United States Fuel Administration, discussed the practicability of eliminating from production various unnecessary types of lamps, limitation in the production of carbon and "gem" lamps, discouraging use of the larger sizes of lamps where smaller sizes would give adequate illumination, and in general the elimination of wasteful and inefficient use of electrical energy so as to conserve fuel to the greatest practicable extent.

Recommendations resulting from the conferences, presented to the Fuel Administration by John W. Lieb, chairman of the committee appointed, were formally accepted and definite steps are now being taken to carry the program into effect. Letters will be sent by the Fuel Administration to the national associations representing the manufacturers of incandescent lamps, jobbers and contractor-dealers, central station companies, the public service commissions and the National Committee on Gas and Electric Service inviting their enthusiastic co-operation in carrying the program into effect and securing from producers and distributers of incandescent lamps and from the general public a hearty response which will produce prompt results.

The report of the committee of which Mr. Lieb was chairman, is addressed to Charles E. Stuart, chief of the power and light section of the Fuel Administration. It outlines the preliminary steps taken in the first conferences. At the initial meeting the following committee was appointed, with Mr. Lieb as temporary chairman:

TEMPORARY ORGANIZATION

Representing exclusive carbon filament lamp manufacturers: H. A. Baum, general manager Safety Electric Company, Chicago; J. B. Estabrook, Sunlight Electrical Manufacturing Company, Warren, Ohio; B. G. Erskine, president Novelty Incandescent Lamp Company, Emporium, Pa.; W. H. Dyer, sales manager North American Electric Lamp Company, St. Louis, Mo.

Representing licensee interests: T. C. Dowling, Westinghouse Lamp Company, New York; J. Camp, Franklin Electric Manufacturing Company, Hartford, Conn.; H. B. Rogers, General Electric Company; G. C. Osborn, General Electric Company.

Representing central stations: John W. Lieb, chairman National Committee on Gas & Electric Service; Samuel Ferguson, Hartford Electric Light Company.

Representing exclusive tungsten manufacturers: Dr. A. J. Liebmann, general manager Independent Lamp & Wire Company, New York.

Manufacturers of both carbon and tungsten: F. W. Marsh, president Consolidated Electric Lamp Company, Danvers, Mass.

Representing the government: Dr. J. F. Meyer, physicist Bureau of Standards, Washington; Theodore L. Gatchel, chief electric draftsman Navy Department, Washington.

Immediately following the appointment of this committee a conference meeting was called by the committee of all the lamp manufacturers of the United States whose names could be ascertained.

This meeting was held in the Engineering Societies Building, New York, on July 19.

A permanent organization was effected by the election of J. W. Lieb as chairman and T. J. McIntyre as secretary and the following names were suggested to be added to the committee and on motion all the nominations made were unanimously approved: Harvey Harper, F. J. Rooney and R. McNeill.

A general discussion was had covering every phase of the various suggestions made at the Washington conference and on motion the chairman was instructed to appoint a sub-committee of five, including the chair, to draw up a conservation program for the production and distribution of incandescent electric lamps as a measure of fuel conservation for presentation at a meeting of the full committee, such program to be drawn up in consultation with the representatives of the national organizations representing the electric light and power companies, the electrical contractor-dealers and the electrical jobbers.

The following sub-committee was appointed by the chair: B. G. Erskine, Dr. A. J. Liebmann, G. C. Osborn, W. H. Rolinson and J. W. Lieb, chairman.

The meeting, on motion unanimously adopted, voted to give the committee full authority and power to represent the meeting in formulating and presenting its formal recommendations to the United States Fuel Administration.

The sub-committee of five at several meetings discussed the various questions involved and called a meeting of the full committee in New York on July 25, at which the complete program was presented and after full discussion unanimously adopted. In addition to the committee the following organizations were represented:

Lamp Committee of the National Electric Light Association.

Lamp Committee of the Association of Edison Illuminating Companies.

National Association of Electrical Contractors and Dealers.

Electrical Supply Jobbers Association.

The following program was presented and after discussion was unanimously adopted and the chairman was instructed to transmit it to the United States Fuel Administration as embodying the recommendations of the committee and representing the views of manufacturers of incandescent electric lamps, the lamp committees of the national associations representing the electric light and power companies, the electrical contractor-dealers, and the electrical jobbers, to be adopted for the duration of the war as a national program to insure the use by consumers of electric light and power and the public of lamps of the highest efficiency, the elimination of unnecessary types and sizes of lamps and the discouragement of unnecessary and wasteful consumption of electrical energy so as to secure the largest practicable saving in fuel and make available for the use of the government and indispensable war industries, every pound of coal that may contribute to the winning of the war:

Conservation Program

The following program is recommended to the United States Fuel Administration:

1. The elimination of unnecessary types of standard carbon lamps and of carbon lamp types for special applications as follows:

The standard 60-watt multiple carbon lamp 100-130-volt range.

The standard 20-watt S-14 bulb multiple carbon lamp 100-130-volt range.

The 120-watt standard multiple carbon lamp 100-130-volt range.

The complete elimination of standard 30-watt and 60-watt round bulb multiple carbon lamps, and all other types of 100-130-volt range multiple carbon lamps with standard base used for decorative purposes.

2. The complete abandonment by central station companies of the installation and renewal of carbon incandescent lamps of all sizes and discouragement of their use by their consumers and the public for any use or application for which tungsten lamps can be substituted; this policy to go into full effect not later than Sept. 15, 1918. (Postponed date, Oct. 15.)

3. The gradual abandonment of the installation and renewal of metallized filament "gem" lamps of all sizes by the central station companies and discouragement of their use by their consumers and the public for any use or application for which tungsten lamps can be substituted.

Under special and unusual conditions where it is absolutely necessary to use lamps with exceptionally robust filaments owing to rough handling or excessive vibration, the use of carbon lamps is recommended so that the metallized filament "gem" type may be completely eliminated. This policy to go into full effect not later than Nov. 15, 1918. (Postponed date, Dec. 1.)

4. It is recommended that the use of considerable numbers of the smaller sizes of lamps for commercial and industrial applications be eliminated where it is practicable to substitute for them large single gas filled lamps of highest efficiency in a smaller number of lighting units.

5. It is recommended that the use of vacuum tungsten lamps in sizes of 100 watts and over be eliminated and whenever practicable gas filled tungsten lamps of highest efficiency substituted therefor.

6. It is recommended that electric light and power companies employ no differentials in their price schedules for the sale or renewal of lamps which may tend to encourage the use of larger sizes of lamps rather than smaller sizes,

7. It is recommended that all manufacturers of carbon and metallized filament "gem" lamps insert with each standard package of such lamps shipped by them a printed notice directing the attention of the user of the lamps to the fact that the particular lamps in the package should be used only in locations where it would be impracticable, because of excessive vibration and rough handling or for therapeutic and heating purposes, to use satisfactorily a more efficient type of lamp.

Manufacturers' Request to Users

It is recommended that the manufacturers use the following standard form for such notice:

> Complying with the request of the United States Fuel Administration, you are asked not to use, or advise the use of, the lamps in this package in such locations and under such service conditions where a more efficient type of lamp would be satisfactory.
>
> (Signed) ——————————.
>
> Manufacturer's Name.

8. It is recommended that when the United States Fuel Administration promulgates these regulations it should call the attention thereto of the public service commissions and other regulatory bodies, state and municipal, and should urge that where a public service corporation in order to comply with the terms thereof has the cost of lamp renewal service under the contracts with its customers substantially increased thereby, the public service corporation be permitted either to collect from its customers so affected the increase in the cost of the lamp renewal service or discontinue the furnishing of free lamp renewal service and, where practicable under present conditions, make therefore an appropriate adjustment.

It is recommended that the central station companies be requested to urge upon their customers and the general public in their advertising in the daily press, company house organs and in all promotion literature the importance of selecting lamps of sizes which do not provide an amount of illumination beyond what is strictly necessary, the exercise of due care in extinguishing all lamps which are not needed and the elimination of all extravagant and wasteful use of light, as a measure of fuel conservation.

10. It is recommended that a pronouncement be prepared and submitted for the approval of the United States Fuel Administration to be distributed to all of the electric light and power companies of the United States, through the facilities offered by the National Committee on Gas and Electric Service, calling attention to the urgent necessity of fuel conservation and inviting the co-operation of all users of electricity, for light and power purposes, to a full compliance with the conservation program as finally approved by the Fuel Administration.

It is recommended that in the promulgation of the program by the United States Fuel Administration the co-operation of the manufacturers, electrical supply dealers and electrical jobbers be invited in order to secure the widest possible publicity for the conservation measures proposed, reaching in these several ways every class of lamp user through all of the production and distribution channels.

11. It is recommended that the United States Fuel Administration communicate the program as finally adopted to the various government departments making extensive

use of incandescent electric lamps, such as the Shipping Board, Army, Navy, Treasury Department, etc., and invite their co-operation in conforming with the program to the largest practicable extent.

STATEMENT OF CONDITIONS INVOLVED

A general statement in regard to the above program is included in the report, as follows:

"Many electric light and power companies throughout the country furnish incandescent electric lamps of the metallized filament 'gem' type, and to a very much less extent of the carbon type, as free renewals within the cost of current or at a small extra charge either for the first installation of the lamps, or for subsequent renewals. The conditions of rendering this service are set forth in the rate schedules of the companies as filed with the public service commissions or other regulatory bodies, state or municipal, and they are often incorporated in the franchise provisions, or in the street lighting contracts between the utility companies and the municipalities.

"A change in the lamps furnished under these contracts from carbon or 'gem' lamps to tungsten lamps, or from large sized vacuum tungsten lamps to gas-filled tungsten lamps, in order to comply with the program above outlined will often result in an increase in the cost of the service. It is impossible for the electric light and power companies to bear this increased burden of cost of service at this time when nearly every public utility throughout the nation is suffering seriously, due to impaired revenues or increased cost of service or both, due to war conditions.

"It is therefore but fair to the utilities, where the substitution of lamps of higher efficiency for those of lower efficiency results in an increased cost of lamp service to their customers in order to comply with the recommendations of the program, that the public service corporations should be allowed to recoup themselves for the actual increased cost of service under the new conditions, and the United States Fuel Administration ministration should issue a definite recommendation to this effect.

"Should it be deemed inexpedient to make an extra charge to the customer to effect the change if the existing contract provides for the furnishing of lamps of the types eliminated under the program, the public utility corporation should be allowed to discontinue the supply of free lamp renewal service and, where practicable under the conditions in which the companies find themselves, an appropriate adjustment should be made therefor.

"It is considered impracticable to make a broad recommendation in regard to the elimination or restriction in the use of 40, 50 or 60-watt tungsten lamps, and the substitution therefor of 10, 15 or 25-watt tungsten lamps. The conditions surrounding the use of these lamps, the locations where installed, the type of fixture and glassware used, and the necessity for adequate illumination either for industrial processes to secure maximum production, or in the home to avoid the glare from naked lamps or the eye strain that would result from insufficient illumination, make it difficult to recommend the general substitution of lamps of the smaller sizes for the larger size lamps.

"It is possible to obtain the results desired by the Fuel Administration in the form of a saving of fuel in a considerable measure by emphasizing to the consumers of electric light and power and to the public generally, the importance of saving electrical energy and hence fuel, the desirability of eliminating every extravagant or wasteful use of light, and by discouraging the use of a larger lamp than is necessary for the immediate purpose for which the lamp is to be used.

"The existing policy of the central stations whereby they recommend to their customers and in various ways encourage the use of standard lamps of medium size, is based upon a broad consideration of all the economics controlling the furnishing to the public of satisfactory lighting service at the lowest total cost. Any temporary departure from that policy toward the encouragement of the use of smaller lamps must therefore be recognized as a step taken to meet an existing national emergency and justifiable for this reason.

"The purpose of the program would, in a measure, be defeated and an objectionable condition created if the substitution of types would result, for instance, in the use of 2-25 watt lamps where formerly a single 40, 50, or 60-watt lamp was used. In considering a more general use of 10 and 15-watt tungsten lamps the increased use of the raw materials required for their manufacture, such as bulbs, brass bases, etc., must be considered as it would be extremely difficult to obtain them in the increased quantities necessary under present conditions. The difficulty attendant upon making an increased number of low wattage lamps with the necessary losses in manufacture, estimated at from 20 per cent to 25 per cent in excess of the higher wattage type, would introduce a serious dislocation of present manufacturing facilities.

"It would also be pointed out that tungsten lamps of the smaller sizes have filaments which are less robust than those in the larger sizes, their life is consequently shorter and an increased number would be required for renewals thus overtaxing already overstrained production facilities.

"Attention is also called to the fact that the efficiency of the smaller sizes of tungsten lamps is considerably less than the efficiency of the larger types.

ILLUMINATION IN WAR INDUSTRIES

"Consideration must also be given to the importance of providing adequate illumination in manufacturing and industrial plants engaged on war industries, so as to secure the maximum production now demanded of them. It is the universal experience that a relatively small increase in illumination, affecting the fuel consumed to a very slight extent, results in a comparatively large improvement in both the quality and quantity of the output. It is therefore necessary to proceed with caution in advising any restriction of illumination in industrial plants engaged on war industries. On the other hand there are many locations and conditions particularly in the household where the larger sizes of lamps are now being used and where smaller lamps would no doubt give adequate illumination, the substitution affording a large reduction in the total consumption of current through which a large aggregate saving of fuel would be effected.

"Where a utility company as a part of its lamp renewal policy supplies tungsten lamps of both large and small sizes, it is recommended that the difference in the renewal or sale prices between the large and small sizes be based on the actual difference in the cost to the company of the service in each case and that no attempt be made to influence the use of the larger sizes of lamps by the consumers or the public through the establishment of a price differential that is not justified by the respective service costs.

"By the abandonment of the types as proposed in Article I such carbon lamps as it might still be necessary to use under the special conditions outlined would be of the next smaller sizes.

"It is desirable to secure the complete elimination of the metallized filament 'gem' type of lamps even though the substitution for them of carbon filament lamps in the few exceptional cases where it becomes absolutely necessary to use particularly rugged filaments may result in an apparently increased energy consumption. This increase in a few isolated cases should not defeat the important advantages to be attained by the complete elimination of the 'gem' lamps, an intermediate type between the carbon and tungsten lamps now become unnecessary.

"In order to secure the most complete elimination possible of the inefficient carbon and 'gem' lamps of all sizes it is recommended that where consumers specifically request lamps of these types from central stations or lamp dealers, their attention be called in each case to the recommendations of the Fuel Administration as outlined in the program and every effort be made to discourage the use of inefficient lamps by the public.

Working to Improve Tungsten Filament

"Many of these problems would be solved and a complete and almost universal substitute for carbon and 'gem' lamps be provided if a tungsten filament were available very much more robust than the present product. It is understood that manufacturers are now very actively at work on this problem and the outlook for its solution seems very hopeful. The manufacturers should be urged to still greater efforts in order to accomplish this very important result at the earliest possible moment.

"Attention is also called at this time to the importance of the proper rating and labeling of lamps by the manufacturers so that the consumption of energy does not exceed the limits provided for in the government specifications.

"The change in production of lamps from the manufacturing standpoint necessary to meet the program above outlined does not present insuperable difficulties, but will inevitably result in some interference with the business of certain manufacturers producing, wholly or in part, lamps of the types it is proposed to eliminate or the use of which is to be discouraged. It is believed that an agreement may be had with the larger manufacturers whose principal business is the production of tungsten lamps that they may abandon their output of carbon lamps, and transfer of the production of carbon lamps may possibly be arranged under a mutual agreement made through the administrative authorities at Washington between the larger manufacturing companies and the smaller businesses now producing carbon lamps. This phase of the question presents some legal, as well as industrial aspects which can no doubt be satisfactorily adjusted at a conference in Washington between the administrative authorities and the representatives of the parties in interest.

"It is a source of gratification to be able to report that all those present at the several meetings manifested the greatest interest in the proceedings, and displayed a most laudable spirit of co-operation and a readiness to make any reasonable sacrifice of personal interest and commercial advantage to the unselfish and patriotic purpose of aiding the government in every practicable way in meeting the supreme emergency which faces the nation.

"All those present at the meeting pledged themselves to devote their best efforts to making the program effective and in securing for the Fuel Administration the largest possible measure of co-operation to this end from the various organizations which they represented.

"Should this program commend itself to the Fuel Administration, it is suggested that the services of the National Committee on Gas and Electric Service be enlisted in the endeavor to make its provisions effective, where desirable also in co-operation with other similar committees of the industries affected, and also with a view to securing the elimination of inefficient lamps through the checking of the orders for such lamps, and enlightened co-operation on the part of the public in the substitution of the more efficient types."

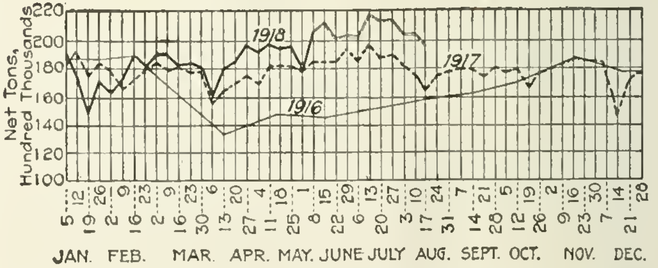
The following committee has been appointed to carry out the manufacturing features of the program: H. A. Baum, J. B. Estabrook, G. C. Osborn, B. G. Erskine, Dr. A. J. Liebmann, W. H. Rolinson and J. W. Lieb, chairman.

Aeroplane Improvements Sought

"Problems of Aëroplane Improvement" is the title of Bulletin No. 3 issued by the Naval Consulting Board and the Engineering Council's war committee of technical societies. D. W. Brunton, chairman of the committee, says in a letter accompanying the bulletin:

"The greatest care will be taken to discover and utilize everything of value that may inhere in suggestions and inventions submitted. Not only will they receive studious examination, but when necessary trials and experiments will be conducted. All inventions which have successfully passed the necessary examinations and tests are turned over to the particular department of the army and navy service where they may be most profitably utilized."

Bituminous Coal Production



The weekly report of the Geological Survey for the week ended Aug. 17 showed a continuation of the decline in production. In the following week, however, a recovery from the slump of the previous five weeks was reported.

War Need of the $200,000,000 Power Plant Law

Additional Testimony Before the Committee of Congress on the Urgent Necessity for More Power Facilities to Make the War Production Program Most Effective

ADDITIONAL testimony on the government $200,000,000 emergency power plant bill, now before the committee on interstate and foreign commerce of the House of Representatives, is now available. The views of Eugene Meyer, Jr., and Secretary of the Navy Daniels, published herewith, supplement those of Secretary of War Baker, Bernard M. Baruch, Lieut. W. W. Stanley and Clarence Dillon, which appeared in last week's issue of the ELECTRICAL WORLD.

Secretary Daniels

Secretary of the Navy Daniels wrote his endorsement of the bill to Chairman Sims of the committee on interstate and foreign commerce of the House of Representatives.

"I have been in conference with B. M. Baruch, chairman of the War Industries Board, the Secretary of War, and others with regard to the power bill, now before Congress," Mr. Daniels wrote. "The question of securing ample power for the ever-increasing contracts for the navy as well as for the Shipping Board and other war industries is one that gives us much concern.

"It is essential that ample power be supplied, and there is no adequate provision in any of the appropriations of the navy for financing agencies to secure the additional power facilities. The legislation proposed in your bill would confer this authority and give the appropriation necessary, and I trust it will come along at an early date."

Eugene Meyer, Jr.

Eugene Meyer, Jr., director of the War Finance Corporation, said that it is almost impossible that any given power situation should be a matter of interest to only one department. It is a matter of interest to almost all departments in every one of the big power markets. Therefore any advances, even if they could be made by one department, would be made for the benefit of the others, and there would be involved a regulation of the relations between the various departments which would be complicated and difficult.

Continuing, Mr. Meyer said that the situation for power is difficult to handle from a financial point of view for a variety of reasons:

First is the difficulty of getting money from any of the departments in sums adequate to the need.

Second, this requirement is a national military necessity and the power companies, so far as control and normal usefulness are concerned, are of local community interest. The national government steps in now and calls upon the local community through its company to provide for a national emergency military need.

One might say from the military point of view, Mr. Meyer added, that this has to be done regardless of cost, but the question at once comes up, "Is it fair to impose on the local community for all time the burden of carrying this improvement built up at these abnormal costs?" Rates, of course, are based on investment principally, the other features depending on the attitude of the local public service commission and on the contract and franchise conditions in the community; but the investment is getting more and more to be the guiding feature to the rate situation locally. Naturally the local community would feel that a special burden in the special location was imposed to cover really the national necessity.

Mr. Meyer pointed out that another consideration lies in the fact that the entire financial structure of public utilities is involved in considerable difficulty. These difficulties lie in the nature of the business. The price for the product is largely stationary. Cost of operation on the other hand has uniformly advanced and generally on a very radical scale.

"Of course," said Mr. Meyer, "this makes the security less attractive as an investment, less safe to the investor, and has proved a real hindrance to all public utilities corporations, more of course to the less financially strong, but even considerably to the heretofore financially strong."

INTERESTS OF LOCAL COMMUNITIES

The interest of the federal government is primarily military, to provide all needed financial assistance as promptly as may be done to meet the military requirements, to do it in such a way as to make clear exactly how it is done, so that there may be no misunderstanding either on the part of the community or the companies, or the people of the United States.

Mr. Meyer quoted from the following letter written by him to Mr. Baruch:

> In guiding the framing of the bill I have endeavored to protect the government's money to the fullest extent and also to show clearly the methods by which this is done. On the other hand, I have sought to have the bill evidence an attitude of fairness to the public service corporations and to the local communities which are being called upon to furnish the additional power. I have discussed matters and fairly with representatives of the various points of view on public service questions, and the endeavor has been made to keep this bill a bill to obtain power and to protect the government's financial interests in its funds advanced.
>
> It has been my special effort to avoid making this bill the incidental or accidental means of accelerating or retarding public ownership of public service corporations.

Expanding these ideas, Mr. Meyer said that public ownership is a big question of policy, and he felt that if Congress would pass a bill as a war emergency measure it should be absolutely what it pretended to be, and it should be made neither by intention nor unintentionally a vehicle for anything else. He felt that the bill had a better chance to be passed quickly if it avoided the question of public ownership and stood plainly and simply for what it was intended to be—a bill to obtain power, to furnish the financial assistance that is necessary and to set the whole matter forth clearly and protect both the government's interests and the public interests and at the same time be fair to the corporations.

Mr. Meyer added that in the work of the War Finance Corporation he is constantly facing the question of financing public utilities. Under the terms of the act it is very difficult in most cases to finance through the War Finance Corporation because it is necessary to get a certain margin of security and lend on terms which Congress carefully set forth. Public service corporations usually are allowed to issue by the public service commissions securities for the absolute value of the investment, of the money expended. They are not allowed to issue securities or have any free assets in their treasury which enable them easily to provide the War Finance Corporation with the necessary margin.

Mr. Meyer also brought up the important element of war waste and said that it will be impossible to say that an addition had a value to the War Finance Corporation from a loaning point of view equal to its cost. This bill may provide a method of taking care of that excess cost by which the War Finance Corporation may legally and with full regard to the restrictions in the act co-operate with the administration of the emergency power bill to help.

On the question of the quantity of power Mr. Meyer declared that he would not feel that there is enough power unless there is apparently too much. The curve of growth of the operations of this country in this war is so rapid that no man can say to-day what the need will be a year or eighteen months hence.

"If we discover we are short of power," he said, "that we have underestimated radically, it will be impossible quickly to provide the deficiency. I feel that a very liberal view must be taken of the requirements needed to provide the margin of safety with respect to power that we ought to have from a military point of view."

Policy on Rates

Replying to an inquiry from Representative Esch as to the rates for power in a government plant as against a plant in the same community which is not taken over by the government, Mr. Meyer expressed the opinion that the administration would have to be guided in its policy by the circumstances and the place. He said that it will not ordinarily acquire a plant in the sense of commandeering it unless it is a peculiar situation. If it constructs a plant, it will use a large part of the power for the United States government purposes, and, being consumed either by its own agents or by contractors working under contract with the government principally, it will be entirely proper and practicable for it to fix the rates. As a matter of fact, it will probably be paying the rates itself to a great extent in those instances.

Representative Esch asked if it was the idea that the power given the government to fix the rates would not seriously menace the private power plant.

Mr. Meyer answered: "I think not at all, because, in the first place, these plants acquired by the government or constructed will average a higher cost than the so-called private, really semi-public, corporations, and a fair return on the capital would undoubtedly protect the public service corporations in the community."

The question was raised as to whether an existing corporation would increase its rates if the government established higher rates than those prevailing in the community. Mr. Meyer said that it would be a matter of administration to administer the interests of the government with due regard to the local interests and fully protecting both to the extent that is possible. He said that the difficulty lies in the nature of the situation, that this is a federal need, and that ordinarily the public service corporation is a local need and there are necessarily in the very nature of things some conflicts. Mr. Meyer personally thought that they could not be entirely eliminated. The federal government would certainly not pass its property over to be governed entirely by the local community or public service commissions, or whatever there may be. On the other hand, a wise administration of this act would not lead to any unnecessary abuses locally.

Power Mainly for Military Purposes

Mr. Meyer declared that as industry is converted more and more from the ordinary uses a larger percentage of the entire industry, and therefore of the entire consumption of power, will necessarily go for military purposes. Investigating the distribution of power in Baltimore in order to find out the position of the Consolidated Gas, Electric Light & Power Company in regard to coal, he found that 83 per cent of the power distributed went to what would be considered strictly military and essential requirements.

"Of course," he added, "the large proportion in number of consumers of power will be householders and small shop people, a little power here or there which might be called unessential, but if you cull it all over you would have saved a very great amount of power and you would have done an enormous amount of harm in upsetting a lot of little people who cannot easily readjust their lives to the emergency."

Representative Hamilton asked if the government, in increasing facilities for production in a given area of the country, was not giving that area a first mortgage upon increased production after the war. Mr. Meyer said that, so far as he could see, to provide the power facilities would not give any advantage to one community over the rest of the country which that community would not have within a short period after the war because of its ability to provide its power on ordinary terms of financing.

"The term 'helping' these companies, gentlemen," he added, "is a little misleading. It is getting these companies to help the United States government. It is a measure to help the government get its power."

It was declared by Mr. Meyer that it would be impossible to carry out any considerable part of the power program inside of a year or eighteen months.

The question was raised as to reservation of the rights of the different states to tax the property. Mr. Meyer said that as long as the title is vested in the United States government he assumed that the states would not be able to tax the property. When it becomes the property of the company under any arrangement with the United States government or otherwise he presumed that it would naturally pass under the taxing powers of the state.

Another question was raised regarding the application of the clause providing compensation when private property is taken in the event that private contracts for power are abrogated. The point was raised that if a contract with the central station for power is annulled the government is in fact taking property. Mr. Meyer said he would be very glad to take up that question. It was also suggested that the question of the application of the act to processes, patented or otherwise, should be taken up, and Mr. Meyer indicated that he would do so.

Confidence in the President

When a member, pointing to the language of the bill, asked whether that was not broader and more drastic in its terms than any legislation that there has been in reference to the use of private property for government purposes, Mr. Meyer answered:

"It is and was intended to be a very broad power, but I may say this—that there was no intention to make easy an abuse of power, that all these provisions have been fully discussed with representatives of all points of view. I mean the power companies themselves and the representatives and officers of the national association of electric light and power people, and of course they recognize that it does place in the hands of the President a very great power. They have confidence in the fair use of that power for military purposes as it is intended in the bill. The companies themselves, in frank and open discussion, approve of these provisions, recognizing them as a military necessity, which is the basic point of view of the whole bill."

Mr. Meyer said that it was thought that the clause "for the purpose of selling or otherwise disposing thereof" showed an intention that the property was to be disposed of and sold, but that it was intended to remove from the President the necessity of disposing of it at a particular time, which might be very disadvantageous to the government's interests. If the bill should show that the property had to be sold at a specific short time subsequent to the war, it might be extremely damaging to the values that the government had invested in it. Reasonable leeway should be given. Mr. Meyer said:

"The question of the after-war conditions is so indeterminate that I think too short a period may jeopardize the government's interests. There is the question of post-war conditions. I think it will depend entirely on who wins the war and who dictates the terms of peace and also on how we handle our post-war problems—the reconstruction period—the transfer from what we now consider essential from a military point of view to what will become essential from an economic point of view. The wisdom and foresight and care with which that bill is handled will determine whether or not these plants will have value greater or less or small. So that there may be an acute period after the war when for a few months or one or two years the situation may be difficult. The volume of industry may sink from a manufacturer's point of view. There will be a period of difficult readjustment. The proper handling of public works which are being suspended and stopped at present may be the solution for the evolution from a war industrial to a peace industrial basis. These power plants may be not as largely used if we do not accomplish that transition carefully and smoothly as will be the case otherwise.

Replying to another question, Mr. Meyer said that he would be glad to consider whether the rates in government plants should be under the supervision of the Interstate Commerce Commission. It seemed to him, however, that it would be better to lodge that power under the administrator.

Mr. Meyer said that the case of a possible loss in the investment is commonly contemplated, and in his opinion the clear setting forth of this fact in the bill is one of the favorable factors. However, the very fact that the government does desire within reason to protect its own investment is the guarantee of the protection of the investment of the local power corporation.

Mr. Meyer said that he was not afraid personally of unfair or dangerous administration of the power granted by the act, and he referred to the consideration of almost every possible viewpoint in the framing of the measure. "It has an unusual history perhaps in the way of legislation from that point of view," he declared, "and the object of obtaining that co-operation was that we might meet every possible objection that can be thought of in advance and remove the difficulties that attend this kind of legislation in general to the extent that is possible."

RECAPTURE PROVISION IN WATER POWER BILL

House of Representatives Rejects Proposition to Substitute "Fair Value" for "Net Investment"—President Wilson's Letter

In considering the administration water power bill this week the House of Representatives rejected the suggestion of President Wilson that the recapture clause be amended to eliminate the provision for paying the net investment in the event that projects are taken under federal, state or municipal control at the end of the lease periods. The recommendation of the water power committee on this point was retained. By a vote of 96 to 71 a proposal by Representative Ferris of Oklahoma that "fair value" be substituted for "net investment" as urged by the President, was defeated.

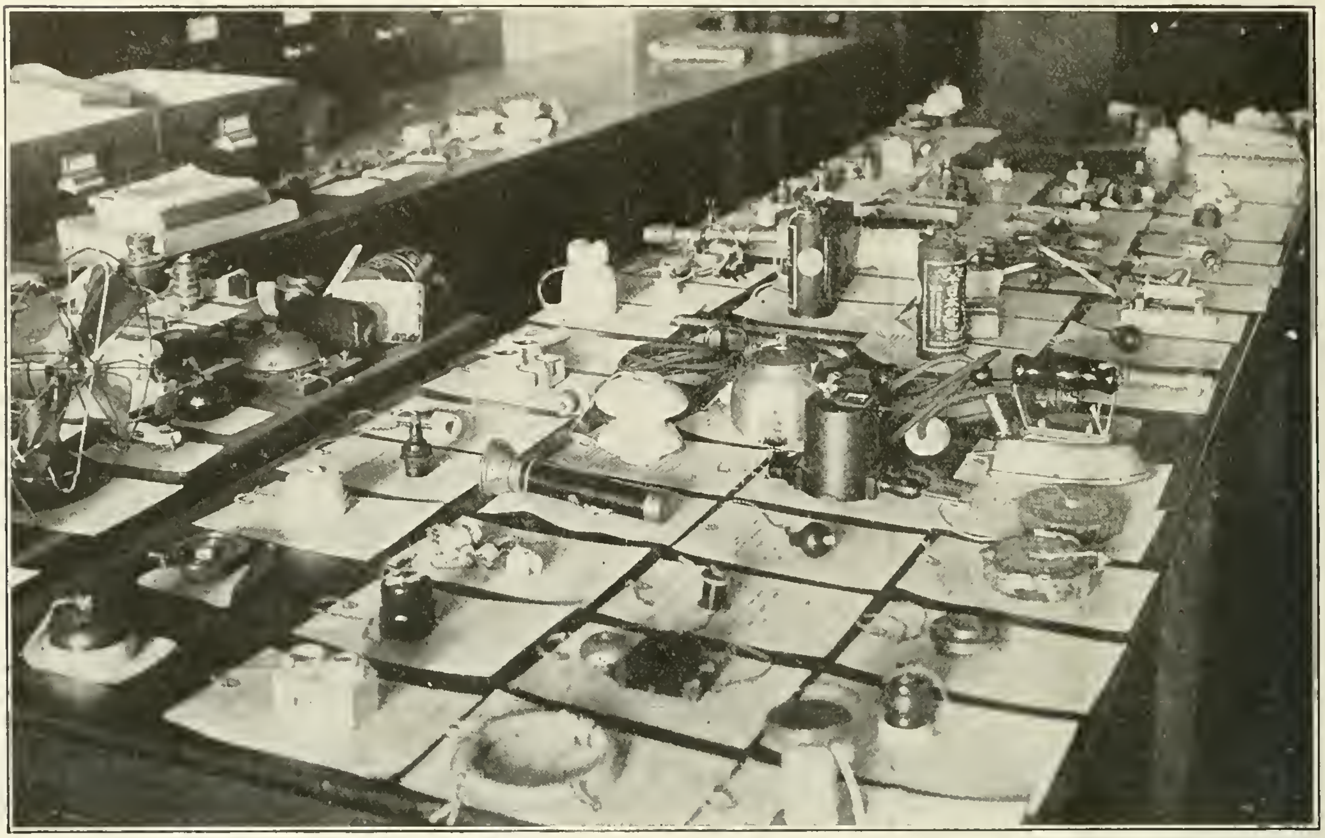
After this vote had been taken Representative Ferris offered another amendment making a similar change but this was also rejected.

President Wilson's letter, addressed to Representative Sims and made public in Washington, says:

I am going to venture to say to you as chairman of the special water power committee what I hope that you will not think I am taking too great a liberty in saying, namely, that inasmuch as the House of Representatives has four times passed a water power bill, each time with a recapture clause practically indentical with the pending water power bill as it was originally proposed by the Administration and agreed upon in informal conference, I am very much in hope that it will be the judgment of the House to reject the amendment and recur to the original bill in the form in which it was delivered by Mr. Pou of the Rules Committee for introduction and consideration by the Congress.

I am very much concerned about this feature of the bill, and have had the privilege of being so intimately associated with those who have from time to time conferred about it that I am venturing to make this earnest suggestion.

Government Exhibit of Foreign Electrical Goods



At the New York district office of the Bureau of Foreign and Domestic Commerce, a large collection of samples of electrical goods used in foreign countries has been displayed. The exhibit is made up of a comprehensive selection of the goods most employed in electrical work in various foreign countries and includes wiring devices, heating appliances, electrical porcelains, dry cells, flashlights, electric bells, conduit and conduit fittings, insulated wire, etc.

These samples have been forwarded mainly in connection with the special investigations undertaken in South America by P. S. Smith, and in Australia, New Zealand, China, Japan and Eastern Siberia by R. A. Lundquist, special agents of the Bureau.

There are several hundred items in the exhibit, and these have been specially arranged by T. O. Klath, Commercial Agent in charge of the Bureau's exhibit room, for inspection by electrical manufacturers and exporters or others interested in supplies of this character.

An interesting case was learned of recently, where an electrical manufacturer immediately visited the sample room upon learning of the arrival of a shipment of goods from a foreign market, and carefully studied certain items in which he was interested. Returning to his plant, he developed a similar line of superior design, cabled quotations and data to his agents in the market, and began selling a new line which has rapidly grown to large volume.

WAR PURPOSE SHOULD LIMIT PUBLIC UTILITY EXTENSIONS

Federal Government Capital Issues Committee Suggests Restrictive Policy to All of the Public Service Commissions

In a letter to all public service commissions the Federal Government Capital Issues Committee suggests postponement until after the war of public utility extensions which are not absolutely essential to the war purpose. It says:

If the men, money and material which the government needs are to be made available for essential war purposes, there must necessarily be a considerable degree of sacrifice on the part of individuals, communities and corporations in adjusting themselves to the substitutions and changed standards which the situation compels. Existing facilities must be made to serve in the place of new ones, regardless of temporary inconveniences and discomfort, unless the public health or paramount local economic necessity is involved.

May we suggest to you that these considerations apply with marked force to the public utility situation. The extensions and betterments which public service corporations are accustomed to make in normal times, either on the initiative of their own or by direction of the regulating commissions under which they operate, should in our opinon be postponed until after the war, unless an immediate war purpose is served, and may we ask of you consideration of the propriety of deferring even the performance of contractual obligations arising from franchise or other local requirements, when no military or local economic necessity is served by such expenditures.

ANNUAL CONVENTION OF ILLUMINATING ENGINEERS

At Meeting to be Held in New York on October 10 War-Time Lighting Topics Will Be Discussed

The Illuminating Engineering Society will hold its annual convention at the Engineering Societies Building, New York on Oct. 10, 1918.

War-time lighting economies, the use of better lighting in speeding up war production and manufactures, the lighting of camps, effect of lighting curtailment on crime, and automobile headlight laws will be discussed.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Rate Increase in Illinois.—A decision has been rendered by the Illinois Public Utilities Commission giving the Central Illinois Public Service Company increased rates for electric service in 148 communities in central and southern Illinois. The residence and commercial rate is increased 1 cent per kilowatt-hour. The commission declined to agree to an increase in municipal lighting rates. Power rates are increased approximately 15 per cent. The heating and cooking rate is increased 15 per cent.

Construction Work Ordered in New York.—At the direction of the Public Service Commission for the First District a letter has been sent to Pierre Jay, chairman of the district committee on capital issues, in reference to the application of the New York & Queens County Railway Company for approval by the capital issues committee of an issue of bonds amounting to $281,000 for the purpose of carrying out certain construction work ordered by the commission in Flushing Avenue, Borough of Queens. The commission letter states that while the company's application in form asks approval of the bond issue, in actuality the petition is a request to the committee to refuse its approval and to disapprove and bar for the period of the war the construction work in question. The commission asks the committee not to give the railroad company the benefit of an adverse decision upon its application, on the ground that the construction work has been ordered by the commission and is a necessary and important public improvement.

Valuation of Property.—Discussing value in a recent decision, the Wisconsin Railroad Commission says in part: "On the whole, it would seem that there could be no more equitable standard of fair value as between the utility and the consumer than that of investment reasonably and prudently made. By the use of this definition, however, we may in fact but be begging the question, for investment as so defined is very difficult of ascertainment. Under ideal conditions capitalization might well be the measure of it. But ideal conditions do not always exist. The company may not have exercised proper foresight or business acumen in the erection of the plant or the installation of equipment. Through failure to charge off renewals the plant account may be inflated. The amount expended to bring about a consolidation or acquisition of additional property may have borne no relation to the amount legitimately expended to construct the original properties consolidated or acquired. Even if the original cost of the property is ascertainable, it may not be the reasonable measure of the investment. Nor is investment necessarily the same as historical cost, if in arriving at historical cost we mean to take into account only those physical units which are still in existence and used and useful. Historical or original cost on this basis may in many cases be the most persuasive of any element to be considered in arriving at fair value. On the other hand, there may be equities and circumstances existing in connection with the construction of the plant and the organization of the company that necessitate the taking into consideration of other and further elements which in fact represent legitimate, honest and prudent investment but which are not represented by the physical property. As a general thing, inclusion of such elements should only be made with caution, and it should be established that neglect to consider such elements would work an injustice before giving them great weight. . . . If the amount honestly and prudently invested in the enterprise could always be ascertained, it would, in our judgment, be a very important element to be considered in establishing fair value, as representing both the measure of sacrifice by the owners of the utility and that amount upon which the public should be asked to pay reasonable returns. The difficulty, however, relates rather to the ascertainment of the facts than to the matter of definition. It is largely because of the difficulty in ascertaining such an amount that reproduction cost is in so many cases resorted to and given a preponderating influence. We are of the opinion that reproduction cost is useful in proportion as it tends to throw light upon investment, rather than as being in and of itself the measure of exchange value. Reproduction cost, both new and less depreciation, is also valuable in other ways. The reproduction estimate is helpful in determining the amount of non-operating property as distinct from the operating property, and assists in the allocation of a large property between different utilities served by the same organization. Investment as defined and limited above may throw but little light on questions of depreciation, a question which cannot be wholly neglected in arriving at ultimate fair value. Reproduction cost less depreciation tends to throw considerable light on the question of treatment of maintenance and renewals, and is especially important in connection with establishing a proper depreciation reserve and fixing a proper amount to be annually credited to that reserve. It also throws light on the question of whether depreciation has been allowed to take place at the expense of service. If the company has neglected upkeep or failed to maintain proper reserve, the earnings in the meanwhile being sufficient for that purpose but being in fact returned to the stockholders in dividends, this fact should be ascertained."

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 479 of this number.

Illuminating Engineering Society.—The Illuminating Engineering Society will hold its annual convention at the Engineering Societies Building, 29 West Thirty-ninth Street, New York City, on Oct. 10. War-time lighting economies, the use of better lighting in speeding up war production and manufactures, the lighting of camps, effect of lighting curtailment on crime, and automobile headlight legislation will be among the subjects to be discussed by lighting authorities of national reputation.

Empire State Gas & Electric Association.—A meeting of the Electric distribution Section of the Empire State Gas & Electric Association will be held in the Hotel Utica, Utica, N. Y., on Fri-Sept. 6, at 9.30 a. m., in order to discuss "Methods of Arming Poles for Transformers," "Economical Methods of Double Arming Poles for Line Strains," "Determining the Necessity for Anchors and Guys and the Method of Installing with Minimum Expense," "Calculating the Size of Wire for Primaries, Secondaries and Street Lighting to Economize in the Use of Copper," "Design of Secondary Networks with the Object of Reducing the Number of Transformers," and the "Progress of Member Companies in Grounding Secondaries." It is hoped that discussion will bring out suggestions as to ways and means of economizing on material and labor.

Southwestern Electrical & Gas Association.—The first quarterly conference of the Southwestern Electrical & Gas Association held in Dallas, Tex., recently was devoted largely to the question of fuel and rates. S. M. Darling of the United States Bureau of Mines, who has just made an investigation in Texas, gave an address on the use of lignite as a fuel in the place of coal, oil or gas by the public utilities and industrial plants. Some interesting comments on the manner of making gas from lignite were given by Prof. E. P. Schoch of the University of Texas. His experiments indicate that it may be possible to make a gas as stable for long distance transmission as natural gas. Efficient and economical combustion of lignite underneath the boiler was discussed by S. B. Flagg, who showed the progress made in bettering the combustion of lignite for steam-making purposes. A. Hargrave of the Fuel Administration of Texas outlined the desires, intentions and suggestions of the government to completely classify and control the supply and distribution of fuel in that district.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

"Fuel Facts."—A booklet published by the United States Fuel Administration, under this title gives much educational information in regard to the personnel, work and problems of this government agency.

San Diego Company Sells Power to Southern California Edison Company.—The San Diego Consolidated Gas & Electric Company during the week ended Aug. 23 sold to the Southern California Edison Company of Los Angeles nearly 500,000 kw.-hr., transmitting it over the line completed early in the summer for the exchange of electrical power between these two companies.

New Division of Fuel Administration Work.—The administrative engineers of the Fuel Administration of Illinois have redistributed the work which has arisen in connection with the handling of reports and questionnaires from all power plants in Illinois. Formerly all power plants in Cook County including Chicago reported to Harold Almert, and all those in the remainder of the State to Joseph Barrington. In accordance with the redistribution of the work all high-pressure plants in the entire state will report to Joseph Harrington and all of the low-pressure plants which constitute mainly the heating plants will report to Harold Almert. This change was made to arrive at a more logical division of the work of the administrative engineers for the Fuel Administration.

Cambridge Company Raises Rates.—The Cambridge (Mass.) Electric Light Company has increased rates, effective on Sept. 1. A letter to consumers, signed by Welles E. Holmes, the treasurer, says: "Owing to the well-known increased cost of production, especially in the item of fuel, it becomes necessary to increase rates for electricity. Up to the present time the company had hopes that some favorable change of conditions would make this step unnecessary, but as conditions are becoming worse rather than better, a further maintenance of all of its present rates is impossible. Therefore, for all electricity used on and after Sept. 1, 1918, and until further notice, a surcharge of 1 cent per kilowatt-hour will be made except as follows: (1) The first $45 worth per month net under General Lighting Rate, Schedule A. (This covers general house lighting.) (2) Domestic Energy Rate, Schedule C. (This covers cooking, heating, etc.) (3) The first $33 worth per month net under all power rates."

Increase Municipal Plant Rates.—The municipal light board of Reading, Mass., has increased rates to 14 cents per kilowatt-hour in Reading, and in Wilmington, North Reading and Lynnfield Centre to 16 cents. Present prices are 12 and 14 cents. The discount for prompt payment remains as at present. the light board states as the reasons for the advance: present high cost of fuel (and inferior quality), increased demands of labor, and general increases in operating expenses.

Governor Goodrich Expresses Attitude Toward Public Utilities.—Governor J. P. Goodrich of Indiana, speaking before a recent meeting of the Indiana Electric Light Association, said he appreciated the situation of the public utilities of the State. He believes, however, that the people of the State do not realize the necessity of granting higher rates to the utilities. Letters that came to his office indicated this, he said. This lack of public enlightenment exists, he said, in spite of the fact that the government has increased the cost of transportation not 15 per cent but nearly 100 per cent.

Water Power Resources Committee Appointed in England.—The Board of Trade of England has appointed, with concurrence of the Ministry of Reconstruction, the following committee to examine and report upon the water-power resources of the United Kingdom and the extent to which they can be made available for industrial purposes: Sir John F. C. Snell (chairman), G. S. Albright, Sir Dugald Clerk, Dr. J. F. Crowley, H. F. Carlill, Board of Trade; Philip Dawson, Professor Gibson, Vernon Hartshorn, Dr. H. R. Mill, A. Newlands, G. C. Vyle, representing the Associated Chambers of Commerce in the United Kingdom; A. J. Walter, Ralph Walter, Ministry of Reconstruction, and D. J. Williams. R. T. G. French is the secretary.

Praise for Salina Company.—The Salina (Kan.) City Council has granted rate relief to the Salina Light, Power & Gas Company, of which W. E. Quillin is manager. Large, rather than small, consumers are affected. Through Ed Mathews, Mayor, and Charles E. Banker, city clerk, the city has commended in a letter to the company the existing relations with the city, saying in part: "One year ago the company voluntarily reduced its incandescent rates 2 cents per kilowatt to private customers, which was absolutely voluntary on its part as the franchise provides for the rate in effect at that time. The city has had arc-light prices reduced, and has had several other concessions from the company in the way of park lights and other public benefits. We have always found the different managers who have had charge of the plant in this city willing to meet the city's demands on any reasonable proposition, and have in some instances done more than we really expected. It has been a pleasure to transact business with a corporation of this kind.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Death of Employee from Negligence.—Where an employee in a railroad shop was electrocuted while holding an electric lamp attached to a cord, and it appeared that the apparatus was defective and had been so for at least a week, that witness had been shocked six or eight different times, and that the dangerous condition had been reported to the officers in charge, who failed to remedy the condition, it was not error to instruct that punitive damages might be allowed, the Supreme Court of Mississippi held (79S.73).

Commission Findings.—While the Public Utilities Commission should be careful to make proper findings respecting material ultimate facts upon which an order is based, where the findings and opinion, considered together, are such that more specific findings would benefit no one, they are sufficient, the Supreme Court of Utah held (173, P. 556). Under the laws of 1917, providing for review of proceedings before the commission, all the Supreme Court can review is whether there is any evidence to sustain the findings of the commission, whether it has exercised its authority according to law, and whether any constitutional rights of the complaining party have been invaded or disregarded.

Condemnation Proceedings Despite the Public Utilities Act.—The Superior Court, in action for condemnation begun under Section 47, as amended by Statutes 1913, is not authorized to determine the value of the property at the time of the trial and to give judgment for such value as the compensation to be paid, for the Superior Court has no function to perform under the statute concerning the value of the property, but must take the finding of the Railroad Commission on that head as conclusive; and, if any additional findings of value can be made for the purpose of a condemnation suit under Section 47, they must be made by the Railroad Commission and not by the Superior Court, it was held by the Supreme Court of California (173, p. 469). The public utilities act, 74, provides a scheme for the condemnation of property by the public corporations mentioned therein by a proceeding wherein the value of the property is to be fixed by the Railroad Commission, and the right and power of the public corporations to condemn the property is to be determined by the Superior Court. The public utilities act also provides the Superior Court with jurisdiction for the enforcement of the right.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

H. L. Doherty has been appointed by the chairman of the Shipping Board a member of the American committee on standardization of Petroleum products.

Ralph H. Rice, principal assistant engineer, Board of Supervising Engineers, Chicago Traction, has been commissioned as captain in the construction division of the army.

John D. Ryan, president of the Montana Power Company, has been selected to act as Second Assistant Secretary of War, succeeding E. R. Stettinius. Mr. Ryan, as Second Assistant Secretary, is designated director of air service and is charged with the responsibility of procuring and furnishing to the Army in the field the material and personnel required for the air service, and is given supervision, control, and direction over the Bureau of Aircraft Production and the Bureau of Military Aeronautics, with full power completely to co-ordinate their activities and to develop and carry out the air program. As a result of the necessity of devoting all of his time to war work, Mr. Ryan has resigned as president of the Anacorda Copper Mining Company and from the board of the company.

Guy E. Tripp, formerly Colonel United States Army, and head of the production division, who as noted in last week's issue of the ELECTRICAL WORLD has been made brigadier general, has been placed in charge of the administration work of the eleven district ordnance offices having charge of the production of ordnance material in their respective sections of the country. The district chiefs will report direct to General Tripp, who is succeeded as head of the Production Division by Colonel C. C. Jamieson. Previous to his connection with the Ordnance Department, General Tripp was chairman of the board of directors of the Westinghouse Electric & Manufacturing Company.

Robert V. Prather, former secretary of the Illinois Public Utilities Commission, at a joint meeting of the Illinois State Electric Association and the Illinois Electric Railways Association, held in Chicago on Aug. 16, was elected joint secretary of the two associations, effective Sept. 1. Mr. Prather will devote his entire time to the two associations. The headquarters of the associations will be located at rooms 304 and 306 DeWitt Smith Building, Springfield, Ill. For the past five years Mr. Prather has been secretary of the Illinois Public Utilities Commission, having been appointed secretary by Governor Dunne a few weeks after the commission was inaugurated on Jan. 1, 1914, and served through the Dunne administration and was reappointed secretary by Governor Lowden on July 1, 1917, resigning the position on July 15, 1918. Prior to his connection with the Utilities Commission, Mr. Prather was western solicitor for a large New York brokerage house.

H. E. Jacks, formerly chief electrician for the Fort Worth Power & Light Company, Forth Worth, Tex., resigned that position to become chief electrician of power plants for the Kansas City Light & Power Company, Kansas City, Mo.

W. H. Morton, who resigned as secretary of the National Electrical Contractors' Association in 1913, has been appointed general manager of the National Association of Contractors and Dealers of which the former was the forerunner. Mr. Morton was born in Springfield, Mass., in 1869, where he received his early education, later taking a two-year course in the Gunnery Preparatory School of Washington, Conn. For three years he was in the woolen business and in 1890 he entered the students' course of the General Electric Company at Schenectady. At the conclusion of this course he was placed in charge of the testing department of the Schenectady works until 1895, when he went to Utica, N. Y., to enter the electrical contracting business. He continued in this business for ten years, at the same time carrying on the work of secretary of the National Electrical Contractors' Association. From 1905 up to his resignation in 1913, he devoted all of his time to this association work. From 1898 to 1902 Mr. Morton was secretary of the New York State Electrical Contractors Association. He was also secretary of the Knit Goods Manufacturers' Association, the Utica Employers' Association and the Park Board of the City of Utica. For the past five years Mr. Morton has been in Porto Rico where he was engaged in growing grapefruit. Mr. Morton is a pioneer Contractors' Association man and was largely responsible for the organization of the National Association. He was elected temporary secretary of the first meeting in 1901 and later permanent secretary of the National Association.

W. H. MORTON

S. Morgan Bushnell, formerly with the Commonwealth Edison Company, Chicago, and later with the Illinois Maintenance Company, has taken a position with Critchell, Miller, Whitney & Barbour, agents for insurance companies of England and America. In 1911 Mr. Bushnell was appointed chairman of the central station heating committee of the Commercial Section of the National Electric Light Association.

Obituary

William H. Elliot, president of the Keene (N. H.) Gas & Electric Company, died recently at his summer home in Nelson at the age of sixty-eight years.

Elbert B. Peck, vice-president and comptroller of the Indianapolis Tractional & Terminal Company and of the Terre Haute, Indianapolis & Eastern Traction Company, died on Aug. 24 following a long illness. Mr. Peck had been associated with the Indianapolis Traction & Terminal Company since he went to Indianapolis from Kansas City, Mo., in 1899. He was made vice-president of the company in 1906. He was also a director of the Terre Haute Traction & Light Company. He was at one time president of the Central Electric Railway Association.

Thomas R. Taltavall, editor and part owner of the *Telegraph and Telephone Age*, died at his home in Mahwah. N. J., on Monday, of heart disease, at the age of sixty-three years. Prior to taking up the editorship of the *Telegraph and Telephone Age* in 1910, Mr. Taltavall was for fourteen years associate editor of the ELECTRICAL WORLD. He began his editorial career in 1890 with his brother, John B. Taltavall. owner of the *Telegraph Age*, which property was expanded later into three journals by the publication from the same office of the *Telegraph Age*, *Street Railway News* and *Electrical Age*. He became editor of the latter journal upon its creation and continued as such until 1896, when he joined the staff of the ELECTRICAL WORLD. Previous to taking up editorial work Mr. Taltavall was one of the most prominent telegraphers in the country. He was selected as one of the original operators to man the first wire leased by the Associated Press to carry the newspaper service between New York and Washington in 1875, having been assigned to the Washington Bureau. He was soon transferred to the New York office where he remained for fourteen years, during the latter eight of which he filled the position of superintendent of the leased wire system of the Associated Press.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

GOVERNMENT ORDERS STEEL STOCK INVENTORY

Should the Government Order a Redistribution of Surplus Stocks Manufacturers of Electrical Material and Supplies May Benefit

Questionnaires are being sent by the government to more than 40,000 manufacturers using steel in any quantity to ascertain the amount of steel stocks in the country.

The War Industries Board announced:

"A country-wide inventory of stocks of steel on hand is being made by the War Industries Board at the instance of its chairman, Bernard M. Baruch, in co-operation with the census bureau of the Department of Commerce. The ascertainment of the supply of steel is of first importance in view of the deficiency of production of steel for direct and indirect war needs.

"The present estimated total production of steel in sight is 17,000,000 tons, and war demands total over 23,000,000 tons, with the demand constantly rising."

In a recent interview with the Washington newspaper correspondents, Mr. Baruch announced he could not approve requests for an ounce of steel for domestic uses, because of the imperative need of meeting the war demand.

This action of the War Industries Board is taken to foreshadow the requisition by the government of all surplus steel stocks in order that there might be a more satisfactory distribution of steel for essential purposes.

Undoubtedly the answers to the questionnaires will bring to light considerable quantities of steel which the government might consider can be better used elsewhere. In this case the electrical industry should benefit largely since it is now operating virtually on a 100 per cent essential basis. The inability to obtain larger stocks of steel has been a handicap to the electrical industry for some time.

BASIC PRICE FOR ALUMINUM CONTINUED UNTIL MARCH 1, 1919

Same Conditions Hold as Were Formerly in Effect—Prices Effective on Existing Contracts if Made With Such Specification

The President has approved an agreement made between the producers of aluminum and the price-fixing committee of the War Industries Board (after investigations by this committee in conjunction with the Federal Trade Commission as to the cost of production) that the maximum base price for aluminum of 33 cents per pound f.o.b. United States producing plants, for 50 tons and over, of ingot of 98 to 99 per cent, be continued until March 1, 1919. Differentials for sheet, rod and wire, and differentials for quantity, for grade and for alloys will remain those approved by the price-fixing committee of the War Industries Board as effective from June 1, 1918. Copies of the price list, including differentials, may be obtained upon application to the non-ferrous metals section of the War Industries Board.

These prices will be effective on deliveries made during the period from Sept. 1, 1918, to March 1, 1919, on contracts made during said period; and, furthermore, the new prices will be effective on deliveries made during said period on existing contracts which specify that the price shall be that in force at the time of delivery. Deliveries made during the period of Sept. 1, 1918, to March 1, 1919, on other contracts shall be at the price stated in such contracts, except that on existing "direct and indirect government contracts" containing a provision that refund is to be made of the difference between the price stated in the contract and the "government fixed price, if as and when made" such difference shall be refunded on deliveries made during the period from Sept. 1, 1918, to March 1, 1919, on presentation of proper proof that the purchasing government gets the benefit of the refund.

The conditions are as formerly: First, the producers of aluminum will not reduce the wages now being paid; second, aluminum shall be sold to the United States government, to the public in the United States, and to the allied governments at the same maximum base price; third, they will take the necessary measures, under the direction of the War Industries Board, in the distribution of aluminum to prevent it from falling into the hands of speculators, who might increase the price to the public, and, fourth, they will pledge themselves to exert every effort necessary to keep up the production of aluminum so as to insure an adequate supply so long as the war lasts.

CLOSER CONTROL OF CREDITS ADVOCATED

Long Time Allowances and Partial Payments Sharply Critized—Interest and Overdue Accounts Not Favored

Prompt settlement of accounts and a closer watch upon credits and collections throughout American business in general were advocated by Robert Adams, Cleveland, Ohio, at the convention of the National Retail Credit Men's Association, Boston, Mass., on Aug. 20. It was shown that war conditions offer a remarkable opportunity to impress upon the retail buyer the patriotic importance and economic benefits accruing from cash or thirty-day settlements. Competition both within the country and from Europe will force better business methods upon American trade and industry in the near future. Slackness and loose methods in the collection of accounts are a source of economic and capital waste, the speaker declared. "Long-time credits, such as ninety-day allowances, are among the foremost 'non-essentials' of to-day," he said. Few know the difference in the cost of collecting a thirty-day and a ninety-day account.

The speaker contended that now is the time for the credit manager to take the initiative and educate the public along the line of the moral responsibilities of running accounts. No fear need be felt as to losing trade if credits are more closely watched and controlled, Mr. Adams intimated. The practice of permitting partial payments on bills in circumstances where the entire amount could readily be settled was severely criticised. The author advocated charging interest on accounts more than sixty days overdue, but in a brief discussion following his paper a number of speakers opposed this on the ground that it places the dealer in the positions of a banker toward the purchaser.

This has been the contention of the majority of credit men in the electrical trade for some time. A few houses are charging interest, but the results do not seem to warrant a general entrance into this practice. Strict adherence to terms with a withdrawal of credit if bills are not paid promptly seems to have met with the best results.

THE WEEK

IN TRADE

THE volume of buying continues undiminished but the trade generally is in an unsettled condition. This has been brought about by the recent rulings of the government. However, as these ruling are more fully understood by buyers more stable conditions will undoubtedly exist. The trade is showing a disposition to obey all of the official rulings obsolutely.

Prices are more stable than they were a month ago but there appears to be certain indications of advances shortly.

Stocks while low in certain items, especially conduit, are on the whole in rather good shape. Deliveries seem to be somewhat better in spots but more transportation delays can be expected from now on until next spring.

NEW YORK

Conditions in the industry are still uncertain but when the stricter and more definite rules now being formulated by the War Industries Board become generally known manufacturers and jobbers expect a steadier market. No violent changes have been noticed in the supply and demand over last week, but with the end of vacations and with everybody back at work it is thought that the fall buying will start with a rush.

Manufacturers whose product has been declared non-essential are turning to war work in the best way they can. Stocks of such devices are reported to be good and will be meted out to customers as long as they last.

The copper situation remains the same and manufacturers think they will have no trouble in obtaining it for essential industries. Exports have fallen off a great deal but this is said to be due to the fact that increased manufacture of wire in this country offsets former imports from abroad. Also the tremendous shipments of copper to France the latter part of 1917 makes comparison difficult.

WIRE.—Twelve of the largest manufacturers report the wire base ranging from 30 cents to 37 cents, with the majority setting it at 34 cents. However, the discounts are slightly different so the base will run actually between 33 cents and 34 cents. The utilities are buying some wire, in fact, all they can obtain, but it is estimated that between 75 per cent and 85 per cent is going direct to the war industries.

FIXTURES.—Manufacturers of fixtures using brass chains are completely shut down in consequence of the order declaring chains for this purpose non-essential. A meeting was to be held in Washington yesterday to attempt standardization of a fixture that will be useful and still use a minimum amount of material. When this is decided upon the fixture assembler will be in a more certain position and in all probability will be able to continue somewhat in business. A large chain producer corroborates the complete stoppage of the manufacture of brass chain until the government orders otherwise. Some stock is on hand which is being supplied to customers. All sizes are not available, however, but substitution is made where possible.

LAMPS.—Although plentiful now, manufacturers will not make any prediction on the future supply of lamps. An uncertainty due to the daylight-saving law and orders of the War Industries Board will probably not be straightened out for some little time. Fall orders are coming in this week, however, and the only fear is that the supply will not keep up with the demand.

POLE-LINE HARDWARE.—The expected increase in pole-line hardware on Sept 1 has not been brought about as yet but it is predicted that a 5 per cent increase will occur shortly.

POLES.—Good demand for poles has been reported this week as the utility men return from their vacation holidays.

GUY-WIRE ANCHORS.—A large number of guy-wire anchors being exported to France at present is taking care of the supply until the domestic demand starts up.

MOTORS.—The demand for fractional horsepower motors has fallen off and a further decrease in the demand is expected on account of the restriction placed on washing machaines and vacuum cleaners. Larger motors are being demanded for essential industries.

CHICAGO

Among the jobbers and their customers the pledge system of handling essential goods is receiving a great deal of attention. In order to be able to obtain materials for replacement of stocks the jobbers must furnish the manufacturers with proof that the goods sold went for government needs, either directly or indirectly. The absolute necessity of following out this patriotic course is not fully understood by the jobbers' customers, and this causes trouble. It also leads to a lot of detail work for the customer and much more work for the jobber. Attempts are being made to educate buyers to follow this plan. House organ and circular letter appeals are being employed to this end. But in spite of this some customers are found who lose their tempers because they do not appreciate the patriotic duty they owe the government to help restrict the movement of goods to non-essential industries.

Another evidence of restriction for non-essentials came in the shape of an announcement that no more schoolhouses would be built in this district during the war except for replacements. This will have a deleterious effect on the little electrical contracting business which still exists. The newspaper talk about the dearth of war business in Chicago, however, seems on closer investigation to be exaggerated. There are 2000 plants in Chicago to-day on war work. The exaggeration no doubt sprung out of the fact that the manufacturing done here is not of the more spectacular "cannon and shell" type.

In connection with the war business coming to Chicago it is interesting to note that certain underlying electrical trade conditions give evidence of being changed by the government in such a way that electrical manufacturers who never before could sell in Chicago will now be able to find a ready and profitable market here.

The labor situation in the last few weeks has surely been stabilized by the government's wise policy of closing enlistments. There are thousands of men between 18 and 45 years who would have enlisted during the last week, had it been possible, in order to escape being drafted later. The temporary closing of all avenues of enlistment fortunately prevented this flurry in labor.

The volume of trade is characterized as "pretty good," this statement being qualified with the further comment that more orders would be welcome. While the summer slump is here its proportions are not up to normal. Prices still show an upward trend.

WIRE AND CABLE.—Wire products are on a 34-cent base, but the customer's first question is not about price—it is about delivery.

CONDUIT.—Stocks in Chicago are generally in pretty good shape but those of jobbers outside the city appear to be low, judging from the orders Chicago jobbers are getting due to delivery. Some see improvement in conduit stocks ahead. They are, however, among the fortunate preferred customers of the pipe mills. Non-metallic flexible conduit has advanced 20 per cent this week.

PIPE FITTINGS.—Condulets and like equipment have advanced slightly—about 5 per cent—for shipment out of distributers' stocks. The margin of handling was becoming too close with the increased freight charges.

LAMPS.—Stocks are in good shape with the exception that high-wattage lamps and miniatures are not plentiful.

SCHEDULE MATERIAL.—An advance in the future is rumored, but is only a rumor so far. Some sales managers have not taken it seriously enough to notify their salesmen.

AUTOMOBILE ACCESSORIES.—Jobbers who deal largely in this line are worrying. Nothing is being done to these goods on an essential list and furthermore the gasoline-less Sunday is expected to curtail pleasure car driving about 50 per cent.

FANS.—Fans are still in stock. If more are not made this winter the jobbers who have them may still turn them at a nice profit.

LIGHTING REFLECTORS.—There is a general movement all along the line to increase the price of lighting reflectors. Some companies have already advanced their prices and it is reported that other advances are in immediate prospect. Some of the companies which have already advanced the prices have arranged a scale of four discounts. They have a distributers' discount, a jobbers' discount, a contractor-dealers' discount, and a consumers' discount. The companies which have not yet increased prices are reported to be considering the adoption of a similar plan.

BOSTON

Barring a noticeable reduction in business due to the holiday week end, trade continues well maintained. Collections do not show much of any improvement in face of forthcoming governmental needs, but underlying conditions appear sound. The good news from the Western front unquestionably has a wholesome psychological effect upon nearly everyone in the industry. The shortage of labor, skilled and unskilled, is perhaps the most troublesome problem confronting the trade at this writing. Without question, more women will have to be pressed into service in order to "keep the home wheels turning" at the requisite speed and efficiency.

Some imporvement is noted in railroad shipments into New England, especially in connection with Westinghouse motor orders filled at Pittsburgh. Stocks are beginning to look rather spotty, but jobbers are of the opinion that war requirements can be met reasonably well with due care in advance ordering, coupled, of course, with the usual priority service.

The New Home Sewing Machine Company, Orange, Mass., has recently purchased about 1000 hp. in Westinghouse motors of 75-hp. rating down, for munition work. A six weeks' delivery was given. Service will be furnished by the Athol (Mass.) Gas & Electric Company.

MOTORS.—Small motors are still in large demand. Stocks are, on the whole, satisfactory up to about 25-hp. rating. No immediate increase in prices is in sight. The textile industry is buying consistently, and the government seems to have no end to its demands for motor applications.

FANS.—The season is about over, and dealers report a fair business, all things considered. The weather has been far from favorable to a good fan year. Stocks are in reasonably good shape to meet the small but important demand for fans for use in ventilation and window clearings as the season grows late.

WIRE AND CABLE.—Weatherproof and rubber-covered wire are quoted at about 30 and 32 cents respectively, with government orders dominating the market. Very little stocking up is permitted under present conditions.

ELECTRIC FLAT IRONS.—The demand continues heavy. There is a tendency toward a shortage in some popular designs, which does not seem likely to be overcome this month.

RAILWAY MOTOR COILS.—A substantial business has lately been handled in the sale of motor coils for street railway repair shop use. This is due to the heavy maintenance required as a result of storms last winter. The Bay State Street Railway is reported to have ordered no less than $50,000 worth of spare coils, to get in readiness for the coming winter's work.

WASHING MACHINES.—The demand for these exceeds all previous totals, and the market appears to be rapidly becoming oversold. An advance in price of $15 to $150 was scheduled for Sept. 1 on the "Easy" washer. A good fall business is anticipated.

VACUUM CLEANERS.—Trade is brisk, and many orders are being filled for direct government use. Stocks are not accumulating much at the factories and the outlook is good for an active fall trade. Further price advance is sensed from a recent factory visits.

ATLANTA

The volume of business in all lines continues heavy with the exception of meters. Practically all takings are for government account or for essential work for the prosecution of the war. The government has been very active of late in negotiating for going plants for reclamation service. The city of Atlanta has secured a temporary restraining order to prevent the Georgia Railway & Power Company from putting into effect on Sept. 1 the new rates.

While there have been general rains throughout the Southeast, there has been practically no precipitation on the drainage areas which supply the Georgia Railway & Power Company's water-power plants, and the drought remains unbroken. During the past few weeks this company has been materially assisted by other water-power companies, but the drought is being felt by these systems as well, and it has become necessary for the Georgia company to make further arrangement for power curtailment. At present it looks as though all users of 25 hp. and above will be required to shut down on Sept. 4.

LAMPS.—The trade in all sizes appears to be brisk, and the fall demand is opening up in good shape. Stocks have been accumulating during the summer.

RECTIFIERS.—The volume of sales is very satisfactory, the demand exceeding the supply. Shipments are reported as being poor.

METERS.—While there appears to be a sporadic call for power type, the customary demand for the residence type is probably 30 per cent off, compared with the same period a year ago. Shipments are very good.

TRANSFORMERS.—Manufacturers report that the demand for the distributing type has shown an increase this week. The activity is not due to orders from the larger central stations, but from the smaller municipalities. Shipment shows a remarkable improvement.

STREET LIGHTING.—There is very little call for this equipment from lighting companies, but quite a satisfactory trade has been coming in from cantonments, shipyards and allied industries.

WIRE.—Standard sizes of both the rubber covered and weather-proof, together with heavier cables, are moving freely; in fact several substantial orders for varnished cambric cable have been placed this week. Shipments are considerably better than this time last year.

FLOODLIGHTING.—There appears to be no cessation in requirements of this class of illumination, and a steady stream of orders continues to come in from industrial plants, as well as from government establishments. The 500-watt lamp seems to be most popular at this time. Shipments are comparatively good.

SEATTLE—PORTLAND

Prominent jobbers and dealers in the Northwest report the past week's business as usual, with slight increases in some lines, particularly motors and domestic appliances. The volume to shipyards and allied industrials is about the same while sales to government and lumbering interests show a slight increase. The Portland territory reports an order placed for motors for a large tub factory to be built immediately by the Union Meat Company. The spruce division of the Signal Corps received bids recently covering switchboard equipment for spruce mills at Toledo. Motors for this mill were ordered ten days ago on promise of sixty days' shipment.

Seattle campaign for immediate building of homes to care for incoming industrial workers is rapidly gaining impetus. Approximately 1000 residences are already pledged and the largest shipbuilding plant in the city has awarded the contract for a $250,000 apartment house for the use of plant employees. Tacoma will build 1000 new homes during the remainder of the year. The Portland territory reports building is steadily increasing in that city and in Vancouver, Wash. Tentative plans for the construction of seventy new barracks with a capacity of 10,000 men at Camp Lewis is in the hands of the construction quartermaster. The proposed structures will cost approximately $1,250,000.

The labor situation throughout the Northwest is unsettled on account of the pending new draft and constant drain for military service. Coal mines in Washington report an acute shortage and this also applies to shipyards. The tension has been slightly relieved in Seattle by patriotic business men who are flocking to shipyards. A strike of 1500 employees of the Pacific Coast Steel Company in Seattle is disturbing industrial equanimity in Seattle plants, as this steel plant was an important factor in supplying local shipyard needs. The Portland district reports the following:

WIRE.—Stocks are ample except on a few of the larger sizes. Orders contributing to the government program predominate. Demand for cable continues active.

CONDUIT.—There is a general scarcity owing to the restrictions imposed by the government upon raw materials.

ELECTRIC RANGES.—The demand is good but stocks are low and considerable difficulty is being experienced in receiving new shipments. This condition also applies to Seattle.

WASHING MACHINES.—There is a very active demand and stocks are in fair shape. Movement in other household appliances is very slow.

LAMPS.—Stocks are in good shape generally, although 500-watt sizes are scarce due to unusual demands of war industrial plants. Seattle jobbers report stocks in smaller sizes are comparatively well filled but a scarcity exists in larger sizes.

COLLECTIONS.—Portland reports local collections continue good. In Eastern mining and wheat districts business and collections are exceptionally good.

SAN FRANCISCO

Jobbers in reviewing this year's business find that it increases regularly every month. A great deal of urgent rebuilding is necessary at Fresno, where fire damage calculated at $1,000,000 has been done by I. W. W. agitators. Important canneries, lumber mills and the dry goods store of the Kutner-Goldstein Company have been consumed. A new tuna cannery is to be erected at San Pedro, sixty cottages of an average value of $4,000 each are to be erected in Phoenix, Ariz., for the inspiration Copper Company and a $125,000 building for the new Cornelia Copper Company. The Government is adding new buildings at an estimated value of $150,000 for its Mather Flying Field near Sacramento.

MOTORS.—Motors are sold only after strict examination of the character of the industry that demands them. Lately there has been an extraordinary demand for big motors of from 50 to 150 hp. for big power and irrigation projects. The demand for 5, 7½ and 10-hp. motors is also brisk, and as there has been a serious shortage of water in the East San Francisco Bay district, it is not improbable that a lot of private well boring will immediately begin with an increased demand for pumping plants. Local stocks are only fair with small belief in their improvement.

CROSSARMS.—The Pacific Northwestern mills have notified their distributers of a change in the quality of wood used in their product, since the United States government is demanding the best grade of Rainier fir for aircraft production and the cheap fir grade of yellow pine for ship construction, which leaves an intermediate grade only for crossarms, in amounts insufficient to apply against the demands anticipated on account of the difficulty in securing labor and cars.

POLE-LINE HARDWARE.—There has been a recent advance of from 20 to 33⅓ per cent, principally because of the iron and steel situation, with the added cause of high freight. Local stocks are good but as there are a great many power projects in course of survey or almost ready for construction, it will demand a vast deal of this material and the situation may become very complicated.

PORCELAIN INSULATORS.—There has been another advance of 10 per cent. Those who predicted a stampede by California electrical legislative bodies in favor of knob, tube and cleat construction in place of conduit, which is difficult to secure, have been disappointed so far, for the situation as regards essential industries is not yet acute. A few municipalities, among which is Oakland, have authorized such construction in residential entrance work only.

LAMP GUARDS.—Two types have increased about 10 per cent in price with a big demand for all types. Shipyard and cannery people report a prevalent malicious spirit in the breaking of lamps that renders the use of lampguards absolutely essential.

WIRE.—The government action in commandeering all available supplies of telephone wire and especially No. 17 copper-clad wire, has brought public and private telephone construction to almost a standstill with a wild scramble to secure substitutes. A noteworthy feature of the past month was a shipment from San Francisco of 1,500,000 ft. of the above wire for the United States government via New York for the overseas forces. Some small advances in weatherproof wire have been noted.

LAMP CORDS.—Cords used in marine construction have recently advanced 20 per cent with huge shipments enroute and more orders in sight.

METAL MARKET SITUATION

Tin Still Falling Off in Price—Commercial Copper Supply Lower

There has been practically no change in the metal market over the holiday. The available copper for commercial interests appears to have shrunk now to less than 5 per cent. Tin prices are reported to be dropping off gradually, forecasting a price-fixing action by the English government shortly, at a price considerably below the high price that prevailed a few weeks ago.

Brass manufacturers have promised to speed up the supply of brass to cure a shortage in the supply of essential war materials. The plans suggested at a meeting on Aug. 28, between the manufacturers and the War Industries Board, were as follows:

1. Each mill to take its full share of government business.
2. Each mill to take work best suited to its equipment.
3. Cut off all non-essential uses of the products in which there is a shortage.
4. Determination by the manufacturers to get out the product in the face of obstacles—in other words, to work up to full capacity.

NEW YORK METAL MARKET PRICES

	Aug. 27	Sept. 3
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26 00	Govt. price 26 00
Electrolytic	Govt. price 26 00	Govt. price 26 00
Casting	Govt. price 26 00	Govt. price 26 00
Wire base	29 25	29 25
Lead, trust price	8 05	8 05
Antimony	14 37½	14 12½
Nickel, ingot	40 00	40.00
Sheet zinc, f.o.b. smelter	15 00	15 00
Spelter, spot	9 50 to 9 75	9 50
Tin, Chinese *	81 00 to 83 50	No quotations
Aluminum, 98 to 99 per cent.	Govt price †33 10	Govt. price †33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	23 50 to 24 50	23 50 to 24 50
Brass, heavy	14 50 to 15 00	14 50 to 15 00
Brass, light	11 50 to 12 25	11 50 to 12 25
Lead, heavy	7 50 to 7 75	7.50 to 7.75
Zinc, old scrap	6 75 to 7 00	6.50 to 6.75

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* No Straits offering. † In 50-ton lots or more; carload, 33.10 cents per lb.; 1-ton to 14-ton lots, 33 20 cents per lb.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List Per 1000 Ft.
No. 14 solid	$61 00
No. 12 solid	71 00
No. 10 solid	90 00
No. 8 solid	106.00
No. 6 solid	145 00
No. 10 stranded	95 00
No. 8 stranded	115 00
No. 6 stranded	160 00
No. 4 stranded	205 00
No. 2 stranded	266 00
No. 1 stranded	315 00

Twin-Conductor

No. 14 solid	104 00
No. 12 solid	135 00
No. 10 solid	185 00
No. 8 stranded	235 00
No. 6 stranded	370 00
No. 4 stranded	575 00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	12½%—57 25

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	12½%—66 75

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	12½%—97 75

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	12½%—126.80

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20% to List
Coil to 1000 ft	5% to 15%

	No. 12 Solid
Less than coil	+20% to List
Coil to 1000 ft	5% to 15%

Twin-Conductor

	No. 14 Solid
Less than coil	+5% to $80 00
Coil to 1000 ft	5% to 75 00

	No. 12 Solid
Less than coil	+20% to +5%
Coil to 1000 ft	5%

ATTACHMENT PLUGS

List ranges from $0 22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	12%
1/5 to std. pkg	20%
Std. pkg	44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to 12%
1/5 to std. pkg	List to 20%
Std. pkg	25% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 40	$0.40
12 to 50	.35—.36	35—.36
50 to barrel	.31—.32	32—.33
Barrel lots	.28—.289	.29—.299

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 40	$0 40
12 to 50	35	.35
50 to barrel	319 to .322	329 to .33
Barrel lots	289 to 292	299 to .302

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5 00
3/8	250	7 50
1/2	100	10 00
3/4	50	13 00
1	50	21.00
1¼	50	26 00
1½	25–50	35 00
2	25–50	45 00
2½	25–50	52 00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75 00— 82 50	$63 75— 69.75
3/8-in. double strip	75 00— 82.50	72 00— 93 00
1/2-in. single strip	100 00—110.00	93.00—100 00
1/2-in. double strip	100 00—110 00	96 00—100.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75 00	$63.75 to $64 25
3/8-in. double strip	78 25 to $78 75	71 25
1/2-in. single strip	100.00	75.00 to 85 00
1/2-in. double strip	105.00	93.00 to 95 00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0 05½	1	$0.25
1/4	06	1¼	.33
3/8	09	1½	40
1/2	12	1¾	.47
5/8	15	2	.55
3/4	18	2¼	.65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	25 00–55 00	24 00–24 45	21 50–23 00
1/4-in.—	30 00–60 00	27 00–28 00	23 50–26 00

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$60.00	$30 00	$26 50
1/4-in —	65 00	32 50	29.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
1/4	$0 08½
3/8	08½
1/2	08½
3/4	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
1/4	$0.05	$0 19
3/8	.06	.19
1/2	.07	19
3/4	10	25
1	13	.37
1¼	17	.45
1½	21	.50
2	.28	1 10
2½	40	1 80
3	60	4 80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	7% to 12%	10% to 15%
2500 to 5000 lb.	9% to 14%	12% to 17%

(For galvanized deduct six points from above discounts)

DISCOUNT—CHICAGO

	1/4 to 1/2 In.	3/4 to 3 In.
Less than 2500 lb.	1.5% to 6 8%	3.5% to 8 8%
2500 to 5000 lb.	4 5 to 10.7%	6.5% to12 7%

(For galvanized deduct six points from above discounts)

FLATIRONS

NEW YORK

List price	$5 00 to $6 00
Discount	30%

CHICAGO

List price	$6 00 to $7 00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp to 30-amp	100	$0 25
35-amp to 60-amp	100	.35
65-amp. to 100-amp	50	90
110-amp. to 200-amp	25	2 00
225-amp. to 400-amp	25	3 60
450-amp. to 600-amp	10	5 50
600-Volt		
3-amp. to 30-amp	100	$0 40
35-amp. to 60-amp	100	60
65-amp. to 100-amp	50	1 50
110-amp. to 200-amp	25	2 50
225-amp. to 400-amp	25	5 50
450-amp. to 600-amp	10	8 00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30% to 31%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std pkg	$5 00 to $5 50
1/5 to std. pkg	4 50 to 4 75

Standard packages, 500. List, each $0 07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$7 00
1/5 to std. pkg.	5.75

Standard packages, 500. List, each, $0.07

LAMPS, MAZDA

105 to 125 Volts

Regular, Clear:	Std. Pkg	List, Each
10 to 40-watt—B	100	$0 30
60-watt—B	100	35
100-watt—B	24	70
75-watt—C	50	70
100-watt—C	24	1 10
200-watt—C	24	2 20
300-watt—C	24	3 25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25.	50	53
25-watt—G 25.	50	55
40-watt—G 25.	50	55
Round Bulbs, 3¾-in., Frosted		
60-watt—G 30.	24	77
Round Bulbs, 4⅜-in., Frosted		
100-watt—G 35.	24	1 10

DISCOUNT—NEW YORK

Less than std pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft)	$20 20—$35 90
Coil to 1000 ft.	26 95— 27 18

CHICAGO

	Per 1000 Ft Net
Less than coil (250 ft.)	$35 00
Coil to 1000 ft.	26 00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24 00

CHICAGO

Net per 100	$21 75 to $30 00

OUTLET BOXES

Nos.	List, Per 100
101—A, A1½, 4 S.C., 6200, 320	$30 00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30 00
103—C.A., 9, 4R, B 1½	25 00
106—F.A., 7, C.S., 1½, 3 R	20 00

DISCOUNT—NEW YORK

	Black	Galvanized
Less tban $10 00 list	25% to 33%	20% to 27%
$10 00 to $50 00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Glavanized
Less than $10.00 list	30% to 40%	20% to 35%
$10 00 to $50 00 list	40% to 50%	30% to 45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$21 00 to $38 00
1/5 to std. pkg.	17 85 to 19 00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$16 80
1/5 to std. pkg.	15 80

Standard package, 2200. List per 1000, $20 00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std Pkg 3500 5½ N C—Solid	Std Pkg 4000 Nail-it—N C.
Less than 1/5 std pkg	$16 00 to $20 20	$32 00
1/5 to std pkg	13 60 to 15 60	27 20

CHICAGO

Per 1000 Net	Std Pkg 3500 5½ N C—Solid	Std Pkg 4000 Nail-it N.C.
Less than 1/5 std. pkg.	$11 70 to $24 00	$33 85
1/5 to std pkg.	10 15 to 20 40	26 60

SOCKETS AND RECEPTACLES

	Std Pkg.	List
½-in. cap key and push sockets.	500	$0 33
½-in cap keyless socket	500	30
½-in. cap pull socket.	250	60

DISCOUNT—NEW YORK

Less than 1/5 std pkg	+10% to 10%
1/5 to std pkg	5% to 8%

DISCOUNT—CHICAGO

Less than 1/5 std pkg.	List
1/5 std. pkg	16⅔%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0 80
60-amp. S. P. S. T	1 20
100-amp. S. P. S. T	2 25
200-amp. S. P. S. T.	3 48
300-amp. S. P. S. T	5 34
30-amp. D. P. S. T	1 20
60-amp. D. P. S. T.	1 78
100-amp. D. P. S. T	3 38
200-amp. D. P. S. T.	5 20
300-amp. D. P. S. T.	8 00
30-amp. 3 P. S. T.	1 80
60-amp. 3 P. S. T.	2 68
100-amp. 3 P. S. T.	5 08
200-amp. 3 P. S. T.	7 80
300-amp. 3 P. S. T.	12 00
Low Grade:	
30-amp. S. P. S. T.	$0 42
60-amp. S. P. S. T.	74
100-amp. S. P. S. T.	1 50
200-amp. S. P. S. T.	2 70
30-amp. D. P. S. T.	68
60-amp. D. P. S. T.	1 22
100-amp. D. P. S. T.	2 50
200-amp. D. P. S. T.	4 50
30-amp. 3 P. S. T.	1 02
60-amp. 3 P. S. T.	1 84
100-amp. 3 P. S. T.	3 76
200-amp. 3 P. S. T.	6 76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+5% to Net
$10 to $25 list	11% to 15%
$25 to $50 list	14% to 20%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16% to 25%
$15 to $50 list	24% to 28%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+15% to +5%
$10 to $25 list	List to 11%
$25 to $50 list	5% to 14%
	Low Grade
Less than $10 list	+5% to 5%
$10 to $25 list	8% to 16%
$25 to $50 list	16% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std Pkg	List
5-amp. single-pole	250	$0 28
5-amp. single-pole, ind	250	32
10-amp. single-pole	100	48
10-amp. single-pole, ind	100	54
5-amp. three-point	100	54
10-amp. three-point	50	76
10-amp., 250-volt, D P	100	66

10-Amp., 250-Volt Push-Button Switches

	Std Pkg.	List
10-amp. single-pole	100	$0 45
10-amp. three-way	50	70
10-amp. double-pole	50	70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std pkg	+10%
1/5 to std pkg	5% to 8%
Std pkg	23% to 25%

DISCOUNT—CHICAGO

Less than 1/5 std pkg	+20% to 10%
1/5 to std pkg	List to 16⅔%
Std pkg	25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0 34
No. 160	60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 40%	Net to 30%
$2 00 to $10 00 list	10% to 50%	5% to 40%
$10 00 to $50.00 list.	20% tn 60%	10% to 52%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10 00 list	25% to 50%	20% to 40%
$10.00 to $50 00 list.	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6 00
Discount	30%

CHICAGO

List price	$6 35 to $7 00
Discount	25% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools.	$0 434—$0 51
No. 18, full spools	.384— 49

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	$0 65 to $0 69
No. 18, full spools	55 to 575

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

No.	Price per 1000 Ft. Net: Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15 00–$20 00	$12 50–$15 00	$11 00–$11 25
12	21 29– 27 10	19 35– 23 20	17 05– 17 42
10	29 70– 37 80	27 00 32 40	23 75– 24 30
8	41 90– 53 35	28 10- 45 70	33 35– 34 29
6	60 30– 84 40	54 27– 72 35	51 55– 53 05

CHICAGO

No.	Price per 1000 Ft. Net: Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$21 00–$22 00	$16 00–$22 00	$13.25–$16.50
12	28 70– 29 46	28 70– 29 46	24 50– 25.54
10	40 10– 41 10	40 10– 41 10	34 23– 34 62
8	56 50– 57 90	48 23– 57 90	41 34– 50.18
6	85 31- 91 18	77 84– 85 31	66.72– 72.27

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$37 75 to $38 40
25 to 50 lb	36 40 to 37.75
50 to 100 lb.	32 40 to 36.75

CHICAGO

	Per 100 Lb. Net
Less than 25 lb	$37 00 to $39 72
25 to 50 lb	36 00 to 38 72
50 to 100 lb.	35 00 to 37.72

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

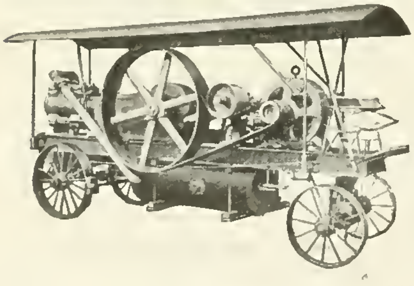
Weatherproof Sockets

Porcelain, molded mica and composition weatherproof sockets, shown in the accompanying illustration, are now being manufactured by Harvey Hubbell, Inc., Bridgeport, Conn. These sockets are furnished with 6-in. (15-cm.) No. 14 B. & S. stranded rubber-covered wire, but sockets with longer wires will be furnished on special order. These sockets are rated at 660 watts and 600 volts.

SOCKETS RATED AT 660 WATTS AND 600 VOLTS

Contractor's Motor-Driven Compressor

At this time when the labor problem calls urgently for solution the portable motor-driven compressor outfit manufactured by the Ingersoll-Rand Company, 11 Broadway, New York, is said to prove extremely valuable. Because of the rapidity with which these outfits work and the great amount of work they save, air-operated tools, such as drills, hammers, rivets, chisels, reamers, calkers and tampers, have been extensively employed by contractors and builders. A portable compressor outfit that can be readily hauled to the job, put immediately to work and promptly removed when wanted elsewhere forms, therefore, a very valuable addition to the contractor's equipment.

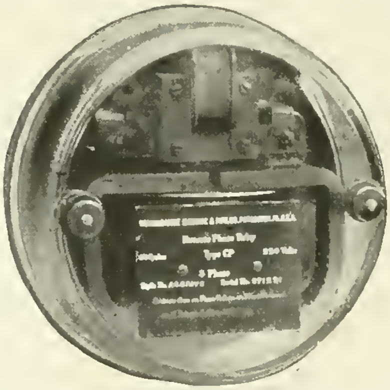


MOTOR-CIRCUIT ATTACHED TO CONVENIENT ENERGY SUPPLY

The electrically operated portable compressor illustrated is especially adapted for city work where energy is available at all places, and it is more conveniently and easily handled than corresponding types operated by steam, gasoline or oil. The compressor is a 10-in. by 12-in. (25.4-cm. by 30.4-cm.) type E.R. made by this company, is driven by a 50-hp. Westinghouse motor, and has a capacity of 300 cu. ft. (91 cu. m.) of air per minute at 100 lb. (7 kg. per sq. cm.) pressure.

Reversed Phase Relay

To protect motors against phase reversal where such protection is necessary, the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has developed a reverse phase relay which it claims has positive and dependable operating characteristics. If a phase is reversed or if a phase fails, or if the voltage drops below 75 per cent normal, the relay contacts close and trip the circuit breaker either through a shunt-trip coil or by short-circuiting an under-voltage trip coil having a series reverse resistor. The relay operates on the induction principle, the torque holding the contacts open against the force of a spiral spring. On low voltage the torque diminishes and the spring closes the contacts, and on reversal of phase connections the reversed torque assists the spring in closing the contacts. This relay is especially desirable for use with polyphase elevator motors, as it eliminates the possibility of reversed operation of motor with resultant human danger.



PREVENTS POLYPHASE MOTORS FROM REVERSING

Electric Washing Machine with Safety Stop

Complete safety is claimed for a washing machine for use in residences, apartment buildings, hotels, etc., that is being manufactured by the Chicago Dryer Company, 624 South Wabash Avenue, Chicago. This is accomplished by an automatic safety stop on the power wringer by which, if clothes wind around the rubber rolls or if the operator should catch her fingers between the rubber rolls, the wringer is automatically disconnected from the driving motor. The machine is practically "foolproof," and thus all danger as far as operation is concerned is completely eliminated. The manufacturer claims that this machine will wash the clothes thoroughly without injury to the most delicate fabrics, and there is no possibility of getting spots on the clothes. The machine does not easily get out of order and can be conveniently used in any position. The tub is driven from the water by means of a belt operating two revolving gears. The gears operate and pull the washing tub forward and backward, creating the oscillating motion. The washer tub is carried backward and forward as accurately as the pendulum of a clock, and all jerking motions are eliminated. There are no springs subject to any strain to wear out or to get out of order. It is driven by a ⅓-hp. motor which may be operated from any lighting circuit. The cost of operating the motor is from 1 cent to 1½ cents an hour, according to the rate of the energy.

"FOOLPROOF" ELECTRIC WASHER

Portable Electric Heater

For supplying auxiliary heat when the regular heating system in the house is not being employed or if the cold is excessive, a portable electric heater, manufactured by the Willis Manufacturing Company, Cleveland, Ohio, proves very convenient. The heating element of this heater, the maker claims, is practically indestructible. It is so constructed that the wires never individually reach a red-hot or incandescent point of heat. They are so arranged in relation to each other that they "pack" the heat within the element and radiate it in full volume, using nearly all the heat units that are produced by the current passing through the resistance coil. The heat is thrown out at the top of the "Torid" heater at a temperature of about 260 deg. Fahr. (126.6 deg. C.). The circulation is rapid and positive, according to the maker, there being a constant flow of hot air into the room directed toward the ceiling, which is the correct principle of the circulation of heat. The circulation is accelerated by the intense heat produced by the element, which forms a suction medium like a chimney. The manufacturer claims that this heater is absolutely safe in every respect and that there is no danger of fire. It is also said that the "Torid" heater may be used at a very low cost of operation.

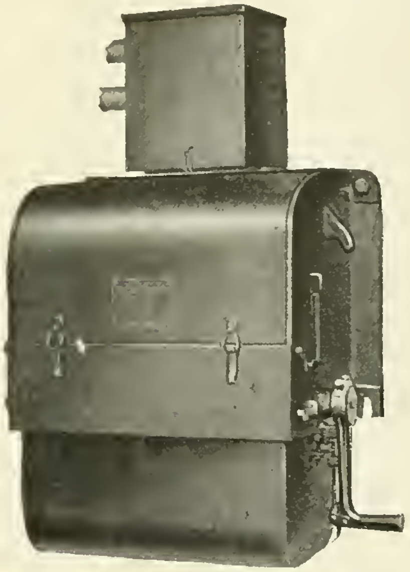
HEATING ELEMENT PRACTICALLY INDESTRUCTIBLE

The heater is particularly advantageous for heating bathrooms.

Potential Starter for Induction Motors

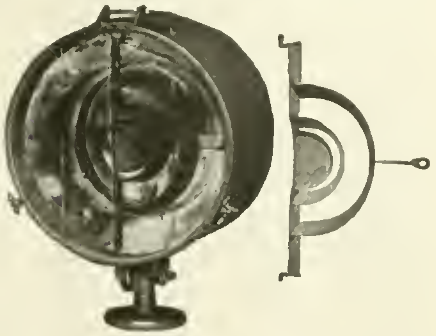
Complete protection to motor and machinery, as well as safety to the operator, is claimed for a potential starter for squirrel-cage induction motors that is being manufactured by the Allis-Chalmers Manufacturing Company, Milwaukee, Wis. This starter is not only simple to operate and convenient to install but has all operating points completely inclosed yet readily accessible for inspection or adjustment. The cost of installation, whether for conduit or for open wiring, is exceedingly low, the maker claims, as is also the maintenance expense. With its reliability of operation, its automatic protective features and the adjustments provided for heavy or light starting duty, as well as for the amount and duration of overload, this starter is adapted to the great variety of installations where polyphase squirrel-cage motors are used. As shown in the accompanying illustration, the operating handle turns in only one direction while the motor is being started. In starting the handle is moved forward a few inches, when it strikes a stop indicating the starting position. Here it should be held until the motor comes up to speed. Pressing the thumb latch allows the handle to be moved forward toward the running position to a point where the mechanism trips free of the handle and snaps quickly from starting to running position. The operating handle, being free, falls to its original position when the operator's hand is removed.

Thus the starter cannot be left in starting position and cannot be held in running position in case of voltage failure or a sustained heavy overload. An under-voltage release automatically disconnects the motor from the line on failure of voltage and returns the starter to former position. It is set mechanically by operation of starter and trips by a direct hammer blow. Overload relays are used to protect the motor against dangerous overload, but they permit short peak loads without interruption to service. They can accurately be adjusted for the load and conditions under which the motor operates, thus giving better protection than fuses, says the manufacturer. These relays automatically reset themselves after each operation. A drum switch makes and breaks connections under oil. Contact fingers are adjustable for tension and are easily accessible and readily removed.


SAFETY MOTOR STARTER ARRANGED FOR CONDUIT WIRING

Spill-Light Eliminated by Means of Shield

When lighting fences for protective purposes it is sometimes necessary to prevent the spill-light from falling inside the fence when it may be highly desirable outside. Thus the watchman patrolling inside is constantly in shadow and is enabled to see better the fence and the area immediately bordering the fence. This objectionable spill-light can be eliminated by means of a spill shield, No. 10,269, developed by the National X-Ray Reflector Company of Chicago. The shield shown herewith can easily be placed in position inside the cover of the regular "X-ray" projector unit so that it will cut off all spill-light from that side of the unit to which it is adjusted. This shield is made of sherardized iron, can be quickly installed, and, according to the manufacturer, is designed in such a manner that the main beam from the reflector is unimpaired in efficiency.

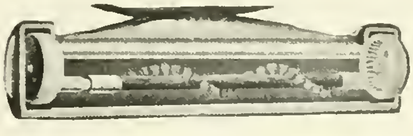

SHIELD PLACED ON ANY SIDE OF FLOOD-LIGHT LENS

Commutator Resurfacer

Ability to resurface a commutator running under regular load is claimed for a commutator resurfacer that has been developed and is being marketed by the Ideal Commutator Dresser Company, Chicago. This resurfacer is an abrasive material, in block form, conveniently mounted on a handle. It is non-metallic, non-copper-collecting, and therefore will not cause short-circuiting or wear smooth, according to the maker. When held against the revolving commutator, it is claimed to cut down high mica bars and high spots, and leave the commutator perfect.

Vacuum Cleaner with Gear-Driven Brush

An internal-gear-driven brush is the chief feature of the "Bee" vacuum cleaner recently placed upon the market by the Birtman Electric Company, Randolph Street and Odgen Avenue, Chicago. The motor on the machine, which was designed especially for vacuum cleaner use to give high efficiency and great durability, is controlled by means of a switch on the grip handle. Another feature of the machine is its special self-feeding oil wells, which make frequent oiling unnecessary. The cleaner is designed so that it can easily reach carpets beneath low furniture.


DETAILS OF INTERNAL-GEAR-DRIVEN BRUSH

Trade Notes

EXPORTATION OF TIN—The War Trade Board under date of Aug. 26, announced a set of regulations governing the exportation of tin and manufacturers thereof.

D. P. CARTWRIGHT has been appointed manager of the New York branch of the North East Electric Company to succeed R. J. Hardacker, who is shortly to assume the management of the Chicago branch.

ITALIAN REGULATIONS OF IMPORTS—A decree published by the Italian government, effective on July 1, 1918, forbids the purchase abroad and importation into Italy of any material or product without an import license from the Italian government.

TRADING WITH THE ENEMY—Cumulative Supplement (No. 9) to the Enemy Trading List (revised) containing additions, removals and corrections from March 15, 1918 to Aug. 9 has been issued by the War Trade Board, Washington, D. C.

F. L. HUBER, city representative of the Mohawk Electrical Supply Company, Syracuse, N. Y., assigned to the industrial-plant trade, has been made sales engineer of the company. This is in line with the company's intention to develop its apparatus business.

THE CHICAGO PNEUMATIC TOOL COMPANY announces the appointment of C. W. Cross as special representative for the sale of pneumatic tools to railroads, succeeding L. C. Sprague, promoted to be district manager of sales for the company at New York.

THE ELLIOTT ELECTRIC COMPANY, 322 Champlain Avenue, Cleveland, Ohio, has taken a ten-year lease on the building at 813 Superior Avenue, now occupied by the H. W. Johns-Manville Company. It consists of a five-story and basement building, and the rental for the term is in the neighborhood of $50,000.

THE AMERICAN CONDUIT MANUFACTURING COMPANY, New Kensington, Pa., is sending to many members of the War Industries Board and various other government officials interested in conservation or in electrical construction work a photograph and a letter illustrating the waste in steel, labor and material cost.

THE NEW PROCESS SPECIALTY COMPANY, Milwaukee, Wis., has moved from the Enterprise Building to its new factory at 230-232 Hanover Street. This move was necessitated to provide greatly increased facilities for the manufacture of high-grade jigs, dies, gages, tools and special machinery.

GEORGE V. W. INGHAM, who has been a field representative for the Bryant Electric Company in the Central Western territory for several years past, has been appointed Eastern sales manager, with headquarters at the factory, Bridgeport, Conn. Mr. Ingham will direct the sales activities of the company in the territory east of the Allegheny Mountains.

THE CUTLER-HAMMER MANUFACTURING COMPANY of Milwaukee, manufacturer of electric controlling devices and allied apparatus, announces the opening, on Sept. 3, of a branch office in the Union Trust Building, Fifteenth and H Streets, N. W., Washington, D. C. H. W. Knowles and C. W. Yerger, engineers, who are entirely familiar with the company's products, will be stationed at this new office.

THE SQUARE D COMPANY, Detroit, Mich., manufacturers of safety switches, has recently opened a new district office in Pittsburgh. D. M. Stone, who traveled the company's Pennsylvania district for several years, has been placed in charge with established headquarters at 1502 First and Second National Bank Building. H. H. Miller, formerly of the Double-Day Hill Hill Electric Company, Pittsburgh, will be associated with Mr. Stone.

THE CENTRAL TELEPHONE & ELECTRIC COMPANY, St. Louis, Mo., recently underwent complete re-organization. F. D. Phillips has been elected president to fill the vacancy created by the resignation of J. S. Cuming, who has disposed of his holdings in the company. Under its new policy the company have disposed of its manufacturing interests and will confine its efforts to the electrical jobbing business. This change has greatly increased the warehouse space and enables the company to carry larger stocks of the products of those manufacturers whom it represents.

VULCAN STEEL PRODUCTS COMPANY, INC., 120 Broadway, New York City, has made the following announcement: Governmental restrictions concerning house organs and the urgent need for the conservation of labor and material render it advisable to discontinue the publication of *Vulcan*. The August issue—which we have striven to make our best edition—will be the last *Vulcan* during the period of the war.

PAGE STEEL & WIRE COMPANY annual meeting resulted in the election of Norman Bridge to the board to fill the vacancy created by the death of the late Austin Clement. The board organized by electing the following officers: B. Lissberger, president; A. A. Clement and J. N. Podrasnik, vice presidents; A. B. Cody, secretary; J. E. Carr, assistant secretary and assistant treasurer; J. N. Podrasnik, treasurer, and E. C. Sattley, general manager. Dividends were declared from the profits in the period from Jan. 1, 1918, to July 1 last as follows: $3 a share on the first preferred stock and $3.50 a share on the preferred stock, payable on Oct. 31 to stock of record as of Oct. 15. The net profits before taxes for the year ended June 30, 1918, were $420,556. It was stated after the meeting that the company had approximately $4,000,000 of unfilled orders on its books.

Trade Publications

SWITCH BOXES.—W. N. Matthews & Brother, Inc., 3722 Forest Park Boulevard, St. Louis, is distributing a folder, having the appearance of a slate which tells about the type "BF" Matthews "fuswitches."

SOCKETS.—Bulletin 16-5 of Harvey Hubbel, Inc., Bridgeport, Conn., illustrates and lists weatherproof sockets, Schedule B of this company.

MAGNET OPERATED BRAKES.—In booklet G issued by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., under date of August, 1918, magnet-operated brakes for direct-current service are illustrated and described. The most important features of this brake denoted as type M, from 100 hp. to 300 hp., are listed and formulas are given for the selection of size of brakes. The ratings of these brakes and the information required for recommendation of size of brake are also produced. The dimensions of the brakes are also given for the various sizes.

HIGH-TENSION DISK INSULATORS.—The Jeffrey Dewitt Insulator Company, Huntington, W. Va., has issued catalog, No. 2, describing and illustrating its high-tension disk insulators. Illustrations are produced which show the effect of high-frequency tests on these insulators at 600,000 volts and 10,000 cycles. High-frequency tests are also shown with Corona effects top and bottom at 110 kv. and the flashover in air at 125 kv. These insulators are also shown in strain. Substations equipped with the "JD" insulators and transmission lines are also produced. The actual dimensions of the hardware used with these insulators are shown in outlined diagrams.

BELT FASTENER.—In determining how most effectively to join any given belt, an engineer should consider the belt width, its thickness, the pulley diameter and the type of work. To make decisions in these matters so simple and easy that any unskilled workman may be instructed with the work, the Crescent Belt Fastener Company, 381 Fourth Avenue, New York City, prepared its new Crescent service chart form, N. Y. 201, which gives in tabular arrangement all the data for every kind and make of belt of every length, width and thickness, under all service conditions. This service chart should be of great assistance and value to engineers, shop superintendents and purchasing agents. Copies will be mailed with full Crescent information to all interested parties.

CONDENSERS, ETC.—Bulletin 112-A, just published by the Wheeler Condenser & Engineering Company, Carteret, N. J., deals with condensers, pumps, cooling towers, etc. Under the head "Choice of Kind of Condenser" the two general classes of condensers are discussed. The remainder of the bulletin illustrates and describes other Wheeler condensing machinery in detail. The bulletin embraces large and small surface condensers, showing typical complete installations, rectangular and cylindrical types, jet condensers, barometric condensers, air pumps, rotative dry-vacuum pumps, the turbo air pumps, centrifugal pumps for circulating water and natural and forced draft cooling towers. In addition, a page is devoted to the feed-water heater and two pages to multiple-effect evaporators and dryers.

INSTRUMENTS AND RELAYS.—In catalog 3-B, dated June, 1918, the Westinghouse Electric Manufacturing Company, East Pittsburgh, Pa., has issued a very comprehensive bulletin on switchboard, portable and precision instruments, meter shunts, instrument transformers and relays. This book covers a wide number of instruments, including automobile ammeters, switchboard ammeters, radio ammeters, switchboard frequency meters, power-factor meters, reactive factor meters, synchronoscopes, electrostatic ground detectors and voltmeters, switchboard-type shunt-specifications and ratings, temperature indicators, watt-hour meters—single-phase and polyphase, graphic power-factor meters, totalizing graphic watt-meters for five circuits, switchboard and portable graphic instruments, portable watt-meters, precision instruments for alternating-current or direct-current circuits, portable testing outfit, portable potentionmeters for hot-spot temperature measurements, overload reverse-power relays, reverse phase relays, transfer relays, cycle counters, bell relays, definite time-limit relays, current transformers, voltage transformers, outdoor metering equipment, electrical street indicators, portable fault localizers, harmonic analyzers, circular oscillogram attachment, crest voltmeter outfits and high-voltage measuring instruments. In the account of these devices in this well-prepared bulletin, the applications, such as industrial uses and laboratory uses, the distinctive features and the construction and operation of the meters are described.

New Incorporations

THE GOFF MANUFACTURING COMPANAY of Collingswood, N. J., has been chartered by O. P. Wheaton, F. H. and Howard E. Goff. The company is capitalized at $250,000 and proposes to manufacture electric and pneumatic brakes, etc.

THE ROCHESTER (N. Y.) MAIN ELECTRIC COMPANY has been incorporated with a capital stock of $15,000 to do a general electric business. Paul E. Illman is interested in the company.

THE TOOL MACHINING CORPORATION of New York, N. Y., has been incorporated with a capital stock of $250,000 by G. Norris, M. M. Capelle, 115 Broadway; and A. Jasper, 122 Maiden Lane, New York, N. Y. The company proposes to conduct a machine shop and to manufacture and deal in machinery, engines, etc.

THE WESTERN BATTERY & SUPPLY COMPANY of Sioux Falls, S. D., has been incorporated with a capital stock of $100,000 by W. E. Stevens, James J. Elliot and Roy A. Van Brunt.

THE H. W. WOLCOTT COMPANY of Buffalo, N. Y., has been incorporated with a capital stock of $200,000 by Charles W. and William H. Gabriel of Cleveland, Ohio, and Herbert W. Wolcott. The company proposes to manufacture electric batteries and other products.

THE COBB CONTROL MANUFACTURING COMPANY of Boston, Mass., has been chartered with a capital stock of $50,000 to manufacture electrical and mechanical devices. Albert B. Cobb is president, and James H. Woods, treasurer.

THE JENNEY ELECTRIC COMPANY of Brockton, Mass., has been incorporated with a capital stock of $100,000. The officers are Arthur E. Jenney, president and Herbert W. Patton, 11 Radford Lane, Boston, Mass., treasurer.

THE BURN-FUEL-SAVING CORPORATION of Philadelphia, Pa., has been incorporated by O. B. and C. E. Day and others. The company is capitalized at $25,000 and proposes to manufacture mechanical systems for fuel savings.

THE EVANS AUTO SIGNAL COMPANY of Canton, Ohio, has been incorporated by David Seitner, Edward Hambechuen and others. The company is capitalized at $75,000 and proposes to manufacture electric automobile signals.

THE SAFETY STOVE PIPE COMPANY of Toronto, Ont., has been incorporated with a capital stock of $50,000 to manufacture gas and electric ranges, stoves, pipe, etc. The incorporators are: Mervil MacDonald, Andrew Dods, Edwin Smiley and others.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

STRATTON, ME.—The Public Utilities Commission has granted the Stratton Light Company to furnish electricity in the town of Eustis and Coplin Plantation. The Stratton Electric Light Company was given permission to sell its property, franchises, etc., to the Stratton Light Company for the sum of $3,200.

NASHUA, N. H.—The New England Power Company of Worcester, Mass., has petitioned the Public Service Commission for permission to render a limited service in Nashua.

ST. JOHNSBURY, VT. The Twin State Gas & Electric Company has purchased Pierce's Mills and water power above St. Johnsbury Center, which will be added to other water powers on the Passumpsic River for its local needs.

HAVERHILL, MASS.—The Jacques-Potter power plant, controlled by the Jacques estate, has been purchased by Michale Schiffs, who will continue the operation of the plant. The plant was first established in 1872.

PEPPERELL, MASS.—Preparations are being made by the Nashua River Power Company for the construction of a new dam and electric power station on the east bank of the Nashua River north of the Main Street bridge. The new dam will be built between the old one and the bridge and will be about 10 ft. higher. Equipment, including electric generators, for the proposed plant, it is understood, has been purchased.

CENTRAL FALLS, R. I.—Plans have been filed by the General Electric Company of Schenectady, N. Y., for alterations and improvements to its local Bryan-Marsh electric works, at 528 Mill Street, to cost about $50,000. Contract has been awarded to the J. Bishop Company of Providence.

NEWPORT, R. I.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 9 for the installation of an electric distributing system at the local naval station, to cost about $75,000. Specification 3339. A deposit of $10 will be required for plans and specifications.

HARTFORD, CONN.—Plans have been filed and contract awarded to C. A. Sibley, 902 Chapel Street, New Haven, by the Connecticut Power Company for the construction of an addition to its boiler plant.

NEW LONDON, CONN.—The National Housing Company contemplates the installation of electric, telephone and gas systems, to cost about $25,000. L. L. Tribus is engineer.

OAKDALE, CONN.—The local plant of the Massasoit Company is being equipped for electrical operation. Steam power is used at present.

Middle Atlantic States

BROOKLYN, N. Y.—Plans are being prepared for the erection of new buildings, including machine shop, forge and blacksmith shop, boiler shop, carpenter shop and other buildings, at Dykmann and Walcott Streets, for the Ramberg Iron Works, Inc., Pioneer Street, Brooklyn.

BUFFALO, N. Y.—Plans have been prepared by the New York Central Railroad Company for the installation of a new automatic signal system on its lines from East Buffalo to Black Rock. The company is also making improvements in the signal system on its Belt Line.

FULTON, N. Y.—Plans have been prepared by the Fulton Steel Company for the installation of a new large electric furnace at its plant near Division Street. The company is contemplating improvement involving an expenditure of about $100,000.

LONG ISLAND CITY, N. Y.—Plans have been filed by the Wright-Martin Aircraft Corporation, Starr and Borden Avenues, for a one-story addition, 109 ft. by 499 ft., to its plant, to cost about $400,000.

LYONS, N. Y.—The Empire Gas & Electric Company is rebuilding its local water-power plant in Geneva Street. Two 200-hp. waterwheels and generators will be installed. L. C. Reynolds of Geneva is general superintendent.

NEW YORK, N. Y.—Plans have been filed by the Goodyear Rubber Insulating Company, 105 East 130th Street, for the construction of a two-story addition to its plant, to cost about $9,000.

WATERVLEIT, N. Y.—The Adirondack Electric Power Corporation of Glens Falls has begun work on the erection of a new substation, 20 ft. by 40 ft., at its local plant.

KEARNEY, N. J.—Contracts, it is reported, have been awarded to Holbrook, Cabot & Rollins, 53 Vanderbilt Avenue, New York, N. Y., for the construction of a large dry dock plant for the Federal Shipbuilding Company on the Hackensack River. The cost of the entire work is estimated at between $6,000,000 and $8,000,000.

NEWARK, N. J.—Plans have been filed by the Newark Wire Cloth Company, 224 Verona Avenue, for the construction of an extension to its power house on Mount Prospect Avenue, to cost about $4,000.

PAULSBORO, N. J.—The proposed new shipbuilding plant to be erected by the Fort Mifflin Shipbuilding Company, Widener Building, Philadelphia, will be equipped for electrical operation. The initial plant will include machine shop, iron works, forge shop, light plate shop, heavy plate shop, joiner works and auxiliary structures. The cost is estimated at about $1,000,000.

TRENTON, N. J.—Plans have been prepared for the installation of new motors at the Trenton School for the Deaf.

ALLENPORT, PA.—Contract has been awarded by the Pittsburgh Steel Products Company, Frick Annex Building, Pittsburgh, for the erection of a new power house, to be built in connection with additions to its local plant, to the Wilson Construction Company, Fulton Building, Pittsburgh.

COATESVILLE, PA.—The Chester Valley Electric Company has filed notice with the Public Service Commission of an increase in capital stock from $750,000 to $2,000,000, of which part of the proceeds will be used for extensions and improvements.

FREEPORT, PA.—According to an announcement made by the officials of the West Penn Power Company a new power plant will be erected on the Allegheny River at Freeport, at a cost of about $5,000,000. The proposed plant will have an output of 40,000 kw., and will provide power for essential industries of the district doing war work for the Government. Of the necessary capital the Government has agreed to advance $2,000,000. The plant will be in charge of the Government, which will specify the distribution of the power.

HAZLETON, PA.—The Lehigh Navigation Electric Company has entered into a contract with the Bethlehem Steel Company to supply additional power to operate the plant of the latter company. To supply this service the Lehigh company has been compelled to curtail the power furnished several plants in the vicinity of Coplay.

PHILADELPHIA, PA.—Mark D. Ring & Sons, Sixty-ninth Street and Haverford Avenue has awarded contract for the construction of an addition to its engine plant to the Hughes-Foulkrod Company, Commonwealth Building.

PHILADELPHIA, PA. Plans are under consideration by the Samuel H. French Company, Lawrence and Callowhill Streets, for the installation of new equipment, including several boilers, at its plant.

PHILADELPHIA, PA.—Contract has been awarded to the Turner Concrete Steel Company, 1713 Sansome Street, for the construction of the new battery storage building at the League Island Navy Yard. The cost of the building is estimated at $129,750.

PHILADELPHIA, PA.—Plans have been prepared for the erection of a two-story plant 18 ft. by 87 ft., to be built in connection of the new emergency hospital building on the Grays Ferry Road for the United States Government. The cost of the entire work is estimated at about $355,000.

PHILADELPHIA, PA.—Plans are being considered by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the installation of a turbo-generator at the local navy yard. (Specification 3356). Also to install a machinery and electric shop (Specification 3345) to cost about $650,000. Bids will be received for building for flasks and accumulators under Specification 3344, for the navy yard here.

YOUNGSVILLE, PA.—Steps have been taken by local business men to organize a company to build a dam on the Brokenstraw River and erect an electric plant to supply electricity in Youngsville. E. Z. Swanson, H. H. Hull, Victor Engstrom and others are interested in the company.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company, which is installing two 55,000-hp. turbo-generator units at its steam-driven power plant at Westport, is said to be considering the installation of two additional units of same capacity upon completion of the work now in progress. The company is reported to be considering further extension to the Westport plant involving an expenditure of more than $3,000,000.

INDIAN HEAD, MD.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning to install a turbo-generator (Specification 3352), at the local navy yard.

SOUTH CHARLESTON, W. VA.—The Bureau of Yards and Docks, Washington, D. C., is planning to install a turbo-generator at the local navy yard. Specification 3352.

PORTSMOUTH, VA.—Plans are under consideration by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the installation of a turbo-generator at the local navy yard (Specification 3352).

RICHMOND, VA.—Work will soon begin on the erection of several new buildings for the Chesapeake & Ohio Railroad Company, Richmond, including a one-story foundry, 50 ft. by 245 ft., to cost about $50,000; machine shop with lean-to extensions, 43 ft. by 200 ft., $100,000; locomotive shop, 110 ft. by 400 ft., $200,000. The Arnold Engineering Company, Chicago, Ill., has charge of the engineering work.

STAUNTON, VA.—Amendments have been filed to the charter of the Blue Ridge Light & Power Company, changing its name to the Shenandoah Traction Company.

BELLEVUE, D. C.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning to install electric cranes at the navy yard here, to cost about $18,000.

WASHINGTON, D. C.—Plans have been prepared by the Potomac Electric Power Company for the installation of a 15,000-kw. turbo-generator and other improvements at its plant.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 16 (under Specification 3298) for power-plant improvements at Puget Sound, to cost about $30,000. Bids will also be received until Sept. 9 (under Specification 3339) for installation of an electric distribution system at Coddington Point, to cost about $75,000.

WASHINGTON, D. C.—The Construction Division, War Department, Washington, D. C., has authorized an expenditure of $150,000 for each laundry and power house at the following camps: Camp Johnson; Camp Sevier, Greenville, S. C.; Camp MacArthur, Waco, Tex.; Camp Las Casas; Camp Devens; Camp Gordon, Chambles, Ga.; Camp Dodge, Des Moines, Iowa; Camp Grant, Rockford, Ill.; Camp Pike, Little Rock, Ill.; Camp Taylor, Louisville, Ky.; Camp Greene, Charlotte N. C.; Camp Hancock, Augusta, Ga.; Camp Shelby, Hattiesburg, Miss.; Camp Sheridan, Montgomery, Ala.; Camp Beauregard, Alexandria, La.; Camp Wadsworth, Spartanburg, S. C.; Camp McClellan, Anniston, Ala.; Camp Meigs, Washington, D. C.; Camp Mills, Long Island; Fort Wright and Fort Terry.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Portsmouth N. H., until Sept. 13, 5634½—5000 switches and 100 interior fittings. Brooklyn, N. Y., Schedule 5643½—chain cable. Puget Sound, Wash., Schedule 5648½—three motor-driven saws. Until Sept. 9, Eastern yards, Schedule 5723½—21 transmitters and indicators for mechanical telegraph system. San Diego, Cal., Schedule 5763½—one motor-generating set. Until Sept. 16, Brooklyn, N. Y., Schedule 5751½—23,000 flashlight batteries. Boston, Mass., Schedule 5746½—electric hoists. Pensacola, Fla. Schedule 5759½—rubber-insulated electric wire. Until Sept. 20, Schedule 5784½—seven refrigating machines. Application for proposal blanks should designate the schedule by number.

North Central States

BARRYTON, MICH.—The capital stock of the Barryton Electric Light & Power Company has been increased from $2,000 to $10,000.

DETROIT, MICH.—The Hoskins Manufacturing Company is erecting a new foundry at its Lawton Street plant. The company manufactures electrical measuring instruments.

DETROIT, MICH.—Bids, it is reported, will soon be asked by the Aluminum Castings Company, 6210 Carnegie Avenue, for construction of one-story and two-story factories, to cost about $100,000.

GRAND RAPIDS, MICH.—A petition has been presented to the City Council by the Ottawa Merchants' Association asking to have electric wires placed underground.

KALAMAZOO, MICH.—The Michigan Railway Company is contemplating the construction of an extension from Morrice to Flint.

SAULT STE. MARIE, MICH.—Carrol H. Shaw of the War Industries Board has filed a statement recommending the installation of electrically operated pumps at the waterworks station as a coal conservation measure. The cost is estimated at $35,000. An issue of $50,000 in bonds is proposed for improvements to waterworks systems.

AKRON, OHIO.—The Goodyear Tire & Rubber Company of Akron, it is reported, has awarded contract to the Hunkin-Conkey Construction Company of Cleveland for construction of power plant. The cost is estimated at about $250,000.

CANTON, OHIO.—The Canton Sheet Steel Company is contemplating the construction of an addition to its steel mill, machine shop, forge shop, rolling mills and storage building, to cost about $750,000.

LIMA, OHIO.—Preliminary plans are being prepared by W. McConkey, engineer, for extensions to the plant of the Lima Locomotive Works, South Main Street, including a roundhouse, machine shop, factory, etc.

LORAIN, OHIO.—Extensive improvements, including a machine shop, boiler shop, and tool room, have been authorized by the Railroad Administration to the local shops of the Baltimore & Ohio Railroad Company, to cost about $156,000.

SANDUSKY, OHIO.—Contract has been awarded by the Matthews Engineering Company for the erection of a new factory, 100 ft. by 350 ft., adjoining its present plant. The building will be used for machine shop, erecting, testing and shipping purposes.

VAN WERT, OHIO.—Plans are being considered by the Department of Public Works for repairing the electric lighting plant at the waterworks station, which has not been in use for several years, and using it for furnishing electricity for lighting the city hall.

YOUNGSTOWN, OHIO.—A new boiler plant, 76 ft. by 65 ft., is being erected at the steel plant of the Republic Iron & Steel Company. A complete coal and ash-handling equipment to serve the boilers is also being installed.

FRANKFORT, IND.—The city officials have petitioned the Public Service Commission for permission to issue $50,000 in bonds for improvements to the municipal electric light plant.

BENTON, ILL.—Plans are being prepared for the erection of a new machine shop and engine building for the Illinois Central Railroad Company at Benton, Ill.

CHICAGO, ILL.—Plans are being prepared by the Crane company of Chicago for another addition (making the fifth building erected at its plant this year) to its Corwith plant, at Kedzie Avenue and Forty-sixth Street, to cost about $400,000

CHICAGO, ILL.—Bids will be received by the clerk of the Sanitary District of Chicago, 910 South Michigan Avenue, Chicago, until Sept. 26 for construction of Evanston sewage pumping station as follows: (A) building; (B) pumping machinery, including three 30-in. centrifugal pumps, three 14-in. centrifugal pumps (in accordance with designs submitted by the Sanitary District) with suction and discharge chambers, five-ton hand crane and accessories, excavation, etc.; (C) electrical equipment, including six 100-kva. transformers, three 100-hp. induction motors, three 25-hp. induction motors, (motors to be of the vertical type), two 5-kva. transformers, oil switch equipment and miscellaneous appurtenances; (D) switchboard, conduit and wiring. Control switchboard and accessories, conduit and wiring for connecting all electrical equipment and for station lighting and power, installation of electrical equipment. John McGillen is clerk.

LINCOLN, ILL.—The reconstruction of the Lincoln Municipal railway system is reported to be under consideration.

MILWAUKEE, WIS.—Contract has been signed whereby the city is to sell the surplus power generated at the electric plant at the garbage incinerator to the Milwaukee Electric Railway & Light Company and is to purchase the excess power needed for the operation of the Milwaukee River flushing station.

RHINELANDER, WIS.—The Rhinelander Paper Company is planning to build an addition to its boiler plant and to install several 200-hp. boilers. L. A. DeGuere, consulting engineer, Grand Rapids, Wis., has charge of the work.

TOMAHAWK, WIS.—The Tomahawk Light, Telephone & Improvement Company is contemplating extensions and improvements to its hydroelectric power plant on the Tomahawk River, to cost about $15,000.

DENNISON, MINN.—The Gunderson Milling Company, it is reported, has been granted a franchise to supply electricity in Dennison and Norstrand.

ST. CLOUD, MINN.—The Great Northern Flour Milling Company is contemplating equipping its flour mill for electrical operation.

KANSAS CITY, MO.—The City Council is considering calling an election to vote on the proposal to issue $100,000 in bonds for the construction of an ice plant.

ST. LOUIS, MO.—The construction of a machine and pattern shop, to cost about $250,000, is under consideration by the American Car & Foundry Company. Brussel & Viterbo, Wright Building, are architects and engineers.

ST. LOUIS, MO.—The American Car & Foundry Company is contemplating the construction of a machine and pattern shop, to cost about $250,000. Brussel & Viterbo, Wright Building, are architects.

ST. LOUIS, MO.—Plans, it is reported, have been prepared by the Laclede Gas Light Company for the construction of a munitions plant, 200 ft. by 1200 ft., one story.

BONESTEEL, S. D.—Bonds to the amount of $14,000 have been voted for the installation of a municipal electric light plant. The light plant will be installed in connection with the new water-works system.

BUFFALO, KAN.—An election will soon be called to vote on the proposal to issue $20,000 in bonds to rebuild the municipal electric light plant. W. B. Rollins is engineer.

KINGMAN, KAN.—The City Commissioners are considering increasing the output of the municipal electric light plant to meet the demands for electricity for power purposes.

Southern States

TARBORO, N. C.—The City Council is considering an issue of $50,000 for improvements to the municipal electric plant.

CORNELIA, GA.—The State Railroad Commission has granted the Wofford Shoals Light & Power Company permission to issue $50,000 in bonds.

PENSACOLA, FLA.—The Bureau of Yards and Docks, Navy Department, is planning to install an electric-lighting system in connection with the development of a new townsite near Bayou Grande.

FLORENCE, ALA.—Work has begun on the construction of a dam, about 4800 ft. long, on the Tennessee River at East Florence in connection with the proposed nitrate works of the United States government near Florence. The project, including power-house equipment, will cost approximately $22,000,000. The plans provide for a development of 860,000 hp., of which 260,000 hp. will be utilized to operate the nitrate plants.

IVERNESS, MISS.—Plans have been prepared for extensions and improvements to the municipal electric-lighting plant. X. A. Kramer of Magnolia is consulting engineer.

BEARDEN, ARK.—The purchase of four 72-in. boilers and other power-plant equipment is reported to be under consideration by the Cotton Belt Lumber Company.

MANSON, ARK.—The Manson Mercantile & Gin Company is contemplating the purchase of cotton ginning and power-plant equipment, to cost about $16,000. W. T. Holland is interested in the company.

TUCKERMAN ARK. — Arrangements have been made with the Arkansas Light & Power Company to supply electricity in Tuckerman. The local electric generating plant, it is reported, will be closed down.

MARIANNA, ARK.—The local plant of the Arkansas Light & Power plant, it is reparted, was recently destroyed by fire, causing a loss of about $40,000.

NEW ORLEANS, LA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is considering the installation of a turbo-generator at the local navy yard. Specification 3352. Also to install air compressors. Specification 3370.

HUGO, OKLA.—The Choctaw County Gin Company is considering the purchase of equipment for power plant and cotton gin, to cost about $15,000. R. D. Wilbur and others are interested in the company.

MENA, OKLA.—A tentative agreement has been reached between the city officials and the Public Service Company of Muskogee whereby the latter will be granted a 21-year franchise to construct and operate an electric light and power system in Mena. Under the terms of the franchise the company is to furnish the city with 150 electric street lamps for $125 per year during the life of the franchise.

McALLEN, TEX.—The Louisiana-Rio Grande Canal Company of McAllen is planning to install two 48-in. pumps at its second-lift irrigation pumping plant near McAllen, to cost about $200,000.

Pacific and Mountain States

SEATTLE, WASH.—The Standard Electric Company, 73 Horton Street, has been awarded the contract for wiring the proposed new plant of the Gulowsen-Grei Engine Company at Salmon Bay. The cost is estimated at about $8,000.

SEATTLE, WASH.—The City Council has passed an ordinance providing for an issue of $1,200,000 in bonds for an extension of the Seattle Municipal Railway from the city limits north of Green Lake to connect with the elevated line and thence to the Lake Burien line.

PORTLAND, ORE.—A one-story shop building, 147 ft. by 269 ft., will be erected at the Benson Polytechnic School for use in special mechanical courses.

PORTLAND, ORE.—In a report submitted to Acting Mayor Bigelow by F. I. Fuller, vice-president of the Portland Railway, Light & Power Company, plans are outlined for additional transportation facilities for the shipworkers on the west side of the Willamette River. Connections are planned with the North and South Portland lines at points nearest the South Portland shipyard center and also adjacent to the industrial center in North Portland. The company, it is understood, will receive assistance from the Federal Government.

FRESNO, CAL.—The San Juan Light & Power Company has acquired a site (five acres) in Fresno, on which, it is reported, it proposes to erect a power plant.

FRESNO, CAL.—The San Joaquin Light & Power Company is contemplating the construction of a substation in the vicinity of California and Orange Avenues to supply electricity to the large plants in that vicinity.

LOS ANGELES, Cal.—A permit recently granted the Southern California Edison Company by the California Water Commission approves the direct diversion and storage in Huntington Lake of the waters of Pitman Creek and the storage of 3781 acre-ft. annually in Pitman Creek reservoir for the development of electric power. It is proposed to construct a dam at Pitman Creek 860 ft. on top and 50 ft. long at the bottom. The cost of the dam and conduit line to Huntington Lake is estimated at $855,000. Two plants have already been erected at Big Creek, known as Big Creek power plants Nos. 1 and 2, and it is proposed to build two additional plants below these. The water after being used in all these plants is to be returned to the San Joaquin River from the tailrace of plant No. 4 in Madera County. Construction work is to be completed on or before July 21, 1921.

REDLANDS, CAL.—The Southern Sierras Power Company of Denver, Col., has purchased the entire property of the Coachella Ice & Electric Company of Redlands, which supplies electricity in Riverside and Imperial Counties, which is purchased from the Southern Sierras Company.

SACRAMENTO, CAL. — Arrangements are being made by the Northern California Power Company of San Francisco for the erection of an electric transmission line from Pitt River to Sacramento.

SAN FRANCISCO, CAL.—The State Board of Harbor Commissioners has decided to equip the Belt Line Railroad, which operates along the water front connecting the various piers with the several railroads that enter San Francisco, for electrical operation.

VALLEJO, CAL.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., in contemplating the installation of a turbo-generator at the navy yard, Mare Island. Specification 3352.

VALLEJO, CAL.—Extensive improvements and extensions are contemplated by the Vallejo Electric Light & Power Company, including the installation of new transformers, etc., the erection of a second transmission line (pole) from South Vallejo to the Kentucky Street plant.

Canada

ROSSLAND, B. C.—The West Kootenay Power & Light Company, which has completed its high-tension transmission line to Northport, will now take active steps toward the construction of a 100-mile line from Greenwood to Copper Mountain in Similkameen County to supply electricity to the Canada Copper Corporation to operate the 2000-ton mill and mines of the company.

VANCOUVER, B. C.—The Columbia Block & Tool Company is planning to build foundry and machinery shops, each 50 ft. by 150 ft., at 509 Richard Street, to cost about $15,000. An electric traveling crane will be installed.

MATHESON, ONT.—The installation of an electric light and power plant in Matheson is under consideration. The proposed plant will be driven by an oil engine and will cost about $10,000.

Directory of Electrical Associations

Printed in the First Issue of Each Month

Alabama Light and Traction Association. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

American Association of Engineers. Secretary, A. H. Krom, 29 South La Salle St., Chicago, Ill.

American Electric Railway Association. Secretary, E. B. Burritt, 8 West Fortieth St., New York City. Annual meeting Atlantic City, N. J., Oct. 8 and 9.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Fall meeting, Princeton, N. J., Sept. 29 to Oct. 1.

American Institute of Consulting Engineers, Inc. Secretary, F. A. Molitor, 35 Nassau St., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

American Physical Society. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

American Society for Testing Materials. University of Pennsylvania, Philadelphia, Pa.

Arkansas Public Utilities Association. Secretary-treasurer, W. J. Tharp, Little Rock, Ark.

Associated Manufacturers of Electrical Supplies. General secretary, C. E. Dustin, 30 East 42d St., New York City.

Association of Edison Illuminating Companies. Secretary, George C. Holberton, San Francisco, Cal.

Association of Iron and Steel Electrical Engineers. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa. Annual convention, Sept. 9-14, Baltimore, Md.

Association of Railway Electrical Engineers. Secretary-treasurer, Joseph A. Andreucetti, Chicago & North Western Railway, Chicago, Ill.

British Columbia Association of Electrical Contractors and Dealers. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C. Annual meeting, Sept. 13-15, Victoria, B. C.

Canadian Electrical Association, affiliated with N. E. L. A. Secretary-treasurer, W. Volkman, Toronto Electric Light Co., Toronto, Ont.

Colorado Electric Light, Power and Railway Association. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col. Annual meeting, Hotel Colorado, Glenwood Springs, Colo., Sept. 12, 13 and 14.

Commercial Section, N. E. L. A. Secretary, Henry Harris, Pittsburgh, Pa.

Eastern New York Section, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

Electrical Manufacturers' Club. Secretary, Shiras Morris, Hart & Hegeman, Hartford, Conn.

Electrical Supply Jobbers' Association. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Meeting, Cleveland, Ohio, November.

Electrical Trades Association of Canada. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

Electrical Credit Association of the Pacific Coast. Secretary, Albert E. Elliott, 502 Flatiron Building, San Francisco, Cal.

Electric Power Club. Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

Electric Vehicle Section of the N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York City.

Empire State Gas and Electric Association. Secretary, Charles H. B. Chapin, 29 West 39th St., New York City.

Florida Engineering Society. Secretary, J. R. Benton, Gainesville, Fla.

Illinois State Electric Association. Secretary, R. H Abbott, Petersburg, Ill.

Illuminating Engineering Society. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual meeting Oct. 10.

Indiana Electric Light Association. Secretary, Thomas Donohue, Lafayette, Ind.

Industrial Electric Heating Association. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

Institute of Radio Engineers. Secretary Alfred N. Goldsmith, College City of New York, New York.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex. Annual convention, Atlanta, Ga., Sept. 21-27.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). General secretary, C le Maistre, 28 Victoria St., Westminster, London, S. W., England.

Iowa Section, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

Jovian Order. Jupiter (president), Henry J. F. Strickland, Dallas, Tex.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo. Annual convention, Dallas, Tex., Oct. 14-16.

Kansas Public Service Association. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan. Annual meeting, Kansas City, Kan., Oct. 17-19, 1918.

Maine Electric Association. Secretary-treasurer. Walter S. Wyman, Augusta, Me.

Michigan Section, N. E. L. A. Secretary. Herbert Silvester, Detroit Edison Co., Monroe, Mich. Annual meeting, Pantlind Hotel, Grand Rapids, Mich.

Minnesota Electrical Association. Secretary, H. C. Hoffman, St. Paul Gas Light Co., St. Paul, Minn.

Mississippi Electric Association. Affiliated with the N. E. L. A. Secretary-treasurer, L. D. Gordon, Jackson Light & Traction Co., Jackson, Miss.

Missouri Association of Public Utilities. Secretary-treasurer, F. D. Beardslee, 721 Locust St., St. Louis, Mo.

National Association of Eletrcical Contractors and Dealers. Secretary, H. C. Brown, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin.

National Association of Electrical Inspectors. Secretary-treasurer, William L. Smith, Concord, Mass.

National Electric Light Association. Executive secretary, T. C. Martin, 33 West 39th St., New York City.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

National Fire Protection Association. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

Nebraska Section, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

New England Electraical Credit Association. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

New England Section, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Annual meeting, Hotel Kimball, Springfield, Mass., Sept. 27 and 28.

New Mexico Electrical Association. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

New York Electrical Credit Association. Secretary, Franz Neilson, 120 Broadway, New York City.

New York Electrical Society. Secretary, George H. Guy, 29 West 39th St., New York City.

Northwest Electric Light and Power Association. Affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore. Annual meeting, Portland, Ore., Sept. 13, 1918.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

Oklahoma Gas, Electric and Street Railway Association. Secretary, L. W. W. Morrow, Norman, Okla.

Pacific Coast Section, N. E. L. A. Secretary, A. H. Halloran, 618 Mission St., San Francisco, Cal.

Pennsylvania Electric Association. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa. Annual convention, Bedford Springs, Sept. 6 and 7.

Public Service Association of Virginia. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

Public Utilities Association of West Virginia. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

Radio Club of America. Secretary, T. J. Styles, 152 Beach St., Yonkers, N. Y.

Rocky Mountain Association of Municipal Electricians. President, Lawrence Stone, Denver, Col.

Society for Electrical Development, Inc. General manager, J. M. Wakeman, 29 West 39th St., New York City.

Society for the Promotion of Engineering Education. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

South Dakota Electrical Power Association. Secretary-treasurer, O. J. Gronsdahl, Hartford, S. D.

Southeastern Section, N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus, Ga.

Southern California Electrical Contractors and Dealers' Association. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

Southwestern Electrical and Gas Association. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

Southwestern Society of Engineers. Secretary, C. E. Barglebaugh, 703 First National Bank Building, El Paso, Tex.

Toronto Electrical Contractors' Association. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

Tri-State Water and Light Association. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

Vermont Electrical Association. Secretary-treasurer, A. B. Marsden, Rutland, Vt.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

Western Society of Engineers, Electrical Section. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill. Annual meeting, Chicago, Jan. 28-30, 1919.

Wisconsin Electrical Association. Secretary, J. P. Pulliam, 1408 First National Bank Building, Milwaukee, Wis.

Record of Electrical Patents

Notes on United States Patents

1,274,520. TELEGRAPHY; Patrick B. Delany, South Orange, N. J. App. filed Aug. 23, 1917. Transmission of Morse signals over telephone circuits by conveyance of mechanical and air vibrations to a microphone by means of impacts caused by vibrations of an automatic vibrator or "buzzer."

1,274,543. SHELL HOLDER FOR ELECTRIC CUT-OUTS; George Heineman, Philadelphia, Pa. App. filed June 22, 1917. Eye and neck are punched out of the portion of plate from which open frame is constructed, thus effecting a saving of material and consequent expense.

1,274,545. ELECTRICAL GENERATING SYSTEM; Frederick A. Herwehe, Monroe, Iowa. App. filed Sept. 28, 1914. An aero-turbine of simple, durable and inexpensive construction.

1,274,552. ELECTRICAL FITTING; Cecil R. Hubbard and Henry R. Gilson, Baden, Pa. App. filed Feb. 21, 1916. Improvement.

1,274,555. CHOKE-COIL MOUNTING; Ernest H. Jacobs, Chicago, Ill. App. filed April 29, 1918. An adjustable choke-coil mounting adapted to receive coils of different lengths, whereby the inductance of the unit may be readily varied.

1,274,575. ELECTRIC STARTER; Albert H. Midgley, Acton Vale, England. App. filed July 10, 1915. Displaceable armature for coupling the shaft of the electric motor with the engine shaft, the displacement of the armature being effected by the axial pull exerted thereon by the field magnet.

1,274,602. SYSTEM OF DISTRIBUTION; John A. Ritter, New York, N. Y. App. filed Oct. 23, 1915. Telegraph system in which are connected a plurality of energy-storing devices which are charged during the normal operation of a telegraph line.

1,274,603. SYSTEM OF DISTRIBUTION; John A. Ritter, New York, N. Y. App. filed July 6, 1916. Method of storing surplus energy at certain definite points along a line in order that it may be utilized at these points for any desired purpose.

1,274,629. AUTOMATIC SIGNAL; Guy P. Thurber, Pittsburgh, Pa. App. filed Aug. 23, 1907. For preventing railroad accidents and collisions.

1,274,654. TELEPHONE-EXCHANGE SYSTEM; Joseph L. Wright, Cleveland, Ohio. App. filed Oct. 6, 1914. No slow-acting relays or retarded devices are used.

1,274,658. TELEPHONE-EXCHANGE SYSTEM; Walter P. Albert, Chicago, Ill. App. filed Nov. 21, 1913. Automatic switching mechanism issued for interconnecting subscribers' lines.

1,274,660. RELAY; Claxton E. Allen, Pittsburgh, Pa. App. filed Aug. 6, 1915. A simple and economical relay mechanism that may be operated by the current derived from the circuit in connection with which the interrupter or other device is employed.

1,274,661. MEANS FOR TRANSLATING WAVE IMPULSES; Edward H. Amet, Redondo Beach, Cal. App. filed Feb. 28, 1917. An object is to translate wave impulses without shock or jar, and in the application of this invention to the translation of sound impulses an object is better articulation of reproduction impulses.

1,274,670. INERTIA-ACTUATED CHARGING DEVICE FOR ELECTROLYTIC LIGHTNING ARRESTERS; Quincy A. Brackett, Pittsburgh, Pa. App. filed Sept. 6, 1913. Electrical circuit closers are employed for charging electrolytic lightning arresters.

1,274,674. ELECTRIC SWITCH; Charles W. Brockett, Brooklyn, N. Y. App. filed Oct. 31, 1917. A self-adjusting form of contact for the spring switch arm which will compensate for variations in the size and relation of the parts.

1,274,675. ELECTRICAL MEASURING INSTRUMENTS; Harold W. Brown, Ithaca, N. Y. App. filed Dec. 19, 1913. A device that comprises a watt-hour meter, having its armatures so damped or retared in accordance with the power factor of the circuit to which it is connected as to indicate volt-ampere hours.

1,274,685. MOTOR CONTROLLER; Allan J. Cline, Chicago, Ill. App. filed May 22, 1915. For operating printing presses, machine tools and the like at different speeds.

1,274,691. CONVERTING SYSTEM; David C. Davis, Swissvale, Pa. App. filed April 6, 1915. To provide apparatus and circuits whereby single-phase current may be converted into polyphase current without the use of heavy moving parts.

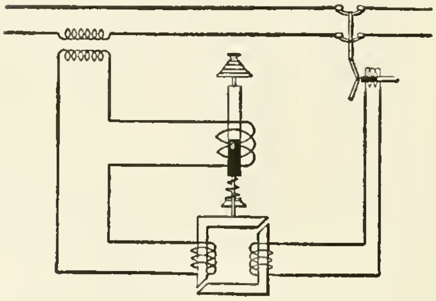
1,274,701. CIRCUIT INTERRUPTER; Frank Fix, Irwin, Pa. App. filed Oct. 9, 1915. Cheap to construct and reliable in operation.

1,274,711. SYSTEM OF CONTROL; Rudolf E. Hellmund and Ralph E. Ferris, Swissvale, and Laurence M. Perkins, Wilkinsburg, Pa. App. filed May 20, 1916. Systems of control for the regenerative operation of electric railway motors and the like.

1,274,713. PORTABLE LANTERN; Oscar Hoffman and Carl Wolter, Stuttgart, Germany. App. filed Sept. 8, 1916. Provided with an electric source of light such as a dry storage cell and a glow lamp to be connected with it.

1,274,725. ELECTRODE FOR ARC LAMPS; George M. Little, Pittsburgh, Pa. App. filed Aug. 6, 1915. A positive electrode for arc lamps which shall produce a steady and uniform light and shall be consumed to a minimum degree.

1,274,728. PLASTIC COMPOSITION AND PROCESS OF MAKING SAME; James P. A. McCoy, Wilkinsburg, Pa. App. filed July 3, 1914. As adapted to the manufacture of electric insulation.



1,274,660—Relay

1,274,733. CIRCUIT INTERRUPTER; Joseph N. Mahoney, Wilkinsburg, Pa. App. filed Aug. 11, 1913. A circuit breaker for relatively high-current service with provisions for cooling and for allowing flexibility of design.

1,274,741. CONVERTING SYSTEM; Friedrich W. Meyer, Pittsburgh, Pa. App. filed March 24, 1915. To provide circuits and apparatus whereby energy may be transferred from a single-phase to a polyphase system without the interposition of heavy moving parts.

1,274,794. ELECTRIC FURNACE; Mark Shoeld, Chicago, Ill. App. filed Jan. 26, 1918. Will produce a substantially uniform heat throughout a certain zone or section of the material treated, in which the electrodes will not be consumed either electrically or chemically.

1,274,795. FURNACE FOR CHEMICAL REACTIONS; Mark Shoeld, Chicago, Ill. App. filed Jan. 28, 1918. Adapted for the production of aluminum nitride.

1,274,796. ELECTRIC FURNACE; Mark Shoeld, Chicago, Ill. App. filed Jan. 28, 1918. Continuous in operation; provides a proper and even distribution of the gaseous ingredients throughout the body of solid material employed.

1,274,798. ELECTRIC FURNACE; Mark Shoeld, Chicago, Ill. App. filed March 6, 1918. Capable of successfully withstanding high temperatures for an indefinite period.

1,274,822. ELECTRICAL MEASURING INSTRUMENT; Thomas W. Varley, New York, N. Y. App. filed Oct. 6, 1913. A commutator clyinder for a four-pole measuring instrument that shall be so constructed that it may be engaged by brushes disposed substantially 180 deg. apart, to preclude any uneven wearing of its bearing parts.

1,274,844. ELECTRIC CONNECTOR; John Berg, Chicago, Ill. App. filed Sept. 29, 1917. A plural-socket connector which is simple and cheap.

1,274,852. X-RAY APPARATUS; Charles E. Campbell, Lynn, Mass. App. filed May 5, 1913. For stepping up and rectifying an alternating current to supply a high-tension unidirectional current for exciting an X-Ray tube.

1,274,857. FIELD TELEPHONE AND TELEGRAPH; Frank Pattison, Audley, Newcastle, England. App. filed Dec. 4, 1917. Portable ringing telephone with buzzer for calling up or for the transmission of Morse signals.

1,274,874. ELECTROMAGNETIC RELAY; Georg Grabe, Nikolassee, near Berlin, Germany. App. filed Dec. 27, 1915. The armature and sets of contact springs extend parallel to the core and have their movable ends arranged at the same end of the relay.

1,274,952. MAGNET CORE; James B. Speed, New York, N. Y. App. filed April 6, 1916. For loading coils for telephone circuits.

1,274,982. SAFETY APPLIANCES FOR AUTOMOBILES; Leonard Brown, Webb City, Mo. App. filed Jan. 3, 1917. To provide means for rendering the ignition system of the engine inoperative, and to operate a signal upon the engine being cranked either by hand or by means of a self-starter.

1,274,992. STARTING SYSTEM FOR AUTOMOBILES; Frank Conrad, Pittsburgh, Pa. App. filed May 11, 1914. Simple and convenient means for automatically controlling the ignition and starting mechanisms of automobiles.

1,274,995. PROCESS OF PLATINUMIZING METAL SURFACES; Benjamin B. Crombie, Port Chester, N. Y. App. filed March 29, 1918. By the use of chemical and mechanical means only.

1,275,003. DYNAMO-ELECTRIC MACHINE; George M. Eaton, Pittsburgh, Pa. App. filed Aug. 9, 1915. Simple, compact and durable in construction, and by reason of its peculiar arrangement of parts is adapted to accommodate a fan of relatively large diameter, whereby greater economies from ventilation may be realized.

1,275,007. STORAGE-BATTERY INSTALLATION; Grant E. Edgar, New London, Conn. App. filed Dec. 22, 1916. For use in storage batteries employed for various purposes, but of special utility in the storage batteries of submarine boats.

1,275,011. AUTOMOBILE; Roland S. Fend, Chicago, Ill. App. filed June 26, 1915. Relates to motor vehicles of the type provided with both gasoline and electric propulsion motors.

1,275,016. TELEPHONE-EXCHANGE SYSTEM; Charles L. Goodrum, New York, N. Y. App. filed March 29, 1917. To provide mechanical means whereby a selector switch, failing to find an idle trunk during its hunting movement, will be automatically restored to the beginning of the selecting movement.

1,275,035. DEVICE FOR CLEANING ELECTRODES OF MAKE-AND-BREAK SPARK PLUGS; Herbert G. Irwin, Spur, Tex. App. filed Dec. 3, 1917. Electrode may be cleared from carbon or other foreign substances without removing the plug from the cylinder of the engine.

1,275,047. ELECTRICAL SWITCH; Hubert F. Krantz, Brooklyn, N. Y. App. filed Dec. 2, 1913. May be controlled from distant points by the energizing of the solenoids of the switch.

1,275,083. ELECTRICAL APPARATUS; Johannes Orth, Berlin, Germany. App. filed June 3, 1915. Adapted for those types of electrical apparatus wherein it is sometimes desired to vary the voltage by varying the number of units or windings in series, as, for example, transformers which are provided with numerous taps connected to the windings in order that the voltage may be varied as conditions demand.

1,275,098. ELECTRIC SWITCH; John R. Spurrier, Bethlehem, Pa. App. filed Oct. 20, 1915. Circuit breakers which will automatically open in the presence of abnormal conditions, even during the time when the operator attempts to close the breaker manually.

1,275,114. AUTOMOBILE SIGNAL; Robert L. Werntz, Freeport, Ill. App. filed Sept. 5, 1917. Two indexes or arrows pivotally mounted and capable of movement independently into horizontal or vertical positions.

1,275,116. ELECTRICAL CONDUCTOR SUPPORT; Shedrick Whitter, Safety Harbor, Fla. App. filed Nov. 12, 1917. For telegraph poles.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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Looking Ahead on Rate Making

SO LONG as the winning of the war is our chief concern it appears likely that changes in central-station rates will in the main be simple flat advances to meet in part the burden of heavier operating costs. Time and money are too valuable at present to be spent in extended readjustments of rate schedules. Man power is needed by the nation for far more serious purposes. Within the central stations the production and distribution of energy indispensable for military and civilian uses is the insistent problem. It does not leave room for too minute a consideration of rate matters. Desirable and urgent as such detailed consideration may be, it can await other days. No one complains of this condition. It is a small part of the cost of our war for liberty. Every central-station manager, however, should see to it that this is clearly understood in his organization, perhaps also outside of it, as one of the acute questions to be taken up just as soon as possible. When things are again normal and staffs are reconstituted in the old or enhanced strength there will be opportunity to investigate the schedules in the light of the conditions which have been developing during the war period and will prevail as that period ends. Radical revisions in conditions of demand in the last few years have not been fully recognized in rate making. And other sweeping changes of far-reaching economic effect may be anticipated in the peace era.

We cannot figure with certainty that the return of peace will mean the return of the old conditions for the industry. The transformation wrought by these stirring years will not be undone in a day. Under the stimulus of the war demand the central stations of the country have gone ahead, not with the old steady rate of annual progress, but by tremendous leaps. The doubled output in four years tells the facts eloquently. In the old times it was, say, a 10 per cent yearly increase that expectation and realization saw. The schedules, the financing, the working forces were arranged with about that annual growth in mind. In general, the new-business policy which was followed was that of building up gross volume of production, of getting all the business of the community on the lines, of apportioning rates only roughly among the different classes of consumers. These methods, carried out intensively with more thoroughness year after year, developed the latent possibilities in factory, store and home. It was because of these methods, because of "mass production," that the central stations were able to meet the loud call for energy for war uses.

War brought many effects in its wake which are powerfully felt now and will in future have some bearing on total operating cost. The dislocation of material and labor costs and supply will be overcome only gradually. For this condition now there is but one quick and sure remedy, a flat advance in rates, not scientific, because industry is still too much disarranged for correct appraisal of the different factors involved. The flat increases take care, in part at least, of the immediate need for more revenue to prevent the threatened overwhelming of net revenue by the high tides of cost. They are emergency advances and in fact are distinctly so regarded by some of the public service commissions which have approved them. What the companies will need when our industries undergo reconstruction for peace conditions is not alone emergency action but the willing and generous coöperation of the governing authorities in meeting a situation as to which no precedent exists as a guide.

Higher Plane for Geographic Sections

THE formation last week of a joint council composed of five San Francisco sections of national engineering societies marked an important advance toward a higher plane of usefulness for the engineer. Of late local sections have been growing in importance and influence, particularly in Western territory where members are too far from headquarters to feel that local conditions could be thoroughly understood by the parent society, and now it is not unusual to find members of really live sections feeling that they derive more benefit from the local than from the national body.

Certain it is that the local organization can do effective and much-needed work for the advancement of the profession. A section organized and officered so that it can grasp and successfully cope with local problems involving the betterment of conditions under which the profession works is of far greater benefit to its members than one which limits its activities to technical discussions. The sphere of the engineer is rapidly broadening, and to keep abreast of the times the technical society must likewise adopt a broader viewpoint and render service in keeping with the real needs of the engineer.

Evidently the San Francisco associations are doing this. The first official act of the newly formed joint council was to bring before the Governor of the state the advantage of appointing an engineer to fill a vacancy on the state utility commission. With a body of about 1100 engineers in the San Francisco region agreed on the advisability of such a move, it will be difficult for the Governor to ignore the suggestion. Many other lines of activity in which the several societies have common interest are being considered by the joint council, and the attention of local sections in other parts of the country will doubtless be directed toward that body. There is no reason why joint councils should not be formed in other cities where there are several sections. In San Francisco the idea began at a luncheon attended by the several secretaries and with enthusiastic support speedily developed in a way that promises to strengthen the position of the individual engineer, the local section and the parent society.

Conservation in Incandescent Lamp Practice

THE program of the Fuel Administration for effecting saving through improvements in current practice regarding incandescent lamps represents the result of careful study of the whole situation by a committee of those who knew the facts. The report on the subject which we gave in our last issue is substantially the basis of the policy of the Fuel Administration and really represents the kind of conservation which is of permanent value. It is not enough to make a flamboyant showing of economy unless the saving effected is based on sound principles of permanent applicability. One can, of course, cut down the use of fuel in electric lighting by abolishing the lighting according to some arbitrary schedule, but all that can be saved both to the coal pile and the consumer by skillful adaptation of means to ends is clear gain. The committee charged with the duty of providing a scientific and sound basis for energy saving in incandescent lighting represented substantially all the organizations supplying either electricity or material for incandescent service. It was a thoroughly well organized and representative committee, and the program recommended to and now followed by the Fuel Administration will certainly be of very direct value from every standpoint in lessening waste of energy and instituting a useful program of standardization.

The main points of the committee's program include the abandonment of certain sizes and types of lamp for which there is no serious need, the substitution of highly efficient units for those of less efficiency, and a campaign of education to enforce the suggested improvements. Broadly, it is advised that the multiple carbon lamp be virtually abandoned except in the few cases where owing to exceptional danger of breakage from shocks the heavy carbon filaments may prove advantageous. It is also recommended that the graphitized-filament lamp be generally abandoned and replaced either by tungsten lamps or by carbon lamps as just stated. This is a particularly sound program, since both the carbon and graphitized-filament lamps have persisted to an extent that is altogether unjustifiable. Unless for very special reasons, there is no occasion now to use anything except metallic-filament lamps.

Tending along the same line of general economy is the recommendation that the use of small metallic-filament lamps be so far as practicable abandoned in favor of the employment of a smaller number of larger and more efficient units. It is, of course, well known that the difference in efficiency between the large and small lamps is very material, and the development of scientific illumination has gone far enough to enable the larger units to be used very advantageously. Finally, as to the material of illumination it is recommended that the use of the vacuum-type metallic-filament lamps in sizes of 100 watts and above be eliminated in favor of gas-filled lamps. This is perhaps the most striking of the suggestions embodied in the present scheme. It now seems to have been well demonstrated that the gas-filled lamp of 100 watts and above represents so material a gain in efficiency that the time is ripe for a general change in practice. Better and better results have been obtained from the moderate sizes, and the point at which the line is now drawn seems a safe one.

The change from vacuum to gas-filled lamps is not a slight one from the standpoint of illumination. The concentrated filament of the latter type with its very high instrinsic brilliancy demands more careful and thorough shading than with the older form of lamp. In this are involved certain inconveniences and some not negligible losses in efficiency owing to the necessity of more thorough screening. It will require some little study to determine just what the final result will be from the standpoint of illumination. We are not sure that the practical economy attainable will be substantial at the limiting size set. The high temperature reached by the gas-filled bulbs is also an inconvenience in going to the smaller units, and this, rather than the matter of efficiency, is likely to be the practical limitation on the universal use of the newer lamp. It is clear that for the present the change may involve some actual increase in the cost of service for which the public service corporations may properly ask opportunity to recoup themselves. It is worth noting that the committee did not think it practicable to make any broad recommendation with respect to the more general use of the smaller sizes of vacuum tungsten lamps, say those up to 25 watts. This has been one of the favorite suggestions for economizing electricity, and when the smaller lamps are used with discretion in suitable places real gain can be made by employing them. Any general pressure brought to bear in their favor, however, would almost certainly tend to lower the resulting illumination undesirably, for the substitution would generally be made socket for socket.

The committee emphasizes the necessity of cutting out extravagant and wasteful use of light in every form and strongly recommends a propaganda of caution in this respect, with the warning that there is some danger of overdoing the matter, particularly in the case of industrial plants where output might be curtailed or injured by too great enthusiasm merely for saving electricity. Indeed, there is very strong probability that in certain cases there would actually be, because of lessened efficiency, a greater total use of fuel resulting from excessive zeal in reducing the quantity required for lighting. The program of the committee on the whole is an exceedingly sound one which will tend very greatly to cut down waste of energy and therefore save output acutely needed for other purposes. Reduction of illumination in itself is likely to be disadvantageous, but all the saving which can be made by the use of efficient methods of lighting is clear gain.

Small Units for Light Loads

IT IS, of course, a widely understood engineering fact that the efficiency of most power-producing and power-delivering machinery falls off very rapidly with the decline of the load upon that particular piece of apparatus. The relation between efficiency and load factor, in other words, is fundamental in importance. One of the chief duties of a first-class operating engineer, therefore, is to see to it that so far as practicable his machinery shall not be allowed to run for extended periods on uneconomical loads. With reference to boilers, engines and turbines, whether of the steam-driven or water-driven type, this close watching of output variations on a given unit may be said to be general practice. It would perhaps be hard to prove it, but is the engineer quite so particular about the relation between loads and capacities in the operation of auxiliary machinery and of equipment on distribution systems under his supervision?

We mention this point at this time, not because it is new in principle, but because the importance of fuel saving justifies renewed attention to all possible methods of securing economical service. Without spending any great amount of money for equipment, many an operating engineer can accomplish fuel savings of real moment if he is willing to put himself a little more "on the alert," as the French say, to anticipate load changes and to cut off capacity not needed at the earliest possible moment. Now is surely the day for some first-class "Yankee guessing" as to the time at which units of different sizes can be removed from the line without hampering the quality of service or making the efficiency take a turn for the worse. Often it may be possible by carrying a little stiffer overload on a unit for a few minutes to avoid starting up another machine, or to get ahead of the game a bit by cutting it off a few minutes before the usual time. Every quarter-hour of unnecessary operation counts to-day on the fuel bill, and the present high price of coal, as well as its threatened scarcity, justifies a much closer watch of the time schedule of main machines and auxiliaries than used to be common.

As the fall loads come on, the time will be ripe to study more intimately than before the daily performance of units of different sizes as well as the total operations of the plant from hour to hour. Shortening days are now beginning to be felt on the curve of lighting output in central stations, and it will not be long before early twilights will influence the production required in industrial power plants. The forthcoming change of time back to the old standard will make sharper watch of outputs and service pay.

The Use of Synchronous Condensers

NOTES by J. T. Peyton regarding some recent practice of the Duquesne Light Company are instructive in view of the emergency requirements impressed on electric supply stations. The case described in this issue is one of a kind not unfamiliar. Great calls for extra load on lines already in place involve troublesome problems not only of line regulation but of station capacity as well. No thoroughly successful method has yet been worked out for control of power factor in connected load. To a certain extent it can be regulated by supervision of apparatus, but to-day the installations have to consist not of what one would wish to have but of what one is able to get at short notice. Had the company foreseen what would fall upon it it would very likely have installed more copper or raised the voltage of its lines, or both, so that the situation could have been dealt with. Under existing circumstances a study of the situation showed that the cheapest way out of a troublesome difficulty was to fall back on the synchronous condenser for regulation of voltage and power factor.

Such use of sychronous machines is familiar enough; in fact, it runs back to the very beginnings of electric power transmission and was worked out in connection with one of the very first three-phase plants ever installed. But it is only within comparatively recent years that the employment of synchronous machines as regulators has become common. In this instance a 7500-kva. unit was installed with extremely beneficial effect, enabling the voltage to be held constant under a very widely varying load and the power factor to be kept up to approximately 90 per cent. The results have been very gratifying in enabling the large and somewhat difficult load to be handled easily without increase in line copper or at the generator station and with an accuracy of voltage regulation otherwise unattainable.

Sometimes transmission systems are fortunate enough to take on big synchronous motors which in themselves can serve the double function of helping out the power factor and providing useful load. Rather frequently just now, however, one meets the condition here faced of getting caught between the devil and the deep sea, between difficulty of getting generating equipment and line material and the requirements of new and difficult loads. For such cases the synchronous condenser affords a ready way out and, furthermore, machines utilizable for this purpose may not infrequently be picked up for prompt delivery, inasmuch as they are not subject to troublesome requirements of speed or starting torque but are operated quite independently in their own peculiar function.

The Coming Issues

EVEN before war was declared by the United States the electrical industry of the country had taken steps to place itself on a war basis. Since then no industry has made a stronger effort to aid the government in its fight for humanity. The manufacturer has turned out equipment to the limit of his capacity, thereby enabling the government to launch its war machine so quickly. The central station demonstrated early that electric power was the one source of energy on which full dependence could be placed. The jobber made it possible for the government to secure in a few hours what it otherwise would have taken weeks and months to obtain. In fact, always has the army of the electrical industry been a full 100 per cent behind the army in the field. This is the story of the next issue of the ELECTRICAL WORLD, the second National Service Number of the paper.

High-Power Factor Induction Motors

Summary of Various Arrangements for Variable-Speed Motors of the Above Description That Have Been Proposed in the Last Fifteen Years, with Particular Reference to French Developments

BY MARIUS LATOUR
Paris, France

NUMEROUS methods have been proposed in the last fifteen years for obtaining high-power-factor, variable-speed induction motors. Therefore it may be worth while to present a simple classification of these arrangements in order to clarify the present state of development and furnish a better basis for further work.[1] The proposed review of the subject has, moreover, some relation to that made by the author on the subject of "The Compounding of Alternators" (see *Bulletin* of the Société Internationale des Electriciens, May, 1917); for it so happens that the same diagrams have been resorted to, these being applicable, according to the purpose in view, for the compounding of alternators, for devising self-exciting induction generators, for raising the power factor of induction motors, and for regulating their speed.

The summary which the author purposes to make relates to the study of the variable features of induction machines having collector rings; so it is necessary to begin by defining what is understood by the term "induction machines," also called "non-synchronous machines." The ordinary synchronous machine (such as a synchronous alternator or motor) being one whose speed is absolutely fixed by the number of poles and the frequency of the supply current, it might be understood that the induction or non-synchronous machine is one which operates at other than synchronous speed and which cannot work at synchronous speed. The ordinary induction motor with a short-circuited rotor is usually thought of as an example of an induction machine, but this interpretation would not, the author thinks, correspond to the modern idea of induction or non-synchronous machines, since this conception would not include induction motors having special modes of excitation.

The non-synchronous character of a machine may be defined from the following point of view. When an ordinary synchronous machine is connected to a circuit the amount of torque exerted on its shaft is regulated by the angular lead or lag of the rotor with respect to the synchronous revolving field developed by the stator. If the machine loses speed, its operation is interfered with. In fact, as a synchronous machine it will not of itself return to the speed at which it can and must operate; it will "fall out of step." In contrast with these operating characteristics of the synchronous motor, we may say that the non-synchronous or induction machine is one in which the torque on the shaft corresponds to the speed of the rotor itself, and in which, consequently, variations of speed alone can produce the disturbances which are produced by variations of angular lead or lag in the case of a synchronous machine. The non-synchronous character of an induction machine is thus defined by an operation which bears a close relation to that of the continuous-current machine.

The proposed definition does not exclude synchronous operation itself from the conception of the induction machine. It is only necessary that the condition of synchronism should represent a speed which is susceptible of being lost and recovered without special complication. This definition does not go further into the question of whether the non-synchronous machine is one operating as a motor, or as a generator, at a given speed which is above or below synchronous speed.

Two Methods of Obtaining High-Power Factor, Variable-Speed Machine

On the assumption that this definition is correct, there are two ways practically of obtaining a non-synchronous machine having a high power factor and running at variable speed when operated as a motor. These are: (a) The rotor may be connected with auxiliary commutator machines which have no relation with the supply circuit and which can turn at a speed independent of the rotor; or (b) the rotor may be joined with special machines connected with the supply circuit in such a manner that there is an established relation between the supply circuit and the rotor, as may be done by the interposition somewhere of a commutator moving synchronously with the shaft of the rotor.

In the case of arrangement (a) the non-synchronous machine cannot operate at synchronous speed. It will work as a motor above synchronism and as a generator below synchronism. In the case of arrangement (b) the machine can operate at exact synchronism and it can also operate indifferently, either as a motor or as a generator, both above and below synchronism.

Induction or Non-Synchronous Machines of Type "A"

It was Maurice Leblanc who first proposed to connect the rotor of an induction motor with a machine having a commutator (1895). He originally proposed to connect condensers with the rotor of induction motors in order to improve their power factor, but because of the practical difficulties experienced in obtaining condensers of sufficient capacity he sought to devise dynamical arrangements capable of being used in place of condensers.

The original arrangement used by Mr. Leblanc is shown in Fig. 1. The induction motor *SR* is supposed to comprise a two-phase rotor which is connected in cascade with two single-phase machines, one with each phase. The armature *A* and the field *E* of the same single-phase machine are connected with different phases of the rotor. The diagram has been modernized

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[1] The idea of writing this paper came to the author after a conversation with André Blondel in regard to the recent paper of R. V. Picou on "An Induction Motor Having a High Power Factor and a Variable Slip." (See *Bulletin* of the Société Internationale des Electriciens for December. 1917.)

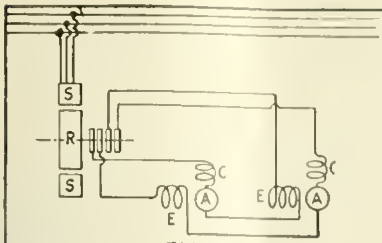

FIG 1

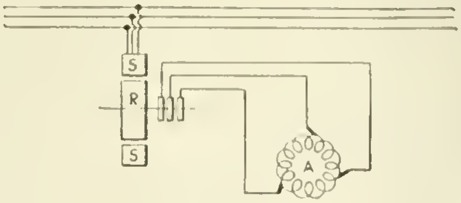

FIG 2

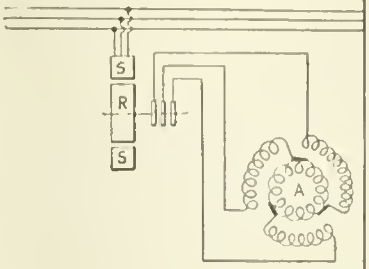

FIG 3

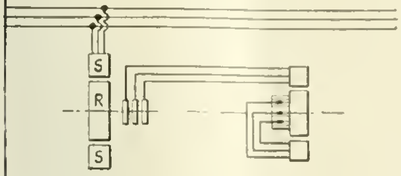

FIG 4

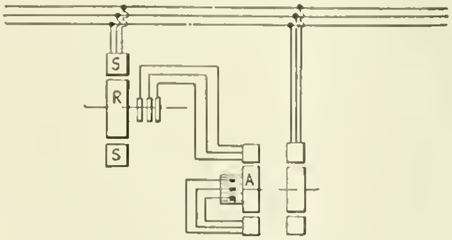

FIG 5

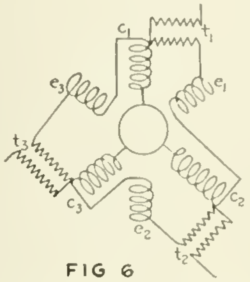

FIG 6

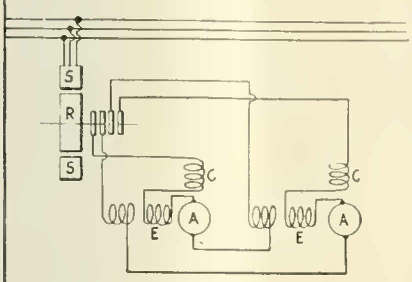

FIG. 7

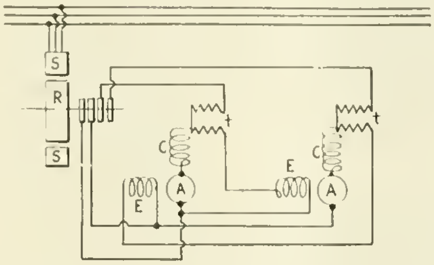

FIG 8

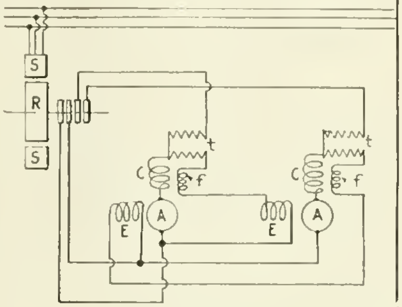

FIG 9

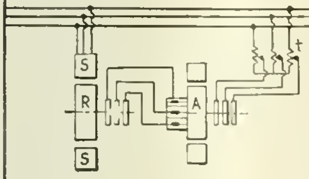

FIG. 10

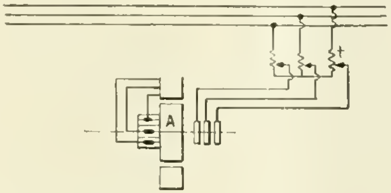

FIG 11

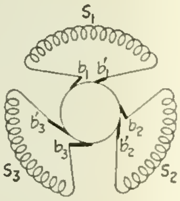

FIG. 12

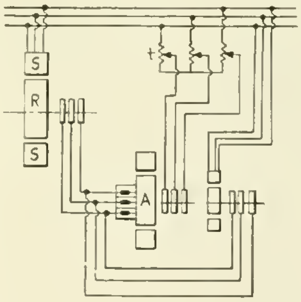

FIG 13

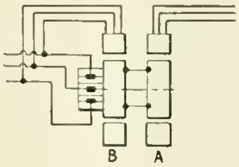

FIG 14

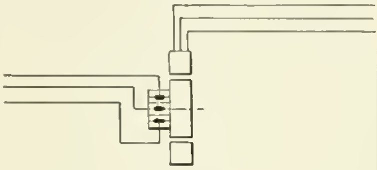

FIG 15

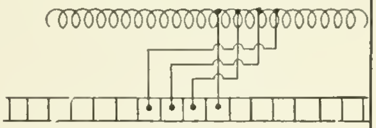

FIG 16

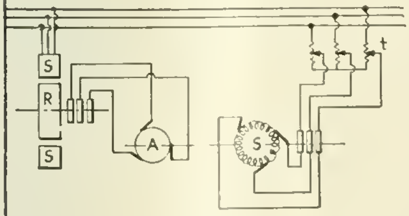

FIG 17

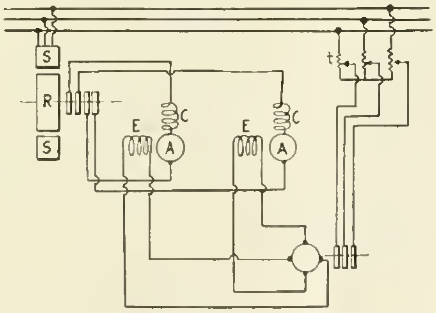

FIG 18

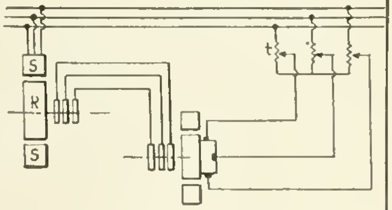

FIG 19

DIAGRAMMATIC REPRESENTATION OF THE VARIOUS METHODS DEVELOPED FOR PRODUCING A HIGH-POWER-FACTOR, VARIABLE-SPEED INDUCTION MOTOR by representing single-phase machines in which the armature reaction is neutralized by a compensating winding *C*. It will be readily seen later that the addition of this winding is indispensable for the operating result desired.

The emf. developed between the brushes in each machine by rotation is in time quadrature with the current passing through the armature, since the exciting current is in time quadrature with the armature current. For a given suitable direction of the excitation winding the emf. between the brushes will therefore have the appearance of an emf. of negative self-induction. Considering the low frequency of the currents due to slip, the narrow air gap and the high peripheral speed which can be attained by the single-phase armatures *A*, it can easily happen that this emf. of negative self-induction will be much higher than the emf. of effective self-induction developed partly in the windings *E*, by the production of the motor field itself, and partly in the winding *C* by leakages. Under those conditions the arrangement as a whole will operate as a negative self-induction. As the currents due to slip are of low frequency, the commutation will not be disturbed. An arrangement such as is represented in Fig. 1 would today be perfectly operative.

USE OF PHASE ADVANCER

However, after the author had shown[2] that an armature provided with a commutator, supplied by polyphase currents, and considered by itself, will have the same effect as a condenser when it is moved at a speed above synchronism in the same direction as the rotating field developed, Mr. Leblanc proposed, as a preferable arrangement, the diagram shown in Fig. 2. The rotor of the induction motor (supposed to be three-phase) is in this case connected through brushes placed 120 deg. apart, with an ordinary armature having a commutator. This armature is moved in the direction of the rotating field developed by the slip currents. It has the same effect as a condenser.

The foregoing apparatus, which is now quite often designated by the term "phase advancer," does not give much better results than those obtainable with the two single-phase machines shown in Fig. 1, however. It merely has the advantage of being simple in construction. On the other hand, it is theoretically subject to greater commutation troubles, because the brushes are to some extent set in the full field. However, it is easy to arrange so that the emf. between the commutator segments which are under the brushes shall be low. The voltage between the brushes corresponds to the voltage between the collector rings of the induction motor, and since the latter is operated nearly at synchronism, the voltage must be quite low. Furthermore, it is easy enough to keep the voltage between the segments from exceeding one volt by increasing the total number of segments of the commutator. In an apparatus of this kind, working at low voltage, the commutator is necessarily large in proportion to the armature.

At the same time that Mr. Leblanc was introducing an armature with an insulated commutator in the rotor of induction motors, he proposed (in the French patent No. 329,154 in 1903) to connect in series with that armature a winding placed on the stator surrounding the armature, in such a way as to develop a "watted" counter-emf. capable of producing a slip. At the same time a real commutator motor, corresponding to the diagram of Fig. 3, was connected in cascade with the rotor of the induction motor.

COMMUTATOR MOTOR IN CASCADE WITH INDUCTION MOTOR

Subsequently to this invention of Mr. Leblanc, German patents (No. 169,453 in 1905 and No. 179,525 in 1905) were granted to Mr. Kraemer and Mr. Scherbius. These two patents aim to connect in cascade a motor having a commutator with an induction motor. The intention is to make the motor operate at a variable speed by reacting on the commutator motor. In Mr. Kraemer's arrangement the commutator motor is placed on the shaft of the induction motor (see Fig. 4); in the arrangement of Mr. Scherbius a separate set is provided (see Fig. 5). The patents do not contain any special explanation, and the machines utilized appear to be of the ordinary commutator type with either series or shunt winding.

Later the author proposed to place the motor having a commutator on the shaft of the prime mover which supplies power for the induction motor *SR*, when the alternator driven by that power is near the motor *SR*, as, for example, in the case of electric propulsion of vessels.

By placing machines having a commutators inside the rotor of induction motors, Mr. Leblanc sought to improve the power factor, but it will be found that the patents mentioned could not have given him very much information.

This development was further contributed to by the author, who proposed, in the French patent No. 417,190 (1909), to connect an induction motor in cascade with a machine having composite excitation. The machine with composite excitation, which is represented in Fig. 6, is supposed to be self-exciting through its stator. This comprises one winding, c_1, c_2, c_3, which tends to neutralize the reaction of the rotor and a second winding, e_1, e_2, e_3, which is connected in shunt with the machine itself and serves to excite the magnetic field.

The secondary windings of a three-phase transformer, t_1, t_2, t_3, through whose primary windings the rotor currents pass, are connected with the three-phase circuit e_1, e_2, e_3.

In the general case it may be supposed that any one or more phases of the rotor can be made to act by mutual induction on each phase of the excitation winding, e_1, e_2, e_3, for the purpose of obtaining any phase and any value of series emf. in each excitation circuit. The three-phase transformer, t_1, t_2, t_3, may be a rotating-field transformer, in which the connections with the secondary would be made at variable points suitably selected.

CONTROL OF SET

The operation of the set composed of the induction machine and the commutating machine will generally be controlled in the following manner: When running without load, whether the outfit be operating above or below synchronism, the commutator machine develops, by self-excitation from its shunt winding, an emf. at the brushes which corresponds to that induced in the rotor by the slip of the induction machine. Under those conditions it may be assumed that the excitation of the induction machine is supplied either by the supply circuit into the stator or else by the commutator machine into the rotor itself, or again in both ways simultaneously. However, it is the second mode of excitation, obtained by overexciting the commutator machine, that is desirable in order to obtain a high power factor.

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[2] See *Eclairage Electrique*, Nov. 26, 1901.

When the induction motor is loaded the currents developed in the rotor of the induction machine pass through the commutator machine. Owing to its series excitation, the machine will operate as if it had a certain inductance and a certain resistance, each of which may be either positive or negative. The compensation for the reactance of the rotor of the commutator machine and the series excitation of the field are to be regulated so as to reduce this inductance and so as to give it, preferably, a certain negative value capable of counterbalancing the effect of leakages in the induction machine. Moreover, the effect of the resistance is to be regulated in such a way as to give the induction machine a suitable characteristic. It has been found that, in order to obtain stable operation as a motor, the machine must run below synchronism and must have a positive resistance. In order to work as a motor above synchronism it would be necessary to have negative resistance, and the torque would then increase with the speed.

It is obvious that the series excitation might be obtained, independently of the shunt excitation, by means of distinct windings, but it would always be necessary to make use of series transformers to counterbalance the inevitable mutual induction that would be produced in the stator itself between the series and shunt windings. In the case where the compensation for the rotor reaction is not such that the magnetic flux produced by the rotor is exactly neutralized in the stator there is even mutual induction between the rotor and the compensating winding, on the one hand, and between the rotor and the shunt winding, on the other hand. This it is desirable to neutralize by the series transformer. It will be possible. of course. to arrange a single winding on the stator and to obtain the compensation, even with the shunt winding, by increasing the capacity of the series transformer.

TWO SINGLE-PHASE MACHINES VERSUS ONE POLYPHASE UNIT

The author had proposed previously (patent No. 401,515, in 1908) to use two series single-phase machines with compensated armature reaction and with field regulation, instead of a polyphase machine such as is shown in Fig. 7. In that diagram the normal series excitation is supplemented by an excitation from the opposed rotor phase in such a way as to obtain a high power factor in accordance with the principle of Fig. 1.

It was proposed by others (English patent, Siemens-Schuckert, No. 29,090, in 1909) to use two single-phase machines with shunt excitation, one connected to the terminals of the other. But, in order to obtain real shunt characteristics and a high power factor at the same time, it is necessary, in the author's opinion, to add to that diagram a series transformer *t*, as represented in Fig. 8. The use of this transformer in separately excited single-phase machines having a commutator forms the subject of the author's German patent No. 11,690 (1906).

In order to obtain a compound characteristic each transformer *t* should, in addition, allow the self-excitation of each machine by its own current. To this end each transformer *t* will require a supplementary primary winding for the current of the other machine which it has to excite.

The arrangement of two single-phase machines instead of a single polyphase machine may appear to be merely a complication, but the author does not believe that such is the case. The first arangement is preferable because more perfect commutation can be obtained at each machine, owing to the fact that there are no brushes set for commutation in the full field, and owing to the use of commutating poles excited by the currents which are out of phase. as in the case of a series motor (see patents of the Oerlikon Company and of the author in 1904). The winding of the commutating pole *f* of one machine is supplied by the excitation current of the principal field circuit of the other, as shown in Fig. 9. The rubbing surface and the volume of the two commutators of the two single-phase machines might be much smaller than would be the case for the single commutator of the polyphase machine.

INDUCTION OR NON-SYNCHRONOUS MACHINES OF TYPE B

The rotor of an induction machine can be connected with a source of current giving of itself emfs. whose frequency corresponds to the slip. This mode of operation dates back to the American patent of Tesla (No. 390,701, in 1888) and to the German patent of Siemens (No. 109,308, in 1898).

In order to obtain the slip-current frequency use is made of apparatus called phase changers. A phase changer is composed of a continuous-current armature *A* having collector rings and a commutator like a rotary converter (see Fig. 10). Currents from the supply circuit having a pulsation w are brought to the collector rings by the transformer *t*. If the frequency changer is operated at the speed w_1 of the rotor of the induction motor, the three-phase emf. developed between the three brushes at 120 deg. from the commutator will have the pulsation $w - w_1$. It is therefore possible to establish a direct relation between the frequency changer and the rotor *R*. The frequency changer itself can be excited by the stator connected in series or in shunt, as shown in Fig. 11. A detailed description of this frequency changer and of its operation in the form shown is given in the French patent of Mr. Blondel (No. 317,989, in 1902). Mr. Blondel at that time obtained, by utilizing this frequency changer as an exciter, a non-synchronous compound generator and was not specially interested in obtaining speed regulation.

Mr. Blondel gave attention (in French patent No. 317,989) to the operation of the apparatus shown in Fig. 11 as a motor pure and simple. In such a motor it is the movable part receiving current from the supply circuit which plays the rôle of stator *S* of the induction motor shown in Fig. 10, and it is the stationary part which plays the part of the rotor *R* of the induction motor supplied by low-frequency currents. It happens that this motor serves by itself as a frequency changer for supplying current to its own rotor. Commutation can never be perfect in such a motor, because there is always an induced emf. between the segments which are passing under the brushes. But for motors of small power the commutation may be satisfactory enough.

The great advantage of the motor shown in Fig. 11 is that it can be made for variable speed and with shunt characteristics, without any other auxiliary apparatus (see Fig. 12), by simply supplying the windings S_1, S_2, S_3 of the stationary part with variable emfs. taken off the commutator of the movable part. To do this, two brushes are provided for each phase b_1, b'_1, b_2, b'_2, b_3, b'_3 (see French patent No. 43,890, of Allmännä Svenska Elektriska Akiebolaget). It is the commutator of the motor which serves as a speed controller[3].

In the case of Fig. 10 the frequency changer must turn synchronously with the rotor of the induction motor *SR*, whose speed regulation it produces. To that end, if it is not driven mechanically by the shaft of the rotor, it should be driven by a small induction motor whose stator and rotor are connected in parallel with the stator and rotor of the principal induction motor, as shown in Fig. 13. This arrangement was given by the Siemens-Schuckert Company, but perhaps a reference to it can be found in the patent of Mr. Blondel. When current is supplied to the stationary portion of the frequency changer shown in Fig. 11 it can run synchronously with the shaft of the rotor and without the addition of any special motor. (Further reference to this point will be made later.)

It may be easily seen that, for the same commutation and the same peripheral speed of the commutator, the commutator of the frequency changer shown in Fig. 10 must have exactly the size of the commutator that would be required for the rotor of the induction machine in order to produce speed regulation directly. Therefore, to substitute indirect speed regulation by the exciter of Fig. 1 for direct speed regulation, by means of a commutator mounted on the induction machine, seems to be, in a sense, an unsatisfactory solution. It would be different if it were possible to obtain the slip frequency by means of a commutator turning at a natural frequency (number of turns per second multiplied by the number of pairs of poles) lower than that at which the induction machine is running. At the same peripheral speed and for the same emf. at the brushes the emf, between the segments would be lower.

The above-mentioned result was attained by the author in the following manner (French patent No. 436,268):

First Arrangement.—In this case (see Fig. 14) the frequency changer comprises an auxiliary induction machine *A* connected in cascade with a machine *B*, similar to that shown in Fig. 11, and the arrangement resembles the Leblanc-La Cour cascade converter, which is often utilized instead of the usual rotary converters for frequencies of 50 and 60 cycles. If it is assumed that the two machines *A* and *B* have the same number of poles, and that they run with a frequency one-half less than that of the principal induction machine, it will be found that the emfs. generated between the brushes at the commutator have the slip frequency of the principal induction machine, although the commutator is working at one-half the frequency of the induction machine. If it is assumed that the two machines *A* and *B*, running at the same speed, differ in the number of poles in the ratio of one to two, and if it is assumed that the natural frequency of the machine *A* is two-thirds of that of the principal induction machine, it will be found that the emfs. obtained at the commutator always have the slip frequency of the principal induction machine, although the commutator is working at a frequency which is one-third of the frequency corresponding to the speed of rotation of the principal induction machine.

Thus it is possible to make various combinations by which the natural periodicity obtained for the commutator is always less than that of the induction machine. The machine *B* operates as a converter and as a motor at the same time in a proportion which depends on the reduction of frequency obtained at the commutator. This means that, in order to obtain the best results, there should be on the stator a compensating winding having for its object the neutralization of the reaction due to the fact that the machine is working partly as a generator and partly as a motor.

Second Arrangement.—In this case the frequency changer takes the form of a single auxiliary machine (Fig. 15) whose rotor has a commutator having its connections with the armature winding reversed, as shown in Fig. 16. This reversal of commutator connections was devised by Mr. Leblanc in order to obtain a compounding exciter. The reversed connections enable the machine *B* of Fig. 14 to be done away with by placing the commutator directly on machine *A*. They do not constitute so great a complication as might seem to be the case at first glance.

If we assume the induction machine in Fig. 15 to be running at one-half the frequency of the principal induction machine, it will be found that the emfs. obtained between the brushes have the slip frequency of the principal induction machine, although the frequency at the commutator is one-half less than that of the principal induction machine.

If it is assumed that the auxiliary induction machine is running at two-thirds the frequency of the principal induction machine, and that the number of poles of the commutator is one-half that of the winding, it will be found that the emfs. between the brushes always have the frequency of the principal induction machine, although the natural frequency of the commutator is one-third the frequency of the principal induction machine.

Furthermore, if it is assumed that the auxiliary induction machine is running at four-thirds of the frequency of the principal induction machine, and that the number of poles of the commutator is reduced to one-fourth the number of poles of the winding, it will be found that the frequency at the commutator is one-third the frequency of the principal induction machine and so on.

Third Arrangement.—In this case sinusoidal windings are placed on the rotor of the principal induction machine, shown in Fig. 15, just as in the case of the compounding exciter of Mr. Boucherot.

Finally, it is possible to utilize an ordinary frequency changer for exciting a commutator machine having a natural frequency at the commutator which is as low as desired. In that connection the author proposed in 1902 (see German patent No. 154,131) an induction machine excited in the manner shown in Fig. 17.

The exciter or commutator machine comprises a stationary field, *S*, which is also provided with a commutator. Rotating brushes, moved by the shaft of the induction motor, receive current from the supply circuit and thus produce direct excitation of the commutator machine from the supply circuit. The use of rotating brushes might be avoided by utilizing the apparatus devised by the author (see French patent No. 327,986 of 1902) to which reference is made in the author's paper on compounding (see *Bulletin* of the Société Internationale des Electriciens for May, 1917).

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[3] The idea of obtaining a variable emf. on the commutator of a frequency changer by the use of two sets of brushes with variable distance, was presented in another form by Osmos. (See *Elektrotechnische Zeitschrift*, 1902, pp. 1078 and 1079.)

The commutator of the stator of the exciter (Fig. 17) can be replaced by a little special frequency changer, in which case the excitation of the stator is produced by low-frequency currents obtained from the frequency changer. It is possible to utilize this frequency changer, not for exciting one single polyphase machine, but for exciting two single-phase machines. This is shown in Fig. 18. The two single-phase machines in Fig. 18 may have a commutating field, the same as the single-phase machines in Fig. 9. This arrangement of two single-phase machines, instead of one polyphase machine, will be very useful when the speed regulation desired must anticipate high slips. The frequency changer can also be made in inverse form. The emfs. of low frequency are developed between the collector rings, and the emfs. of the normal frequency of the supply circuit are applied to the commutator. This well-known arrangement is represented in Fig. 10. The adoption of the frequency changer in that form amounts practically to the same thing as disconnecting the commutator from the rotor of a motor having a commutator, by the introduction of collector rings, as was shown in the author's patent No. 306,229 of 1902.

The foregoing arrangement is also of interest in the case of large motors with commutators operating at high speed and developing large power per pole. In such cases the voltage between commutator segments is still too high, even when the armature winding has only one turn per commutator segment. Since the width of iron may be lower in the frequency changer than in the motor itself, it follows that a single turn per section of armature winding for the frequency changer will reduce the voltage between segments to a lower value.

As the author has already shown, it will be preferable when delivering current from the supply circuit to the commutator of this frequency changer to increase the number of phases of the currents introduced, as was suggested by him for the case of ordinary commutator machines. If the frequency changer is mounted on the shaft of the induction motor, the collector rings of the frequency changer will no longer be necessary and may be dispensed with. The collector rings of the induction motor may also be dispensed with, and it is possible to imagine a relation between the motor and the frequency changer with a very high number of phases.

Investigation of Heating of Conductors—I

Evidence Indicates that National Electrical Code Rating Should Be Modified to Permit Use of Smaller Conductors Where the Load Is Intermittent—Data on Heating Produced by Continuous Loads

BY HENRY C. HORSTMAN AND VICTOR TOUSLEY

IN THE present national industrial emergency the electrical inspector owes two duties to his nation, namely, to see that installations under his jurisdiction are safe and to see that no more material than is actually required goes into the job. Experimental data gathered by the authors and presented herewith indicate that the National Electrical Code might be made less rigid in the case of conductors carrying intermittent and short-period loads. A more economical use of copper thus appears not only possible as a war measure but also sound engineering practice.

Two factors determine very largely what size the mains shall be for any particular job—heating of the conductors under load and demand factor. Not enough has been known about either of these topics by the average electrical man. The authors of this series of articles have attempted to set down in concise usable form the results of experiments made to determine exactly the heating effects of current on wires under (1) continuous load, (2) intermittent load, and (3) limited time ratings. Demand factors are being studied by the authors with a view to bringing out similarly useful tables on that subject.

The steady current which will produce a given ultimate temperature rise in a conductor can be found by the formula $I = \sqrt{KC}$, in which K is a constant and C the temperature rise above the surrounding air in degrees centigrade. The constants for the various wire sizes here considered are deduced from heating curves experimentally obtained in the laboratory of the Commonwealth Edison Company of Chicago, where the tests were made, at the suggestion of the Department of Gas and Electricity of that city. The constants were obtained by dividing the square of the current used in connection with individual tests by the rise in temperature produced in the conductor. Several sets of constants are given, some of them applying to ultimate temperature rise and others for shorter lengths of time. The tests were made jointly by engineers of the above company and the Bureau of Electrical Inspection.

The method used was as follows: Sections of wire or cable were looped three times through a 10-ft. (3.05-m.) length of conduit pipe. Under these conditions the three conductors within the pipe were heated by the same current. The conduit pipes were supported $2\frac{1}{2}$ ft. (1.06 m.) above the floor by means of wooden horses placed at each end. Thermocouples were placed directly in contact with the copper, with as little disturbance to the insulation as possible, and were installed in the center of the conduit. The current was furnished by large-capacity, low-voltage storage batteries and was maintained constant by means of adjustable resistance.

A Leeds & Northrup potentiometer indicator was used to determine the difference in temperature of the hot couple on the conductor and the cold couple, the temperature of which was maintained constant at 0 deg. C. by means of a thermos bottle containing ice.

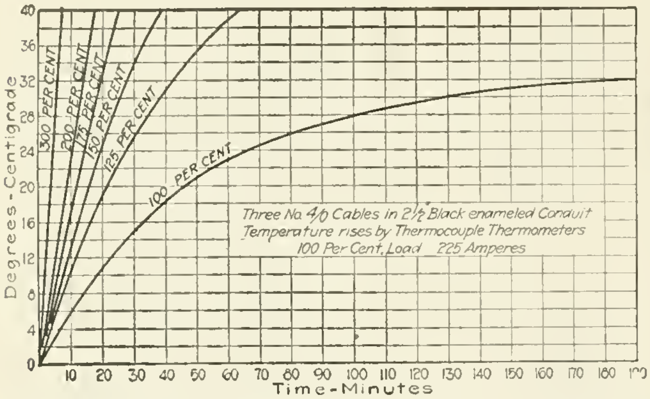


FIG. 1—HEATING OF RUBBER-COVERED CABLES WITH CURRENT

It may be seen that the curves are relatively straight lines during five-minute intervals.

The formula given above is strictly correct only for the ultimate temperatures obtained experimentally, and if other temperatures are to be considered and great accuracy is required, corrections for increased resistance with increased temperature should be made. The errors introduced by failure to make such correction will, however, be small, and for practical purposes negligible. In the accompanying Table I are given the ultimate temperature constants for the various sizes of wire under the heading K. The carrying capacities given are those of the National Electrical Code. In the column "Temperature Rise" are the ultimate temperature elevations attained by the conductors under the test conditions and with the currents given. The temperatures given are also the ones at which calculations made according to the formula will be strictly correct. The column "Time" shows the time in minutes in which the temperature in question is attained. The figures given in connection with 300,000-circ.mil and 400,000-circ.mil cables were not obtained by tests but estimated on the basis of the test on the 500,000-circ.mil cable.

TABLE I—ULTIMATE-TEMPERATURE CONSTANTS FOR RUBBER-COVERED CONDUCTORS

		In Conduit			Open			
B. & S. Gage	Carrying Capacity, N.E. Code	K	Temp. Rise	Time, Minutes	K	Temp. Rise	Time, Minutes	Temp. Outer Braid
14	15	15	15	80	34	6.5	40	3.6
12	20	23.2	17.2	60	61	6.2	20	4.3
10	25	40.3	15.5	55	88	7.0	30	4.3
8	35	73.8	16.6	85	155	9.5	40	6.0
6	50	136.0	18.4	95	291	8.3	30	6.0
4	70	217.0	22.6	110	442	12.0	35	7.1
3	80	333.0	19.2	100	666	9.6	50	6.6
2	90	422.0	19.2	100	898	9.2	60	6.2
1	100	467.0	21.4	110	1,165	9.2	50	7.2
0	125	684.0	22.8	250	1,768	8.8	50	6.0
00	150	969.0	23.2	150	2,079	11.4	60	6.2
000	175	1,392.0	22.0	200	2,992	9.8	60	8.2
0000	225	1,582.0	32.0	215	3,616	14.0	60	..
300,000	275	2,832.0	26.7	240	5,954	12.7	80	....
400,000	325	3,956.0	26.7	240	8,316	12.7	90	....
500,000	400	5,992.0	26.7	240	12,252	12.7	100	...

TABLE II—CARRYING CAPACITY OF VARIOUS-SIZE RUBBER-COVERED CONDUCTORS

	In Conduit			Open		
B. & S.	10 Deg. C.	20 Deg. C.	30 Deg. C.	10 Deg. C.	20 Deg. C.	30 Deg. C.
14	12.2	17.3	21.2	18	26	32
12	15.2	21.6	26.4	24	34	42
10	20.7	28.4	35.9	29	45	51
8	27.2	38.3	47.0	39	55	68
6	36.9	52.2	63.9	54	76	93
4	46.6	65.9	80.7	66	94	114
3	57.7	81.6	99.9	81	115	141
2	65.0	91.9	112.0	94	134	164
1	69.1	96.6	114.0	107	151	186
0	82.7	117.0	143.0	133	188	230
00	98.3	139.0	176.0	144	203	249
000	118.0	167.0	204.0	172	244	291
0000	126.0	178.0	218.0	190	268	328
300,000	168.0	238.0	291.0	243	342	422
400,000	198.0	281.0	345.0	288	406	498
500,000	245.0	346.0	424.0	348	490	602

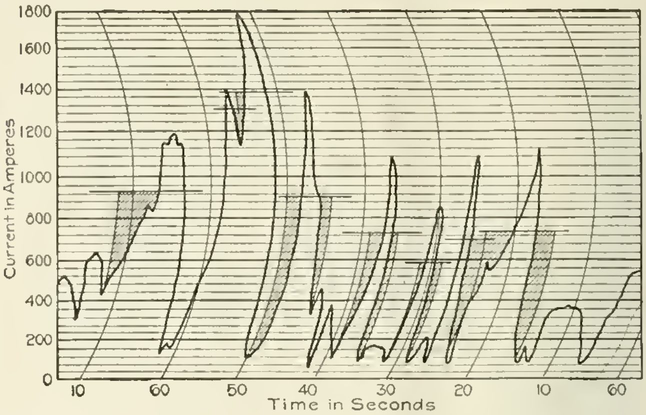


FIG. 2—SIMPLE METHOD OF OBTAINING ROOT-MEAN-SQUARE CURRENT

In Table II are the carrying capacities of the various conductors calculated according to the formula given for temperature rises of 10 deg., 20 deg., and 30 deg. C.

OUTPUT AND WORK OF WOMEN IN INDUSTRY

National Industrial Conference Board Study Covers Manufactures of Electrical Machinery, Apparatus and Supplies

Research Report No. 8 of the National Industrial Conference Board is on "War-Time Employment of Women in the Metal Trades." As published by the board, the data on the output and wages of women cover 127 establishments employing 324,205 men and 47,941 women. Those relating to "Electrical Machinery, Apparatus and Supplies" are published on the opposite page.

In this table the establishments were grouped on the basis of their normal product. In numerous cases establishments were also engaged in the manufacture of munitions. Since, however, the operations on which women were employed are the important consideration, it was considered advisable to use the classification adopted.

OUTPUT OF WOMEN

Total Number of Establishments	Greater in all Operations	Greater in Some Operations, Equal in Some	Equal in all Operations	Greater in Some Operations, Less in Some	Equal in Some Operations, Less in Some	Less in all Operations	Not Comparable or Not Stated
18	2		6	2	2	2	4

A summary comparison of the output of women with that of men on similar work for the electrical establishments is given by the board as printed above.

OUTPUT AND WAGES OF WOMEN, ETC.—ELECTRICAL MACHINERY, APPARATUS AND SUPPLIES

Serial Number and Product of Establishment, and Number of Men and Women Employed (*a*)	Number of Women Added or Substituted on Men's Work Since August, 1914 (*b*)	Occupations of Women (*c*)		Wage Rates of Women Compared with Rates of Men so Far as Reported	Abstract of Employer's Statement as to Wages	Abstract of Employer's Statement as to Output
No. 17—Cranes, electrical motors, controllers—425 men, 45 women	8	Drill press, light *Bench work, light* Stock-room attendant		Piece, equal Time, equal		About average.
No. 18—Electrical motors, meters, etc.—2985 men, 665 women	6	*Machines* *Bench work* Winding induction motor stator coils	*Winding* *Taping* *Testing* **Assembling meters**	Piece, some equal, some less Time, less	For assembling of meters women are paid 84 cents per 100 less than men on one type, same pay on other types. For winding induction motor stator coils, pay is same.	Women's output equal to men's on assembling meters; on winding induction motor stator coils, 20 per cent less than men's
No. 19—Electrical motors—497 men, 108 women	108	Insulating and winding armatures Tool-room attendant Inspecting Assembling, light		Piece, equal Time, equal		Nearly equal.
No. 20—Turbines, electrical generators and motors, electrical apparatus—20,913 men, 2000 women	Very few	*Drill press, light* *Machine taping* *Punch press* *Stamping nameplates* *Winding armatures*	*Winding coils* *Pasting mica* *Assembling, light* *Elevator operator* *Stock-room attendant*			
No. 21—Electrical apparatus and suppplies—13,000 men, 1700 women	300	Drill press Grinding Milling machine Punch press Sewing machine *Building up composite insulation* Assembling coils Coil pressing **Winding coils** Coils, form and pull Connecting *Coil insulating* Core building Insulating Stock-room attendant Janitor	Micarta and composition work *Mica splitting* *Taping* Material cutting Riveting Soldering Lamp repairing Assembling Painting Inspecting Packing Weighing Shipping Messenger	Time, less	Piece rates not stated.	Equal
No. 22—Electrical apparatus and supplies—9765 men, 3485 women	282	**Machines, light** Punch press *Winding* *Insulating*	**Motor testing** *Assembling* *Coremaking* Janitor	Piece, equal Time, less	Women's day rates 80 per cent of men's rates.	Comparative figures no available. In some few cases where nimbleness of fingers is main factor indications are that women's output will equal men's.
No. 23—Electrical apparatus and supplies—4700 men, 900 women	138	Drill press Lathe Assembling, light Screw machine Inspecting			Equal pay on all machine operations.	Women's production somewhat below that of good men. This will gradually improve as women acquire experience.
No. 24—Electrical apparatus and supplies—6400 men, 1045 women	Not stated	*Lathe, light* Machines, light Bench work, light Sorting *Inspecting* *Assembling*			Women receive slightly less pay as a rule than men, although margin of difference is gradually decreasing.	
No. 25—Electrical apparatus and supplies—610 men, 190 women	12	Drill press Machines, light Bench work *Assembling*	*Boxing* *Labeling* Drafting *Coremaking*	Time, equal	Piece rates not stated	About the same.
No. 26—Ignition apparatus—530 men, 198 women	25	Drill press Bench work			Women receive less pay than men.	Women's output 80 per cent of men's.
No. 27—Ignition apparatus—1200 men, 900 women	600	Drill press Bench lathe Hand turret lathe	Punch press Riveting machine *Assembling*	Piece, less Time, less	Women's wages about 10 per cent less than men's	Women show increase of 10 to 15 per cent over men's production.
No. 28—Ignition apparatus—1700 men, 300 women	Not stated	Winding high-tension coils		Piece, less Time, less	Women's rates about 30 per cent less than men's.	Work of women compares favorably.
No. 29—Ignition apparatus—182 men, 368 women	9	Inspecting Elevator operator Messenger			Women inspectors receive about 25 per cent less; men inspectors usually skilled mechanics; girls had no previous experience; elevator operators and errand girls same rates as men.	Practically no difference. Because of special gages, calipers, etc., we have designed, women can handle the work with same speed as men.
No. 30—Ignition apparatus—2020 men, 580 women	Not stated	Grinding machines Turret lathe Inspecting	*Assembling, light* Assembling, all classes Drafting Tool designing	Piece, less Time, less	Women's wages average 20 per cent less, but increase as their efficiency increases.	Production of women in some cases more and in some cases less than men's. In general, on repetitive small work women excel.
No. 31—Gasoline-electrical lighting sets—949 men, 211 women	(Plant established since August, 1914) 211	Machines, light Inspecting Assembling, light		Piece, less Time, less		On some kinds of work women produce more than men, on others less. On repetitive work women's output better.
No. 32—Insulated wires and cables—469 men, 47 women	None	*Braiding* *Spooling*		Time, equal	Women replaced boys and receive wages equal to those of boys, but on weekly basis. No women on piecework.	Not comparable.
No. 33—Molded insulation—189 men, 9 women	9	Inspecting		Piece, equal Time, equal	Work formerly done by boys Day rate plus bonus in some cases.	Work done by women same in quantity but more accurate.
No. 34—Suction cleaners, motor washers—77 men, 14 women	None	*Assembling, light*			All have day rates—all have some piecework jobs.	

(*a*) Include clerical employees in the majority of establishments. (*b*) Include clerical employees in a few cases, but their number is practically negligible.

(*c*) *Italics* indicate occupations on which women were employed previous to August, 1914 **Boldface** indicates occupations on which women were employed previous to August, 1914, and on which their employment has been subsequently extended: roman type indicates occupations on which women have been newly introduced since August, 1914. Clerical occupations are not designated.

Improving Power Factor and Voltage Regulation

By Using Synchronous Condensers Pennsylvania Company Has Met Increased Demands Without Purchasing Additional Generating Equipment and Has Reduced Transmission Losses

BY J. T. PEYTON
Westinghouse Electric & Manufacturing Company

FOR the last fourteen months the Duquesne Light Company, serving the Pittsburgh district and the counties of Allegheny and Beaver in the southwestern part of Pennsylvania, has had in operation on its lines a 7500-kva., 11,000-volt, 600-r.p.m. synchronous condenser for raising the power factor of the system and maintaining voltage regulation. After this condenser was put in service and its ability to handle the unfavorable conditions imposed on the Rankin plant was successfully demonstrated, the Duquesne Light Company ordered two duplicate machines. One of these was installed during April at the Beaver Falls substation, 32 miles (51.5 km.) from the Brunot's Island plant, and connected by two 66,000-volt transmission lines, each having a capacity of 20,000 kva. This station is at the end of the 66,000-volt system, and the load at that point at the present time is only about 500 kva., so the condenser for the present will be used for controlling the voltage, some method of regulation being necessary on account of the line impedance and the comparatively high reactance of the transformers now in use. The other one, when completed, will be placed in the Lawrenceville substation, where the conditions are somewhat similar. As the company expands and the load on the system increases, it will very likely continue to place synchronous condensers at the principal load centers, and the time may come when it can obtain practically a flat voltage curve notwithstanding variations in the power factor.

Benefits of Synchronous Condensers

There is nothing new in the application of synchronous condensers to this class of service, for there are many of them in operation to-day and have been for years. However, when one stops to consider that many of the companies are operating close to maximum rating during these war times, and that generating equipment is necessarily at a premium with a large number of them, it is rather suprising that these machines are not in greater demand. In all probability there are many cases to-day where the conditions are such that the introduction of a condenser would solve the problem, or at least go a long way toward the solution. With the unprecedented increase in prices of apparatus and materials of all kinds, the vital consideration, of course, is the expense incident to any change involving new equipment or construction work. However, a little analysis on the part of the operator who is pressed for sufficient capacity may reveal the fact that by the use of a synchronous condenser he can secure some, if not all, of the following benefits:

1. Meet increased demands without the purchase of additional generating equipment—and by generating equipment is meant not only the generators but the necessary prime movers and auxiliary apparatus.
2. Reduce the cost per kilowatt of additional transmission rating.
3. Effect a material saving in present transmission losses.
4. Improve service by maintaining the required voltage.

Up to 1913 the Rankin plant, now rated at 10,000 kw., was operated independently of the rest of the system. At that time the load had grown to such an extent, owing chiefly to large individual motors and electric furnaces, that it became necessary to parallel with the main generating station at Brunot's Island, where the rating is 115,000 kw. This was done originally through two 11,000-volt lines. The central point of the load was then approximately midway between the two stations so that only about one-half of the line impedance came into the regulation problem, and it was possible to maintain fairly steady voltage at Rankin. During the last few years, however, the load grew so rapidly that it became necessary to deliver power direct to the Rankin bus for distribution. Two 22,000-volt lines were installed between the stations, having a combined capacity of 16,000 kva. The drop in these lines at full load is approximately 13 per cent. The problem which presented itself was how to obtain the best possible regulation in the 11,000-volt transmission network feeding from the Rankin bus, the load being approximately 10,000 kw. and the power factor ranging from 70 to 75 per cent. (The engine-type generators in the Rankin plant, which have been in service for a number of years, can be operated at low power factor only at reduced capacity.)

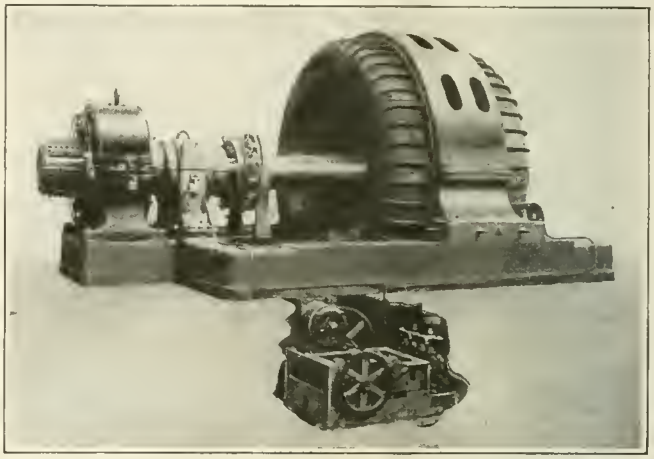


FIG. 1—ONE OF THE SYNCHRONOUS CONDENSERS USED BY THE DUQUESNE LIGHT COMPANY

To accomplish the desired results at minimum expense, and at the same time provide for probable future increase in load, it was found, in view of the low power factor, that the installation of a synchronous condenser for corrective effect would actually reduce the transmission investment required per kilowatt, so that a condenser at this point was warranted on basis of transmission rating alone. A 7500-kva. unit was chosen which will permit operating the tie lines, when fully loaded, at a power factor of 90 per cent.

The particularly interesting feature in connection with the present method of operation, made possible by the fact that the tie lines are not yet loaded to their rating and that the present load conditions do not require the full rating of the condenser at zero power factor, is the use of this machine as a voltage regulator. The Rankin plant is now run at practically full load with power factor of 90 to 95 per cent, and the voltage regulation of the station is taken care of entirely by an automatic regulator controlling the condenser exciter, it being the only one in the plant. The regulation of the entire network, therefore, is affected automatically by the value of the magnetizing current drawn by the condenser.

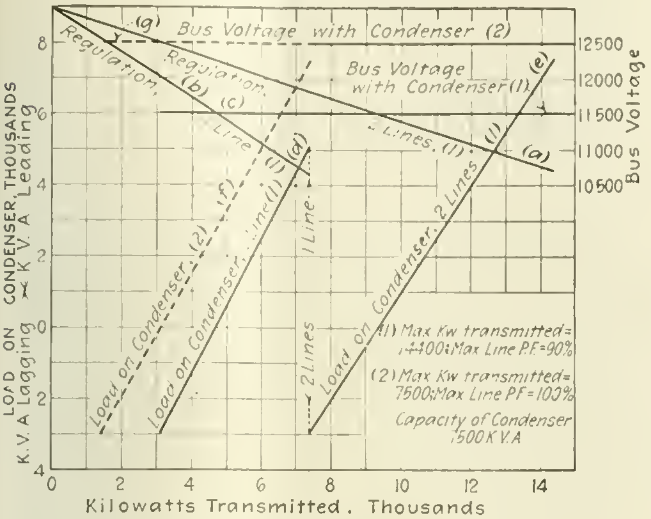


FIG. 2—LOAD AND REGULATION CURVES

The accompanying curves, which were prepared from the transformer and line characteristics, will show the voltage compensation, or regulation, which can be obtained, the line amperes and line power factors, as follows:

(a) Inherent regulation, two lines in parallel, 0 to 16,000 kva., 70 per cent power factor.

(b) Inherent regulation, one line, 0 to 7750 kva., 70 per cent power factor.

(c) Range of constant voltage obtainable when using synchronous condenser from maximum lagging kva. to maximum leading kva.

(d) Synchronous condenser loads, one line in service.

(e) Synchronous condenser loads, two lines in service.

(f) Maximum load transmitted 7500 kw., both lines in service, maximum power factor 100 per cent.

(g) Voltage range corresponding to curve (*f*).

There are several fixed adjustments which can be used to add to the voltage regulation as conditions materially change: (1) The ratio of transformers may be changed; (2) one line or two lines may be used; (3) the old 11,000-volt tie line having approximately 20 per cent regulation can be connected in on exceedingly light loads.

With one line in service and using maximum limits of condenser it will be noted from curves (c) and (d) that the voltage can be maintained constant with load varying from 3100 kw. to 7400 kw. Under load of 7400 kw. the maximum capacity of one line is reached, so at this point the second line is put in service, as shown by the arrows and dotted lines at curves (d) and (e). When the two lines are operated in parallel and using the condenser between its limits, constant voltage is obtained with load varying from 7400 kw. to 14,400 kw., as indicated by curves (c) and (e). With load of 14,400 kw. and condenser operating at maximum capacity leading, the power factor of the line is at its maximum—90 per cent—and the lines are fully loaded at 16,000 kva. When the maximum load is only 7500 kva. and 100 per cent power factor is obtainable, it will be noted that flat voltage range is materially increased, but since the allowable drop is reduced the transformer ratio must be changed.

While the curves show the limits of constant voltage with the condenser in service, it should be noted that it is very undesirable to run the machine at lagging power factor, since it reduces the power factor of the plant, which is already objectionably low. Upon referring to the power-factor curves, especially the one for one line, it will be seen how rapidly the power factor drops when the condenser is drawing lagging current.

While provided with a direct-connected exciter, which was also designed for use as a motor for bringing the machine up to synchronous speed, should this method of starting be desirable at any time, the condenser is self-starting and is equipped with an oil-pressure outfit for raising the shaft up from the bearings in order to eliminate the bearing friction and thereby reduce to a minimum the current required from the line, which otherwise would be comparatively large in amount at the instant of starting. With the oil-pressure outfit in operation the machine can be brought up to synchronous speed without drawing more than 1800 kva. to 2000 kva. from the line, as compared with 7000 kva. required when starting with the bearings dry. A pressure in the neighborhood of 100 lb. per sq.in. (7 kg. per sq. cm.) is required actually to lift the rotating part and provide an oil-bearing surface for the journal.

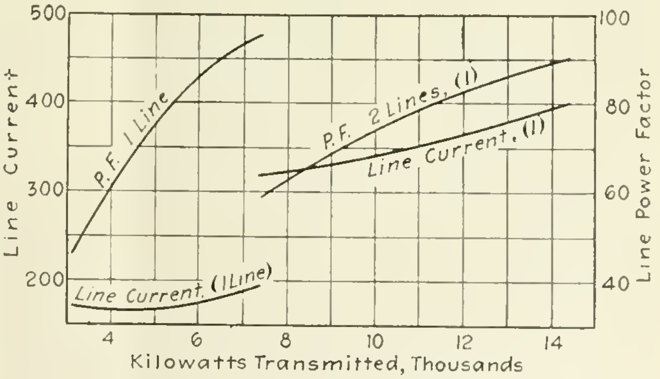


FIG. 3—LINE CURRENT AND POWER-FACTOR CURVES

The equipment consists of a motor-driven duplex pump for each bearing and the necessary high-pressure piping. The cylinders are connected in pairs to a common pipe running to each bearing, the oil returning to the pump chamber by an overflow pipe.

INTERCONNECTION FOR POWER INTERCHANGE IN WISCONSIN

Increasing Capacity of System from 5250 Kw. to 17,300 Kw. Without Installation of New Equipment—Rating to Be 24,200 Kw. Later

THE advantages to be derived from the interconnection of electric plants have long been recognized by M. C. Ewing, manager of the Wisconsin Valley Electric Company of Wausau, Wis. In 1911 this company, then the Wausau Street Railway Company, with only a 1650-kw. plant at Wausau, built a 13-mile (21-km.) transmission line to Mosinee to connect its system with the 3000-kw. plant of the Wausau Sulphite Fiber Company in order to provide for emergency power. A connection was later made with the 2000-kw. plant of the Marathon Paper Mills Company at Rothschild, which is between Wausau and Mosinee. In 1916 the Wisconsin Valley Electric Company purchased the five-wire 125-250-500-volt direct-current (550-kw.) system of the Merrill Railway & Lighting Company at Merrill and built an 18-mile (29-km.) transmission line to connect it with the Wausau system. This line goes through Brokaw, where the plant of the Wausau Paper Mills Company is, and arrangements were made for an interconnection with that plant. When the Stevens Point Lighting Company with a 550-kw. plant was purchased in 1917 by the Wisconsin Valley Electric Company, a 3-mile (5-km.) line was at once built to the plant of the Whiting Plover Paper Company to provide emergency power for the city of Stevens Point. Since then a 25-mile (40-km.) transmission line has been built from Mosinee to Stevens Point.

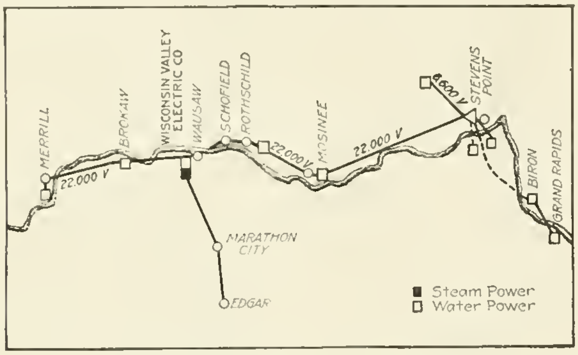


FIG. 1—EXTENT OF INTERCONNECTIONS

Arrangements have recently been completed for an interconnection with the system of the Consolidated Water Power & Paper Company, which has paper mills operated by water power at Stevens Point, Biron and Grand Rapids. The Stevens Point plant, which is being enlarged, will have a capacity of 3800 kw., and a line will be built at once from this plant to the substation of the Wisconsin Valley Electric Company in Stevens Point. A 10-mile (16-km.) line will eventually be built from Stevens Point to connect the system with the plants at Biron (600 kw.) and Grand Rapids (1500 kw.), which are now connected by a 5-mile (8-km.) transmission line.

The transmission lines are on wooden poles with bow-arrow arms insulated for 44,000 volts but at present operated at 22,000 volts. Besides the line which connects the various power plants, a branch line 20 miles (32 km.) long has been built west from Wausau to supply light and power to Marathon City and Edgar. This line is three-phase to Marathon City, a distance of 12 miles (19 km.), and single-phase from there to Edgar. The plants of the Wisconsin Valley Electric Company have a combined capacity of 5250 kw., of which 2250 kw. is supplied by the steam plant at Wausau. The water-power plants have the following capacities: Wausau, 1800 kw.; Merrill, 900 kw., and Stevens Point, 300 kw. The capacities of the plants with which connections have been made are as follows:

	Site	Water	Steam
Wausau Paper Mills Company.......	Brokau	1,000	500
Curtis & Yale Company.........	Wausau		500
Marathon Paper Mills Company ...	Rothschild	2,400	1,000
Wausau Sulphite Fiber Company...	Mosinee	3,000	3,500
Whiting Plover Paper Company.......	Stevens Point	500	650
Total...........	..	6,900	6,150

The capacity of the system has thus been increased from 5250 kw. to 17,300 kw. by the present interconnections, and it will be increased to 21,100 kw. when the interconnection with the Stevens Point plant of the Consolidated Water Power & Paper Company is completed this fall. It will ultimately be increased to 24,200 kw. when the transmission line is built from Stevens Point to Biron and the water-power plant of the Wausau Paper Mills Company at Brokaw is changed from direct to alternating current.

The paper mills need large quantities of low-pressure steam for heating in the winter time so a number of the mills are equipped to use the exhaust steam from the turbines for this purpose. This gives them a large quantity of excess power at the time of the year when the Wisconsin Valley Electric Company has its peak load and needs additional energy. This power can be purchased much cheaper than it can be made by the utility.

It is interesting to note that the kilowatt-hour output of the 300-kw. water-power plant at Stevens Point is at present between two and three times as much as it was before the transmission line was built. The interconnections have made it possible on account of the greater diversity factor to carry increased peak loads and to use the water powers to their fullest extent, thus saving the coal which would ordinarily have been used.

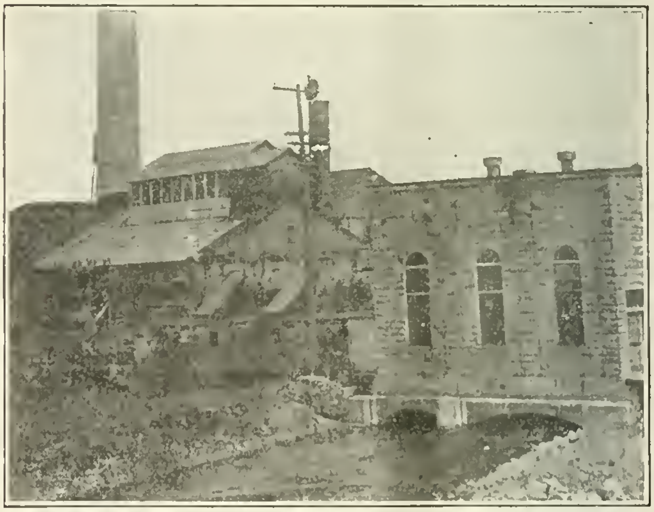


FIG. 2 — COMBINED STEAM AND WATER-POWER PLANT AT WAUSAU

The street railway systems at Merrill and Wausau, with a 5-mile (8-km.) interurban line between Wausau and Rothschild, are also operated by this company.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

PREDICTS BENCHBOARDS FOR USE IN BOILER ROOM

Engineer Foresees Centralized Instruments Indicating and Recording Processes of Combustion in Turbine Room

J. M. Strike, chief engineer of the Acme Power Company, Toledo, Ohio, believes that the very near future will see "the processes of combustion or the entire control of furnaces and boilers centralized in the form of an operator's desk or benchboard. The greater part of the work will be handled automatically. The board will be equipped to bring before the operator a complete operating analysis of conditions existing in the furnaces and boilers." Mr. Strike also expressed the opinion that, no matter how well trained an operator is, he cannot work at his highest efficiency unless he is provided with instruments giving all operating conditions at some central place. Portable instruments are all right in their places, and it is not the intention to discourage their use, for in the average plant great savings can be made with portable instruments. Conditions in most plants, however, change so rapidly that it is impossible to keep accurately in touch with them through the use of portable instruments.

Mr. Strike gave these opinions before a body of station-operating men in Ohio recently.

TREND OF PRACTICE IN OVERHEAD DISTRIBUTION

Standardization of Materials and Use of Larger Transformers Feeding 230-115-Volt Secondaries Recommended

In keeping with the spirit of the times, the transmission and distribution committee of the Ohio Electric Light Association has pointed out that the most important factor in distribution systems is the economical and efficient use of all apparatus and materials. This, it is believed, would lead to a standardization of all materials. Usually a distribution system grows by the addition of transformers and secondaries. Then as the system expands it generally requires complete revision. The most noticeable condition is the great number of small transformers which have been installed. These should be replaced by several large transformers, of which the advantages are enumerated below:

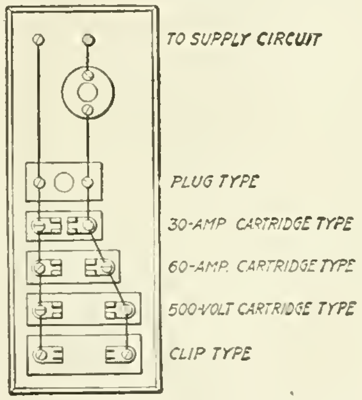
1. The investment in transformers is less because of the smaller cost per kva. of the larger transformer.
2. The core loss is less and therefore the efficiency is greater.
3. The number of lightning arresters is reduced.
4. The transformer capacity might be reduced because of the greater diversity of load which occurs with the larger number of consumers supplied from a single transformer.
5. Transformers should be installed about 1700 ft. (518 m.) apart in residence sections to insure the economical use of a distribution system.

The secondary system should be rebuilt, using three-wire 230-volt circuits for all street mains. Great care must be exercised to provide a balanced condition of the load. The neutral wire in a balanced system may be two sizes smaller than the outside wires. The voltage drop of a balanced three-wire system is one-fourth that of a two-wire system, other conditions remaining the same in both systems.

ANOTHER SIMPLE PANEL FOR THE TESTING OF FUSES

May Be Used in Industrial and Central-Station Plants for Testing Various Types of Fuse—Lamp Indicates Whether Fuse Is Good

The method of testing fuses in use at New Haven (Conn.), as described on page 983 of the May 11 issue of the ELECTRICAL WORLD, may be extended to test other sizes and types of fuses by the addition of more fuse blocks. The accompanying sketch shows the method of connecting five fuse blocks. As will be noted, both sides of the fuse blocks are connected in multiple. One side is connected directly to the supply line, while the other side is connected to the line in series through a 10-watt lamp. The placing of a good fuse in any fuse block will light the lamp.

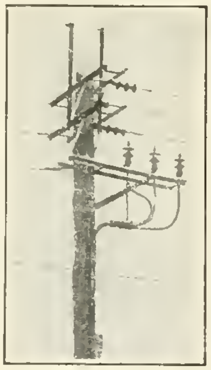


FUSE-TESTING PANEL FOR DIFFERENT SIZES

The use of this test panel may also be extended to the testing of fuses in industrial and central-station plants as well as the testing of fuses as they are sold to consumers. One of these panels permanently mounted at a convenient place near the switchboard and equipped to take the type of fuses in use on the board, including instrument transformer and special fuses, will prove a great convenience in locating trouble.

OPEN-WIRE CONNECTION TO UNDERGROUND DUCT

Terminus of Cable Brought Out in Three Single-Conductor Potheads Held on Metal Cross-Arm—Easily Accessible



Simplicity of construction and accessibility are the features of an open-wire termination for an underground duct on a 26,400-volt transmission line of the Public Service Company of New Jersey. As shown in the photograph produced herewith, the cross-arm supporting the potheads is fastened to the pole so that it is parallel to the open-wire line. The terminal of the open-wire line is made by three strain insulators attached to the ordinary pole cross-arms. The arrangement of the potheads allows a conductor from the underground cable to be connected to any conductor of the overhead line without the danger of short-circuiting it.

CONCRETE MAY REPLACE STEEL IN POWER-HOUSE CONSTRUCTION

Air Ducts and Breechings for Which It Is Almost Impossible to Get Steel Plates Can Be Constructed of Substitutes

A central-station engineer in the Middle West, desiring to bring out discussion through the ELECTRICAL WORLD of reinforced-concrete air intakes for turbines and reinforced-concrete breechings for boilers, offers the following as his first experience with construction of this type:

"In constructing a boiler room to serve a 25,000-kw. addition to the station the breeching, according to the original design, was to be of steel. Just at the time when the station was nearing the state of completion where it would be ready to go into operation it was found that deliveries on the steel plates for the breechings were a long time further in the future than had been expected. As a possible solution of this difficulty it appeared that the situation might be saved by installing a reinforced-concrete breeching. Calculations were at once started to see whether the loading that would be imposed on the remainder of the structure by the heavier concrete breeching could be tolerated. This analysis developed the fact that the shearing stresses in some of the steel-frame members which the extra weight would impose were not within a safe limit. The concrete type of construction was therefore abandoned. Had the idea of using concrete come to light sooner so that the general building design could have been made more liberal the cement breeching would have been used. No difficulties were foreseen from heat or from expansion which could not be easily overcome by patented asbestos lining and by sliding expansion joints. It appeared from the calculations that the concrete construction would have been cheaper than the steel, even though part of the structural steel for the building would have been heavier.

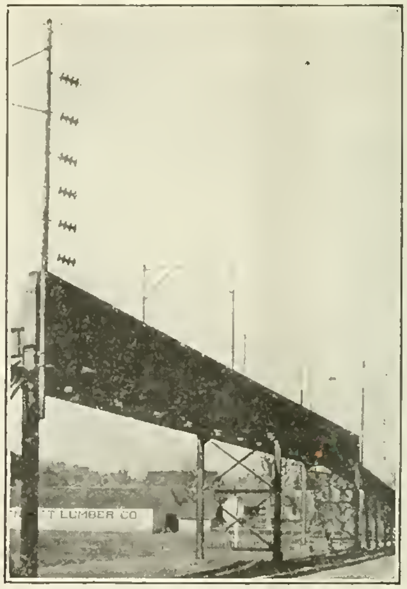
"At about the same time it became apparent that there would be delay in getting the air intakes for the turbine installed. These were to have been of steel. It also happened that the section of concrete floor under which these ducts were to be placed had not been laid. A design for reinforced-concrete ducts was worked out, and these ducts have been installed. They are suspended under the steel beams which support the concrete power-house floor."

INEXPENSIVE OVERHEAD LINE CROSSING AT RAILROAD

Six High-Tension Wires in Vertical Plane Are Supported by Strain Insulators Attached to Overhead Bridge

Two three-phase transmission circuits of the Fort Smith (Ark.) Light & Traction Company have been strung across a railroad right-of-way on supports attached to an overhead bridge. This type of construction was chosen in order to avoid the use of extra-high poles and to make a permanent job. The arrangement, as worked out, proved inexpensive.

At each end of the main bridge span tubular steel trolley poles were attached to upright members of the steel bridge by means of three large U-bolts. These steel poles were also braced at the top by guy wires and by an angle-iron framework which supported the trolley wire over the track. The fact that the high-tension circuits ran parallel to the track on one side of the railroad and at right angles to it on the other made different types of construction necessary at each support. The two types of construction employed are well illustrated in the picture herewith. On one side strain insulators and short "pull-off" wires served to support the wires at this right-angle turn and to give ample clearance between the circuits and the steel bridge span. On the other side of the bridge seven strain insulators hung in a continuous string are supported between angle-iron mast arms attached to the trolley pole. The high-tension wires are then supported at the points between the strings of insulators.



TWO THREE-PHASE CIRCUITS SUPPORTED BY STRUCTURES AT EACH SIDE OF CROSSING

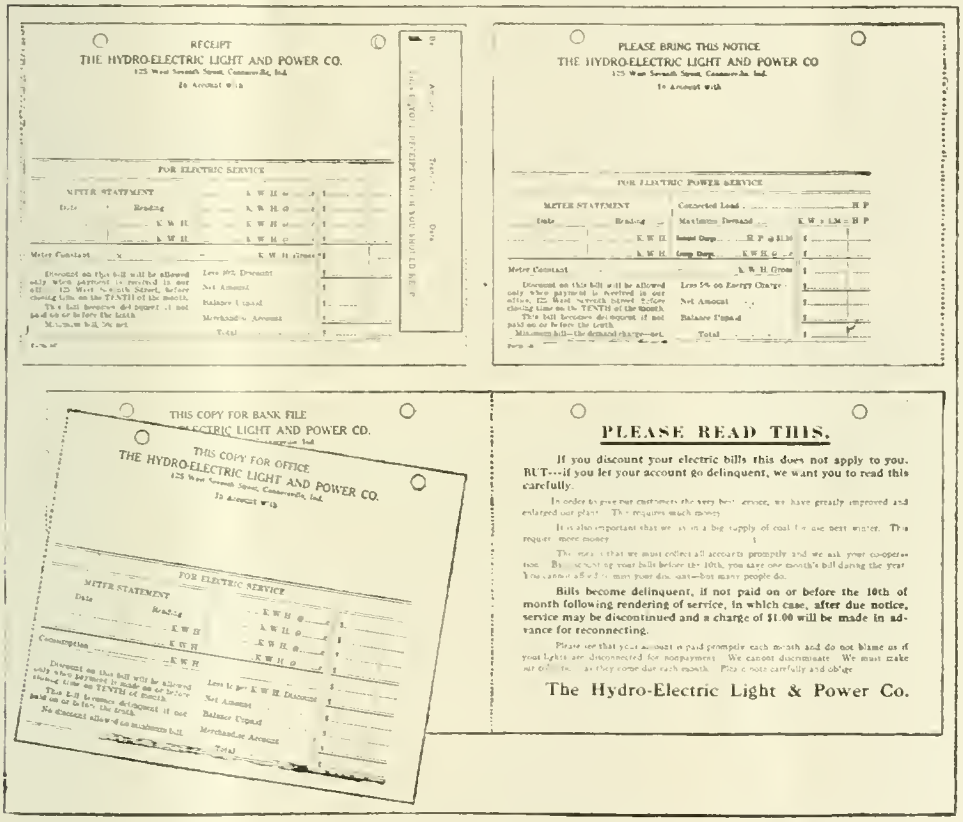
CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

A BILLING PLAN THAT HASTENS COLLECTIONS

Meter Readers Make Out Bills and Leave Them with Customers—Plan Is Inexpensive and by Its Use Bills Reach Customers Promptly

The Hydro-Electric Light & Power Company of Connersville, Ind., has a billing system by which the men who do the meter reading at the same time make out the bills and leave them on the consumers' premises. The company supplies electric light and power service as well as gas in Connersville, which has a population of 8000, and also supplies electric service to several small towns near by. The general form of bills is the same for each class of service, namely, electric light, electric power, electric service in nearby towns, and gas. The bills differ somewhat, however, in detail. The three types of electric bills, which the company designates as forms Nos. 107, 108 and 109, are shown herewith. Form No. 107 is the regular lighting bill, form No. 108 is the regular power bill, and form No. 109 is the bill which is used for small towns where collections are made through the banks. The system as it applies to form No. 107 is as follows:



RECEIPT
THE HYDRO-ELECTRIC LIGHT AND POWER CO.
FOR ELECTRIC SERVICE
METER STATEMENT
Date
Reading
Meter Constant
Net Amount
Balance Unpaid
Merchandise Account
Total

PLEASE BRING THIS NOTICE
THE HYDRO-ELECTRIC LIGHT AND POWER CO
FOR ELECTRIC POWER SERVICE
METER STATEMENT
Connected Load
Maximum Demand
Meter Constant
Net Amount
Balance Unpaid
Total

THIS COPY FOR BANK FILE
THIS COPY FOR OFFICE
THE HYDRO-ELECTRIC LIGHT AND POWER CO.
FOR ELECTRIC SERVICE
METER STATEMENT
Net Amount
Balance Unpaid
Merchandise Account
Total

PLEASE READ THIS.

If you discount your electric bills this does not apply to you. BUT---if you let your account go delinquent, we want you to read this carefully.

In order to give our customers the very best service, we have greatly improved and enlarged our plant. This requires much money.

It is also important that we [illegible] in a big supply of coal for use next winter. This requires more money.

This means that we must collect all accounts promptly and we ask your co-operation. By discounting your bills before the 10th, you save one month's bill during the year. You cannot afford to miss your discount—but many people do.

Bills become delinquent, if not paid on or before the 10th of month following rendering of service, in which case, after due notice, service may be discontinued and a charge of $1.00 will be made in advance for reconnecting.

Please see that your account is paid promptly each month and do not blame us if your lights are disconnected for nonpayment. We cannot discriminate. We must make our collections as they come due each month. Please note carefully and oblige

The Hydro-Electric Light & Power Co.

THE THREE BILL FORMS USED BY INDIANA CENTRAL-STATION COMPANY

The bills are made in triplicate and are perforated for easy detachment. An addressograph is used to fill in the name, address and date. The last readings and any balances are then put on. The meter readers aim to read 100 bills each half day and have ring binders which will take care of that number of bills. As they read a meter they make out the bill and leave the third copy, bringing back to the office the copies marked "File" and "Receipt." Postings are then made, and the bills are distributed in an office rack for payment.

When payment is made the customer is supposed to bring with him the third copy. This gives the account number, which is also put on by the addressograph along with the name, etc. This plan facilitates the locating of the original bill, but, of course, is not absolutely necessary. The company's cash register prints the receipt on the right end of the customer's copy, showing who receives the payment, the account it goes to, the amount, the transaction number and the date. The same information is also shown on the margin of the company's own copy, which is filed for future reference.

The same system applies to the power and gas bills, but the form No. 109 used in small towns is slightly different. The difference is that the customer brings back his notice to be receipted, whereas for the city customer the second office copy is receipted. In the small town meter readers leave one notice at the house, a second notice at the bank and bring back the first copy to the office.

In response to a query about the cost of operating this system, Erle G. Weeks, treasurer of the company, said: "I have no absolute costs, but our men can read 200 meters a day. This gives an idea of what the cost would be. We consider that the expense of getting the bills ready would be no more than that of any other form of billing.

"There are several very distinct advantages in the use of these bills. First is the saving of postage. Second is the fact that the customer can come in and pay his bill just as soon as the meter is read. There are many cases where the customer comes into the office to pay his bill before the meter reader returns after the half day, and since the customer has his own copy of the bill we take his money and get the benefit of the use of it. During these days of close figuring we feel that this early collection is worth something.

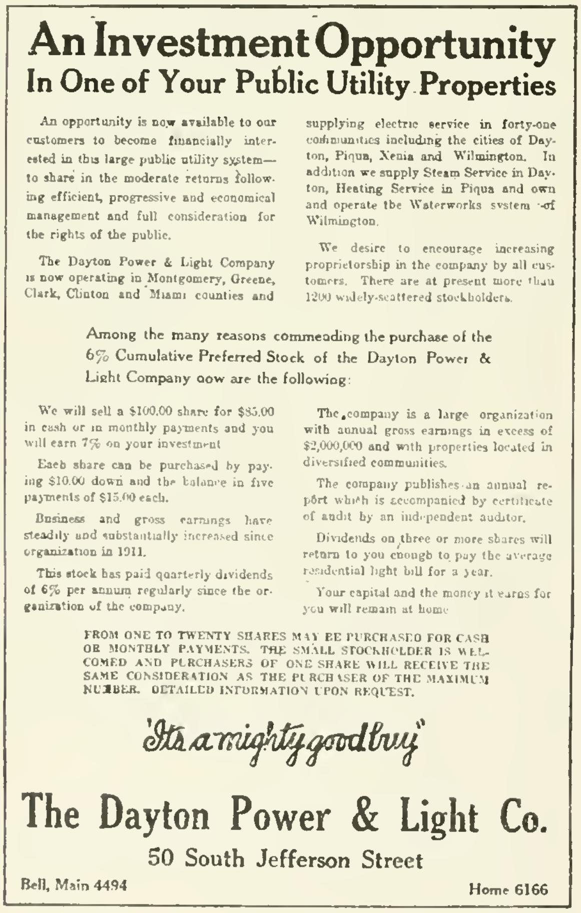
"Then, again, we have the use of the advertising on the back of the bills. This is not a big expense, and the announcements go to every customer, giving us an opportunity of pushing a special item each month. The copies shown, however, can hardly be said to carry an advertisement. We wanted to urge prompt payment."

DAYTON LIGHTING UTILITY SELLS STOCK LOCALLY

Company's Own Organization Without Outside Aid Is Employed to Dispose of $56,000 Par Value of 6 per Cent Cumulative Preferred Stock

A stock-selling campaign in its home territory just completed by the Dayton (Ohio) Power & Light Company was somewhat unusual in that it was handled by the company's own men exclusively. The major portion of the work was carried by the commercial department under the direction of Thomas F. Kelly, commercial manager. The issue consisted of 560 shares of $100 par value authorized for sale by the Ohio Public Utilities Commission at $85 per share. The plan was to sell not more than twenty shares or less than one share to any person. At the end of three weeks 387 shares had been sold, and the entire campaign was completed in less than five weeks.

The issue, being comparatively small, was sold without any really intensive sales effort. Some newspaper advertising in Dayton and in other towns served by the company was used. The advertisement published with this article is typical, the slogan in the literature being "It's a mighty good buy." As further producers of inquiries personal letters were employed, and local bankers in the smaller towns were personally told of the issue in order that they might suggest it to prospective investors asking advice. An interesting feature of the publicity campaign was that the first stock purchaser was the printer who was employed to get out the literature. Proofreading the copy convinced him that he should voluntarily subscribe to the issue to the full amount of his savings.



An Investment Opportunity
In One of Your Public Utility Properties

An opportunity is now available to our customers to become financially interested in this large public utility system—to share in the moderate returns following efficient, progressive and economical management and full consideration for the rights of the public.

The Dayton Power & Light Company is now operating in Montgomery, Greene, Clark, Clinton and Miami counties and supplying electric service in forty-one communities including the cities of Dayton, Piqua, Xenia and Wilmington. In addition we supply Steam Service in Dayton, Heating Service in Piqua and own and operate the Waterworks system of Wilmington.

We desire to encourage increasing proprietorship in the company by all customers. There are at present more than 1200 widely-scattered stockholders.

Among the many reasons commending the purchase of the 6% Cumulative Preferred Stock of the Dayton Power & Light Company now are the following:

We will sell a $100.00 share for $85.00 in cash or in monthly payments and you will earn 7% on your investment

Each share can be purchased by paying $10.00 down and the balance in five payments of $15.00 each.

Business and gross earnings have steadily and substantially increased since organization in 1911.

This stock has paid quarterly dividends of 6% per annum regularly since the organization of the company.

The company is a large organization with annual gross earnings in excess of $2,000,000 and with properties located in diversified communities.

The company publishes an annual report which is accompanied by certificate of audit by an independent auditor.

Dividends on three or more shares will return to you enough to pay the average residential light bill for a year.

Your capital and the money it earns for you will remain at home

FROM ONE TO TWENTY SHARES MAY BE PURCHASED FOR CASH OR MONTHLY PAYMENTS. THE SMALL STOCKHOLDER IS WELCOMED AND PURCHASERS OF ONE SHARE WILL RECEIVE THE SAME CONSIDERATION AS THE PURCHASER OF THE MAXIMUM NUMBER. DETAILED INFORMATION UPON REQUEST.

"It's a mighty good buy"

The Dayton Power & Light Co.
50 South Jefferson Street
Bell, Main 4494 Home 6166

INTERESTING THE LOCAL PUBLIC IN UTILITY STOCK

The Dayton Power & Light Company
Home Telephone Building, 50 South Jefferson Street
Dayton, Ohio

July 15, 1918...

TO OUR CUSTOMERS:

The Public Utilities Commission of Ohio has authorized a limited issue of the company's 6 per cent cumulative preferred stock, the proceeds of which are to be used for additions to our property.

We have felt that a large number of our customers would be glad to avail themselves of an opportunity to invest their savings and thus become partners and part owners in this local enterprise, and therefore, for the first time, we are offering our stock to our customers under the following arrangements:

Each customer will be permitted to buy from one to twenty shares of this preferred stock at $85 per share (par value $100 each). Payments may be made in cash or on the following installment plan:

Ten dollars a share to be paid at the time of subscription and fifteen dollars a share per month to be paid at the time the bill for electric service is due, until the full amount of the subscription has been paid, which shall include the accrued dividend from the last preceding dividend date.

Interest at 5 per cent per annum will be allowed on all payments until the final payment is made, when the investment will begin to earn 6 per cent.

The purchase of this stock at $85 a share means that you will earn over 7 per cent on the money invested, and in addition this stock is tax-free in Ohio.

Your subscription will be received at our office or our representative will call at your convenience. Dividends on three or four shares will return to you each year enough to pay the average residential light bill for a year. The fullest investigation of this offering is desired.

Yours very truly,
The Dayton Power & Light Company,
THOMAS T. KELLY, Commercial Manager,

A LETTER TO THE CENTRAL STATION'S CUSTOMERS

Any union rule or workmen's agreement to limit the output in shipyards should be treated as criminal at this time. Pershing's men are not limiting their output. They don't limit the blood they shed or the efforts they expend, and shame and disgrace should be the portion of any man who here at home limits the output necessary to make the blood and the labor of our soldiers at the front of avail.—*Col. Theodore Roosevelt.*

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Calculation of Commutators of Alternating-Current Machines. — M. SCHENKEL. — General formulas are given for calculating the commutators of any type of alternating-current commutator machines. The dimensions of the commutators and particulars of the brush gear are fixed in relation to quantities that are only to a small extent in the control of the designer. It is important to note that the required dimensions are almost rigidly fixed. The application of the formulas is illustrated by the insertion of average values.—London *Electrician*, July 14, 1918.

Running-Down Methods of Determining Losses of Machines.—In obtaining the running-down curves of small machines difficulty is sometimes experienced owing to the shortness of the time taken to come to rest. Two methods are given to meet this difficulty. In one the machine is allowed to run down from a series of different speeds, the length of time taken in each case being measured by a stop watch. In this manner a number of parallel portions of the whole running-down curve are obtained which can easily be pieced together by shifting them horizontally until the times corresponding to stand-still coincide.—*Science Abstracts, Section B*, June 29, 1918. (Abstracted from *Schweiz. Elektrot. Verein*, March, 1918.)

Circle Diagram of the Induction Motor.—The Heyland circle diagram of the induction motor is more commonly used than the more accurate Ossanna circle diagram. The reason for this lies in the difficulty of following out the repeated inversions associated with the latter method. In the present article it is shown how it is possible to obtain the Ossanna circle with a single inversion, and it is expected that this simplification will favor the more extensive use of the Ossanna circle.—*Science Abstracts, Section B*, June 29, 1918. (Abstracted from *Elekt. Zeits.*, Jan. 31, 1918.)

Generation, Transmission and Distribution

Value of Making Brick Settings Air-Tight.—Economies which have resulted from making brick settings air-tight are cited. The article also discusses the cause of low flue-gas temperatures, the results of tests and the prevention of air leakage.—*Journal of American Society of Mechanical Engineers*, July, 1918.

Report of Bureau of Engineering, Public Service Commission of Pennsylvania.—This report contains: (1) A description of the organization and administration of the Public Service Commission; (2) the administration and special work in connection with service rules and standardization laboratories; (3) investigation of formal and informal complaints; (4) investigation of highway-crossing applications; (5) specification covering construction of crossings of overhead lines of public utilities; (6) uniform service rules for water utilities, and (7) other reports of special interest.—*Second Annual Report*, for year ended June 30, 1918.

Utilization of Anthracite Waste.—This article discusses the burning of anthracite slack or culm and the performance obtained when they are mixed with soft coal in various proportions. Consumption of anthracite at the mines, burning anthracite in suspension, culm production in tons, mixtures of soft coal and culm, producing steam with mixed fuels, effect of size of coal combustion, bituminous firing, thickness of fire, handling frozen coal of fine grades, storage of anthracite coal, firing of anthracite buckwheats and anthracite and soft coal mixed, and briquetting of anthracite waste are also considered.—*Journal of American Society of Mechanical Engineers*, July, 1918.

Improvements in Electric Power Work in France.—Attention is called to the great increase in the use of water power in France since 1914, principally for the manufacture of large-caliber shells and armorplate. It is said that the development of three rivers in the vicinity of the Alps has been carried to the extent of 180,500 hp. These new factories will, after peace is signed, be called upon to play a considerable rôle in the economic struggle of the future. They will enable France to become a larger producer of matter and materials for which Germany had formerly almost exclusively held the monopoly in manufacture, such as chlorine, bromine, magnesium and products required in the dyeing industries.—*American Chamber of Commerce in Paris*, May 15, 1918.

Addition to Formulas for Calculation of Mutual and Self-Inductance.—FREDERICK W. GLOVER.—The subject includes (1) mutual inductance of parallel coaxial circles, (2) mutual inductance of parallel eccentric circles, (3) self-inductance of a single-layer coil or solenoid, (4) self-inductance of a circular coil of rectangular cross-section, (5) self and mutual inductance of linear conductors. Some of the formulas given, notably those for eccentrically placed circles, provide a solution for cases where none has been previously available. Others are extensions of formulas already well known or cover cases where earlier useful expressions are available. This paper is now ready for distribution.—*Scientific Paper No. 320*, Bureau of Standards.

Power Factor and Its Improvement.—E. W. DOREY.—The author discusses the causes of low power factor and the question of whether the cost of its improvement should be borne by the consumer or by the supply company. A special tariff is suggested for the power consumer as an inducement for him to pay for this improvement. The means available for improving the power factor are considered, and examples are submitted showing the economic results obtained. Practical suggestions cover the field of operation of rotary converters and synchronous motors, and static condensers are considered.—London *Electrician*, May 31, 1918.

Static Condensers.—W. B. Taylor.—Unity power factor on a transmission system is a condition much to be desired, but one which is seldom realized except on direct-current circuits. Low power factors entail heavy idle currents, which increase heating and line losses and disturb voltage regulation. Wherever possible some means should be employed to correct this condition, the usual method being the installation of synchronous condensers. These machines, however, are relatively expensive and require the services of an attendant, and in some instances the cost of installation and maintenance is not justified. The static condenser offers a solution of the problem in many cases. This article shows the improvement in service that may be effected by the use of static condensers on circuits of low power factor and compares this improvement with that afforded by installing additional feeder copper. —*General Electric Review*, August, 1918.

Water Power Developed in British Empire.—In this paper the progress of hydroelectric development is shown in Canada, Australia, New Zealand, Africa and India.—*Times Engineering Supplement*, July, 1918.

Traction

The Dynamics of Wheel and Track.—The author investigates theoretically and experimentally the laws of motion of a wheel rolling or sliding down an inclined plane. In order to eliminate any appreciable effect of air friction, etc., the wheel is made heavy (107 kg.) and its form is designed to give high inertia, so that the acceleration is reduced and with it the difficulty and danger of measuring the speed of the heavy wheel. The latter is turned down to form a relatively small-diameter axle on each side, and the bearing pressure on the track is high, so as to imitate railway conditions. —*Science Abstracts, Section B*, June 29, 1918. (Abstracted from *Vereines*, March 30, 1918.)

Installations, Systems and Appliances

Opportunity of Electrical Refrigeration.—H. N. Sessions.—The author suggests the possibilities of electrical refrigeration as one of the most extensive summer loads at the present time, with enormous opportunities for the future. The Southern California Edison Company is supplying electricity to one ice company alone, using approximately 200 hp. in motors to manufacture raw-water ice in connection with cold storage. Several of the large electrically operated ice plants show an average consumption for the year of less than 15 kw.-hr. per ton. The usual motor installation of an ice plant, including all auxiliaries, is approximately 3 hp. per ton of ice to be made each twenty-four hours. The average ice-plant load is one with an annual load factor above 80 per cent, a monthly load factor of 90 per cent, and by using synchronous motors the power factor may be kept close to unity. Advantages in the use of electricity in ice plants are that less labor is required for operating and that the fire hazard is also reduced. Owing to the fact that higher speed, and thus cheaper compressing machinery, may be used with electric drive, electricity is fast supplanting steam in this service.—*Journal of Electricity*, Aug. 1, 1918.

Industrial Controllers.—XIX.—H. D. James.—In the production of coke, control apparatus for the crushing and conveying machines should be especially protected from coal dust and "coke breeze." Many controllers are inclosed in cabinets and provided with felt packing around the door. Alternating-current motors are preferable for all conveyors, crushers, damper regulators and screens. These motors have fewer moving parts than a direct-current motor and are less likely to be affected by the dust. Direct-current motors are preferable for traction purposes, also for the pusher, leveler and door machine, and for the unloading machines (either car-dumping type or hoisting type). All of the motors and controllers in a coke plant are subject to a great deal of dust and to fumes.—*Electric Journal*, July, 1918.

Electrophysics and Magnetism

Skin Effect in Tubular and Flat Conductors.—H. B. Dwight.—A method is presented for calculating the skin-effect resistance ratio of a tube, which is a form of conductor to be recommended for high-frequency work. A formula is also developed by means of which the asymptote to the curve of the ratio R'/R may be drawn, and thus the magnitude of the skin effect at extremely high frequencies may be obtained. The values of the ratio R'/R for tubes of various thicknesses are plotted in a set of curves which may be used for the solution of practical problems. A similar method is described for the calculation of skin effect in a thin strap. Although the calculations cannot be carried out for as high frequencies as the calculations for tube, a method of coördinating the test results for straps has been published. A set of empirical curves for straps is given from which approximate values of R'/R for any case may be read.—*Proceedings A. I. E. E.*, August, 1918.

High-Tension Direct Current from Alternating-Current Supply.—The author describes the arrangement and characteristics of an equipment by which a direct current of about 0.01 amp. at 10,000 volts is obtainable from alternating-current supply. The direct-current pressure is practically constant within a wide range of load.—*Science Abstracts Section B*, June 29, 1918. (Abstracted from *Schweiz. Elelctrot. Verein*, April, 1918.)

Radiation Efficiencies of Light Sources.—Describes the filter employed in conjunction with a thermopile to give the latter the same sensitivity curve as that of the normal eye. By means of this filter the light efficiencies of various sources are compared.—*Science Abstracts, Section A*, June 29, 1918. (Abstracted from *Ann. d. Physik.*, March 11, 1918.)

Distribution of Radioactive Gases in the Open Air.—A theoretical treatment based on the laws of diffusion. Formulas are obtained for the distribution of the various radioactive gases (radium, thorium and actinium emanations) in the atmosphere with respect to distance from the surface of the earth.—*Science Abstracts, Section A*, June 29, 1918. (Abstracted from *Phys. Zeits.*, March 15, 1918).

Electrochemistry and Batteries

Methods and Plant for Battery Charging.—F. Ayton. -The author deals with the present bearing which charging operations have upon the satisfactory working of the electric vehicle, and the different methods invoked for the charging of both lead plate and nickel-iron-alkali batteries. He also describes suitable charging plant and arrangements.—London *Electric Vehicle*, June, 1918.

Units, Measurements and Instruments

New Stellar Photometer.—Light from an artificial source is reflected from a small silvered portion of a glass plate inserted at 45 deg. in the path of the rays from an object glass to the eyepiece. The focus is adjusted so as to give an out-of-focus image, in the center of which will be seen the illuminated silver disk. Adjustments are then made so that the artificial light is just invisible on the starlight. Difficulties owing to the differences of color of starlight and artificial comparison are remedied by interposing colored screens.—*Science Abstracts, Section A*, June 29, 1918. (Abstracted from *Comptes Rendus*, Feb. 18, 1918.)

Reflection of Surfaces with Negative Curvature.—Describes in detail the image formation in the case of mirrors similar to a napkin ring smaller in diameter at the middle, a section of the ring by a plane passing through the axis consisting of segments of two circles whose centers lie outside the ring. The surface considered, in fact, is generated by the revolution of a segment of a circle about a line in its plane lying altogether outside the circle and parallel to the tangent at the middle point of the segment.—*Science Abstracts, Section A*, June 29, 1918. (Abstracted from *Phys. Zeits.*, March 15, 1918.)

Instruments for Central-Station Switchboards.—G. W. STUBBINGS.—It is stated that ammeters or indicating wattmeters are required only to give the load on a machine or in a feeder approximately correctly and, therefore, do not need to be of the highest accuracy. Voltmeters, as a rule, are required to give accurate indication, and with them a higher class of construction is desirable. Integrating wattmeters give the final result of the conversion of the potential energy of the coal into electrical energy. If the efficiency of this conversion is to be known with certainty, and if it is desired to keep the performance of the generating sets under close supervision, the accuracy of these meters should be the highest possible, and such accuracy, apart from mechanical failure, should be maintained for an indefinite time.—London *Electrical Review*, June 14, 1918.

Telegraphy, Telephony and Signals

Closed-Circuit Translation Arrangement for Hughes Typewriter.—The author points out that uniform signaling conditions are necessary to secure satisfactory working on Hughes circuits. This is best secured by suitable earthing periods after each signal is sent to line. In cases of direct communications between corresponding stations this may be easily arranged for. If, however, the line is so long that an automatic repeater (translator) is necessary, earthing arrangements must be provided there. In the Austrian Telegraph Administration the d'Arlincourt translator has been used hitherto, but this is complicated and requires six relays. The author reduces the number of relays to two by adopting a special construction.—*Science Abstracts, Section B*, June 29, 1918. (Abstracted from *Elektrot. u Masch.*, April, 1918).

Audibility Current of a Telephone Receiver.—Describes a method of determining the audibility current of a telephone receiver, using a Wheatstone bridge, the arms of which must be practically free from both inductance and capacity. Film resistances serve very well for this purpose.—*Science Abstracts, Section B*, June 29, 1918. (Abstracted from *Inst. Radio Eng.*, April, 1918.)

Oscillating Audion Circuits.—The purpose of this paper is to explain the general principles upon which depend the uses of the audion for generating electrical oscillations by "regenerative action" and to discuss in detail the action in certain circuits.—*Science Abstracts, Section B*, June 29, 1918. (Abstracted from *Inst. Radio Eng.*, April, 1918.)

Miscellaneous

British Engineering in Spain.—Following up several recent references to the need for British manufacturers to make special efforts to secure a hold upon the Spanish market for engineering and electrical equipment and apparatus, attention is called to an interesting pamphlet bearing the title "Things for British Engineers," which was issued some time ago by the British Engineers' Association, 32 Victoria Street, Southwest. It is written by a British engineer who was in Spain for some years handling British machinery. He makes a number of suggestions based upon his practical experience gained in touch with the principal buyers both official and commercial.—London *Electrical Review*, July 19, 1918.

Exporting Electricity.—International supply of electric energy is already adopted in one or two places, a notable example being the transmission of electricity from a west Swedish hydroelectric power station by means of a partly submarine cable to the Danish Island of Zeeland. This supply has been in operation a couple of years and has worked satisfactorily.—*Times Engineering Supplement*, July, 1918.

The Quick Determination of Incombustible Matter in Coal and Rock-Dust Mixtures in Mines.—A. C. FIELDNER, W. A. SELVIG and F. D. OSGOOD.—The volumeter method consists in using a specific gravity flask with a graduated stem so proportioned that the volume of a definite quantity of dust suspended in exactly 50 cu.cm. of alcohol can be measured by reading the meniscus of the alcohol on the graduated stem and referring to a calibration table. The method of operating the Taffenel volumeter is explained.—*Technical Paper No. 144*, Bureau of Mines.

Weights of Various Coals.—S. B. FLAGG.—This paper reports the investigation of changes in weight of volume when subjected to wetting and shaking of numerous kinds of coal, the results of which are embodied in useful statistical tables. Conclusions arrived at are that, of two samples of any coal that are composed of the same proportions of pieces of different sizes, the sample having the higher moisture content will usually weigh the more per cubic foot and that heavier weights may be expected for coals of high fixed carbon content than those of low. Increased ash content seems to lower the unit weight, and the younger coals are lighter than the older coals.—*Technical Paper 184*, Bureau of Mines.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

IRON AND STEEL ELECTRICAL ENGINEERS AT BALTIMORE

Problem of Training and Conserving Man Power to Get Quantity Production—D. M. Petty Elected President

A vital necessity in the conduct of the war is quantity production of steel, but to get the best steel output it is essential that the man-power of the industry be conserved in every way and trained to the best advantage. This problem occupied the attention of the Association of Iron and Steel Electrical Engineers on the first day of its annual convention at Baltimore on Sept. 11.

Following a short business meeting, the report of the safety committee was read by its chairman, Mr. Greenwood, on rules for the safe operation of electric cranes. Definite rules for the protection of employees were laid down, and emphasis was placed upon proper methods of securing the compliance of crane operators with these rules. In the discussion which followed it appeared that the convention generally approved of the report, although some engineers felt that plant operations would be interrupted too much by the application of too many rules.

The report of Mr. Gilson, chairman of the educational committee, was then taken up. While there was some difference of opinion regarding the proper administration of such work, it was very generally agreed that all companies should foster this movement not only as a war measure but as a permanent policy. It was predicted that effort and capital invested in the education of electrical operators, inspectors and construction men would be repaid many times and would greatly check the unrest and rapid shifting of employees.

There were 110 registered at the opening session, and this number was considerably increased on the following day. This attendance was considered satisfactory, in view of the stress under which men in the steel industry are now working.

The election of officers, to take effect Jan. 1, 1919, resulted as follows: President, D. M. Petty, Bethlehem Steel Company; first vice-president, B. W. Gilson; second vice-president, H. C. Cronk; secretary, J. F. Kelley; treasurer, James Farrington. Directors chosen were E. S. Jeffries, G. W. Richardson, F. A. Wiley and Walter Kennedy.

In speaking briefly of the activities of the association, President-elect Petty predicted a busy year. He said that the war had placed greater responsibility upon the electrical engineers in the steel industry, both on account of need for increased output and also because it was necessary to use a greater amount of automatic and foolproof apparatus owing to the greater use of unskilled labor.

In place of the usual entertainment features a patriotic banquet was arranged for Thursday evening, to be addressed by General Black, chief of engineers of the United States Army; General Gaston, commander of Camp Meade, and Dr. McDowell, prominent in the army Y. M. C. A. service. Friday afternoon was spent on an inspection trip through the steel works and shipyards of the Bethlehem Steel Company at Sparrows Point, Md.

REVISED SCHEDULE PREPARED OF ESSENTIAL WIRING DEVICES

Committee of Manufacturers Working Out Plan of Conservation Proposes Large Reduction in Number of Devices

Manufacturers of wiring devices, acting through the wiring devices committee of the General War Service Committee of the Electrical Manufacturing Industry, have prepared a revised schedule of essential devices to be retained in their listings. In the opinion of the manufacturers present at the meetings, the last of which were held on Aug. 27 and 28, the devices scheduled, as published herewith, represented the minimum number of essential building equipment articles needed to carry forward and preserve the electrical equipment of the nation during the period of the war. It was the general opinion that any further reduction would be detrimental to other essential industries and to the government itself.

Each manufacturer has been asked to check carefully his line of devices as cataloged and report to the chairman of the committee his elimination. The large extent of the eliminations is shown in the following:

	Number of Devices Now Listed	Number of Devices Retained	Number of Devices Dropped	Per Cent Reduction
Sockets and receptacles.	100	20	80	80
Cut-outs and fuses	500	125	375	75
Miscellaneous	25	20	5	20
	625	165	460	68

Large reductions will also be made in rosettes, attaching plugs, snap switches, knife switches, cut-outs and fuses, but details of these have not yet been compiled.

These important facts in connection with this conservation program were brought out at the meetings:

1. The War Industries Board has made it clear that no development for commercial purposes will be permitted during the period of the war, and especially no manufacturer will be permitted to duplicate the essential devices of some other manufacturer as scheduled herein, provided he is not now making them.

2. The scope of this elimination plan, as given in detail here, covers standard listed devices as made by the various manufacturers of this group for the domestic market. Export business is not considered as coming within this action as it is assumed that any export order for which an export license and priority certificate can be obtained may be filled.

3. Makers of any devices not made by other manufacturers or not included in this schedule must decide for themselves which of such devices are essential and should, for their own protection, make eliminations corresponding to those made in scheduled lines.

4. It is understood that a special device which forms part of some other manufacturer's essential product, upon his affidavit to this effect, may continue to be made, but not listed.

Under the proposed plan no manufacturer shall make more varieties or styles than given below:

SOCKETS AND RECEPTACLES

A—Medium-Base Brass Shell Sockets—
   1. (a) Only brush-brass and nickel finishes.
      (b) No special keys; no special length keys; no special length chain guides
   2. No more than two types of shell fastening. (These may be two sizes in the same type)
   3. For each type or size of shell, only.
      (a) One key interior
      (b) One keyless interior.
      (c) One pull interior.
      (d) One push interior.
   4. For each type of shell (but not to include electrolier) only.
      (a) One twin socket interior.
      (b) One key-locking interior.
      (c) One keyless-locking interior
      (d) One pull-locking interior.
   5. Caps—three only; ⅛-in., 1⅜-in. and pendent, in each style of fastening.
   6. Bases—one style of fastening—only.
      (a) Concealed.
      (b) Cleat.
      (c) 3¼-in. outlet box.
      (d) 4-in. outlet box.
      (e) Concealed rosette.
      (f) Wood molding.

B—Miscellaneous Medium-Base Sockets and Receptacles:
   1. 60018, 60019, 60020 or equal.
   2. 50717 or equal.
   3. 4100, 4104 or equal.
   4. 4004 or equal.
   5. 35024 or equal.
   6 Socket reducers: mogul to medium; medium to candelabra; candelabra to miniature.

C—Medium-Base Porcelain Sockets:
   1. (a) Only one key, one push, one keyless, and one pull body
      (b) One key-locking and one keyless-locking interior.
   2. Pendent, ⅛-in., ⅜-in., and ½-in. caps only.
   3. Cleat, concealed, wood molding, 3¼-in. and 4-in. box bases only.

D—Medium-Base Porcelain Receptacles:
   1. Cleat—9171, 9402, 9403, 4013, 59275 or equal.
   2. Cleat (covered contacts)—58300, 58949 or equal.
   3. Concealed—4001, 4002 or equal.
   4 Molding—4025, 4026 or equal.
   5. Sign—not more than two.
   6. Canopy—one only.
   7. Outlet box—not more than two, viz., 3¼-in. and 4-in.
   8. Metal covers with weatherproof receptacles—not more than two, viz., 3¼-in. and 4-in.

E—Medium-Base Weatherproof Sockets:
   Not more than three types.

F—Medium-Base Porcelain Lined Sockets:
   1. Not more than one metal.
   2. ⅜-in. and ½-in. cap, without and with shadeholders.

G—Mogul-Base Sockets and Receptacles:
   1. Brass shell, ⅜-in. cap only, without shadeholder.
   2. Two-piece porcelain, three styles, viz., plain cap, ⅜-in. and ½-in. cap.
   3. One piece porcelain, three styles, viz., plain cap, ⅜-in. and ½-in. cap.
   4 One cleat receptacle.

H—Candelabra-Base Sockets and Receptacles:
   1. One each, key, keyless, pull, candle and pendent sockets and one cleat receptacle.
   2. No miniature base.

ROSETTES

   1. One fusible and one fuseless cap with cleat, concealed and molding bases to match.
   2. One cleat, with covered contacts.
   3. One one-piece fuseless cleat.
   4 One molding rosette for mounting on backing.
   5. Conduit box—not more than 5.

ATTACHING PLUGS

A—Separable Screw Base—660-watt, two-wire:
   1. Not more than three bodies.
   2. Not more than four caps.

B—Non-separable Screw Base—660-watt, two-wire:
   Not more than two styles.

C—Cord Connectors, Current Taps and Chandelier Plugs:
   Not more than five.

D—Surface and Conduit Box Receptacles:
   Not more than five.

E—Flush Receptacles, 10 amp. and under:
   Not more than five.

F—Flush Receptacle Plates:
   1. Only brush-brass and nickel finishes for brass plates.
   2. Only one thickness of metal for single gang plates for any one type of receptacle.

SNAP SWITCHES

A—Surface Switches:
   1. Only slotted base switches, if both slotted and solid are now made.
   2. Only indicating switches, if indicating and plain are now made, single-pole excepted.
   3. No switches with special bases for wood or metal molding
   4. No switches with special bases for conduit box or cast-iron fittings.
   5. Not more than two types of panelboard switches.
   6. No special finishes—one finish only.
   7. Standard length of cord on ceiling and wall switches reduced from 10 ft. to 8 ft.

B—Pull and Pendent Switches:
   1 Not more than three pull and key socket switches.
   2 Not more than two sizes or styles of pendent switches and not more than two caps.
   3. Not more than one through cord switch
   4 No special finishes, one finish only.
   5. Length of cord on pull socket switches reduced from 10 ft to 6 ft

C—Flush Switches:
   1. No rotary switches under 20-amp. capacity
   2. Not more than three types of flush switches other than rotary
   3. One type of door switch.
   4. No steel plates.
   5. All brass plates 0.040-in. and only square cornered, up to and including three-gang.
   6. Only brush-brass and nickel finishes.

KNIFE SWITCHES

   1. No polished finish switches; eliminate all finish except bright dip or tumbled.
   2. N.E.C.S. slate base—not more than one grade in the same capacity. Where more than one grade is now made, eliminate all except the equivalent of Trumbull type C for 60 amp. or under, and all except the equivalent of Trumbull type A above 60 amp.
   3. Unmounted.
      (a) Not more than one grade.
      (b) Not more than one current density in same capacity.
   4. No low-jaw fused switches, front or back connected.
   5. Battery switches—no slate bases.
   6. Combination base switches—no duplication of porcelain and slate base above 30 amp.

FUSES AND CUT-OUTS

A—Cartridge Fuses:
   1. No polished ferrules; eliminate all finishes except bright dip or tumbled.
   2. 250-volt ampere ratings—6, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 100, 125, 150, 175, 200, 225, 250, 275, 300, 350, 400, 500, 600.
   3 600-volt ampere ratings—3, 5, 7, 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 100, 125, 150, 175, 200, 225, 250, 275, 300, 350, 400, 500, 600.
   4. Renewable fuses—fuse elements of same capacity as above.

Cartridge Fuse Cut-Outs:
   1 No duplication of porcelain and slate bases of same capacities, not more than one style for each device retained.
   2. Clips, contacts and lugs—no polished finish.
   3. Slate cut-out bases, single pole only.

Plug Fuses:
   1. Ampere ratings—6, 10, 15, 20, 30.

Plug Cut-Outs:
   One line only.

Similar work having as its motive the elimination of many types in accordance with the wishes of the War Industries Board is under way in about twenty-five group committees of the industry.

ELECTRICAL STANDARDIZATION FOR LARGE HOUSING PROJECTS

Materials Which Will Be Needed in the Extensive Government Program to Be Standardized in the National Interest

A plan for standardization of the electrical materials which will be needed in the extensive housing projects contemplated by the government is being worked out.

Charles E. Dustin, general secretary of the Associated Manufacturers of Electrical Supplies, was asked to go to Washington last week by Richard L. Humphrey, chief of the building materials section of the War Industries Board, to discuss arrangements for getting the movement started. It is believed that the coöperation of the manufacturers in the standardization of such electrical supplies as are needed in ordinary construction will save complication and trouble for the government in the prosecution of the war program.

To further this end a general conference of representatives of manufacturers producing the supplies needed in the government housing projects was called for Sept. 13 in Washington. It was expected that this conference would result in the formation of a war service committee of the building materials section of the War Industries Board. Representatives of the manufacturers in the following groups and of such other materials as will be required in the government housing projects are to take part in the movement: Control, conduit of different types, heating devices, wiring devices, industrial, outlet box, interior fixtures, porcelain, wire and cable, panelboard and switchboard.

Need of $200,000,000 for War Power Plants

Requirements of the United States Shipping Board Emergency Fleet Corporation Among the Vital Important Developments Which Will Be Supplied Fully Under the Government Program

Testimony before the House of Representatives committee on interstate and foreign commerce on the two-hundred-million-dollar government emergency power act, as published in the last two issues of the Electrical World, presented mainly the points of view of the War Industries Board, the army and the navy. Herewith there is printed additional testimony giving the standpoint of the United States Shipping Board Emergency Fleet Corporation.

Testimony of Maurice L. Cooke

In beginning his testimony, Maurice L. Cooke, Washington representative of the Emergency Fleet Corporation and assistant to the chairman of the Shipping Board, handling power matters, said that Edward N. Hurley would be at the service of the committee immediately upon his return to Washington in case the committee should want to supplement his statements.

"There are acute situations," Mr. Cooke said, "at Chester, Pa.; Seattle, Wash.; Portland, Ore.; Norfolk, Va.; Gloucester, N. J.; Wilmington, N. C., and San Francisco." Those are just points with which Mr. Cooke happened to have personal acquaintance. There are similar situations in a number of other shipyards. Pending a decision by Congress as to how it wanted the administration to handle the matter of power, the Secretary of War, Secretary of the Navy and chairman of the Shipping Board have been coöperating to see how they could tide over this emergency situation. A working agreement was reached that no one would make a contract for power without allowing the others to "sit in and comment on the proposition."

The War Department assumed the leadership in the Pittsburgh district, the Navy Department in the New Jersey district and the Shipping Board in the Philadelphia district. The latter district not only includes Philadelphia but reaches into Chester and Bristol, Pa., and Wilmington, Del., and ultimately may cross the river into New Jersey.

The Philadelphia Electric Company, testified Mr. Cooke, anticipates a shortage in Philadelphia in the coming winter. In some respects a shortage is existing now, not a shortage in the territory as a whole but in some distribution districts. Mr. Cooke mentioned the district in which the Midvale Steel Works are located as one where there is already an inability on the part of the company to supply power and where during the coming winter unless some effective action can be taken there will be a shortage. For the winter of 1919-1920 the apparent shortage is all the way from 50,000 kw. to more than 100,000 kw.

Mr. Cooke said that it had been asked what attitude the companies were going to take under the proposed legislation. The Philadelphia company, he added, claimed that to carry out the most conservative construction program which would meet the situation as it would develop before the end of the winter of 1919-1920 would require the expenditure of $20,000,000.

"Our estimates," said Mr. Cooke, "however, are that $13,000,000 is probably nearer the figure." He noticed that the War Industries Board had given a figure of $15,000,000.

"Personally," declared Mr. Cooke, "I do not believe it is possible to come much nearer than those figures because labor is the big gamble, and I do not believe any of us can foresee the conditions that are going to obtain in the next eighteen months in the matter of labor, to come much nearer the final estimate and get a better estimate than is represented by those three figures."

After conferences with officials of the Philadelphia Electric Company and their bankers, the authorities thus far have been unable to get a proposition from them that they felt they could accept. They have made a proposition to the company somewhat along the lines of the one that Secretary of War Baker described for the Pittsburgh district, offering to put up 40 per cent of the cost of construction with the understanding that that included war wastage plus a margin of safety. The war wastage was to be figured two years after the war by a method of arbitration and was defined as meaning the difference between the then normal cost of this construction and what it actually cost.

Mr. Cooke said that he supposed that 25 per cent of the cost of construction is as good a guess of what that war wastage would be as can be arrived at. The reply of the company to the proposition was that if the authorities would reverse the figures and advance 60 per cent and allow the company to put up 40 per cent, possibly they could get together.

"We felt," Mr. Cooke continued, "that in putting up 40 per cent we were going somewhat beyond war wastage and that we were getting into a position where we were financing private corporations rather than producing the necessary power."

If it is possible to get together with the company, the energy will still have to be produced, because a shortage of 60,000 kw. as the authorities estimate it and more than 100,000 kw. as the company estimates it is absolutely certain for the winter of 1919-1920. Of that shortage, about 50 per cent is for the shipyards, 10 per cent for the army, 10 per cent for the navy and 30 per cent distributed so that the responsible department can scarcely be determined.

Alternative Plans for Philadelphia

Mr. Cooke mentioned several things that could be done. He said:

"We can build an isolated power plant in connection with the Hog Island yard, which would be a distinct step backward. We can go in and build this proposed new plant of the Philadelphia Electric Company at Beach and Palmer Streets on the Delaware River, build it and own it for the government, but that would apparently lead to a more direct interest in the operation of that company than would seem desirable. It might even lead to taking the same steps as have been taken at Norfolk, Va., where the government has frankly taken over the operation of the local company."

At Portland, Ore., Mr. Cooke testified, the situation is much the same except that the companies there say that they cannot do anything. At Wilmington, N. C., it is hoped to make a bargain comparable to the one made in Pittsburgh. He added:

"After all, in these places where either the Emergency Fleet or the army or the navy has been able to make reasonably satisfactory arrangements, the operating companies are almost negligible as compared with the whole demand, so that unless this bill is passed, or some equivalent legislation, it will in some parts of the program during the coming winter and through the entire military program in the following winter make a very serious curtailment in our war preparations."

Independent Hog Island Plant Considered

In discussing the matter of building an independent plant at the Hog Island Yard, Mr. Cooke said that of course such a plan "would be a step backward, one absolutely opposed to the principle on which this bill was drawn, of having one great system where the peak of one district might be helped by drawing in energy from other districts where the peak did not occur at the same hour of the day.

Discussing the question of rates, Mr. Cooke testified: "It is hardly possible, it seems to me, that the government, building in these times of high prices, can undersell local companies. I think it is entirely possible that the government may be tempted to charge higher rates for the time being and in certain places than the local companies; and, personally, I see no reason why they should not put a surcharge, a supercharge, on some contracts to take care of that, without disturbing the general system of charging throughout that district."

Taking the case of the Midvale Steel Company as an example, Mr. Cooke discussed the possibility that this company might be in a district which after the war would be oversupplied with electrical energy.

"Rather than change the whole system of electric charges in the Philadelphia district," he added, "I can easily see that the War Department might enter into an arrangement by which as long as those gun contracts and other contracts were operating the Midvale would pay somewhat extra for at least that part of its load which was used on certain stipulated contracts and that would become a part of the expense of building the particular things that were being built under those contracts."

Answering a question by Representative Winslow as to the trend of thought of those who have been building up the bill regarding the equalization of charges for power under this legislation and the charges of companies operating under old contracts, Mr. Cooke said:

"I should imagine, for instance, if we would go ahead with one possible solution in Philadelphia, to take over the building of a new plant there under the plans of the Philadelphia Electric Company, we would in the very nature of things be forced to sell that current to the Philadelphia Electric Company, because they have the distribution system, and I should imagine it would be a relatively easy matter to arrive at a figure at which current was to be sold and they would continue to sell that current to most of their customers under the scale of charges fixed by the Pennsylvania Public Service Commission."

Representative Parker of New Jersey asked Mr. Cooke about the margin between wholesale rates and retail rates.

Mr. Cooke testified that there was a large margin between these classes.

Mr. Parker—And that margin is therefore so large that a change in the wholesale rates, a rather larger wholesale rate, would not be expected to affect the retail rates at all?

Mr. Cooke—Certainly not so much as you would expect.

Representative Parker then asked other questions bearing on rates and took up the subject of the rate of the Midvale Steel Company.

Mr. Cooke—I rather imagine that their rate is perhaps higher than you would expect to find it, because if I recall rightly they had to put in a long high-tension line to reach them, and it has been the practice of that company—and I am not criticising it—to, the first two years of the contract, help absorb part of the cost of the distribution system through a charge that would be a little higher.

The discussion then turned to the question of the attitude of commissions.

Mr. Cooke mentioned the contract between the Philadelphia Electric Company and the Philadelphia Rapid Transit Company. The latter company having a contract for a rate of 0.7 cent acquiesced in the ruling by the state Public Service Commission that raised the rate to 0.75 cent.

Program Not Yet Interfered With

Representative Esch said that when Congress gave the Emergency Fleet Corporation the duty of constructing ships this carried with it the power to develop the necessary energy for such construction. "That being true," he added, "is there a shortage of power development under the Emergency Fleet Corporation for the constructive program which that corporation is undertaking?"

Mr. Cooke—At the moment our program is not being held back on account of power shortage, but we are guarding against shortages that to-morrow or next week will become real, in the absence of action, even though the retardation of the program will not ensue for a year or eighteen months later.

Adding that future needs were being anticipated, Mr. Cooke said that in the Philadelphia district it is just the difference between the judgment of two engineers "as to whether if we begin to-morrow we will avoid the shortage that is threatened in the winter of 1919-1920. One group of engineers says it can be done in fourteen months; another says it will take eighteen months."

Representative Esch—Well, my idea is that the Fleet Corporation now has the power to build as much power plant as is necessary.

Mr. Cooke—We have got the money and the power to provide the necessary current, but if we simply go ahead and act on that, we will be developing at many points independent isolated plants that are not as efficient as the central stations or the superstations would be and we hesitate to do that.

Answering a question by Representative Esch as to the situation in the Puget Sound district, Mr. Cooke said that, as he recalled, between 50 and 60 per cent of the power used in shipyards was now provided by the Seattle municipal plant. The city of Seattle recently obtained permission from the Capital Issues Committee to issue $5,500,000 in bonds for hydroelectric development. It is hoped by this improvement that the needs in that district will be taken care of before the peak, which is expected to come next summer. The private company had a project for increasing facilities and it is asking for government assistance.

Lieut. W. W. Stanley, who was present at the hearing, said that the company was asking for government assistance, but that he did not know whether it would do so now as the municipal plant was going ahead.

Representative Esch also asked questions as to the further development and the use of electrical energy in connection with the manufacture of war munitions. Mr. Cooke expressed the opinion that this must take place not only in connection with munitions but generally. Lieutenant Stanley, replying to questions along the same line, discussed briefly the progress of the electric furnace and electric welding.

Representative Esch—That would be an additional reason for increasing power development.

Mr. Cooke—I should imagine that if we come in three months later with a program, we would even in that short time have made considerable additions to the requirements, for the several reasons you have mentioned, as well as others.

Representative Parker raised a question whether by manufacturing energy the government might save enough to pay for the plant. Mr. Cooke said that the War Industries Board had tentative estimates of the cost at every point where financial assistance had been required. Representative Parker asked for a memorandum comparing the cost of producing energy and the rates paid by the government for energy. This will be furnished by Mr. Cooke.

Representative Esch—This bill contemplates that the government itself may construct a separate independent plant, and it also contemplates that the government can aid in increasing the power facilities of existing plant. The government will not use the first power if reasonable concessions can be made with the existing plant.

Mr. Cooke—I should say that would be good policy.

Representative Esch—Would there be some isolated sections where, owing to the absence of existing plants, new construction would be a necessity?

Mr. Cooke—The country is pretty well covered, Mr. Esch, but I would not be surprised if in the course of a year or two some such situation as you have in mind would develop.

Representative Esch—Could or would the government use this power granted in this bill in a coercive way to secure a beneficial contract or agreement with existing plants?

Mr. Cooke—I think when the government has this power that the private companies as a rule, will come forward with better propositions than they are in a position to come forward with now. They are pretty apt to follow some general principle, and they realize that the government is not now in a position to afford any general relief; and should this bill or some comparable measure pass, I think they will be in a position to be much more generous in providing private funds than they are to-day.

Hearing This Week

The House committee on interstate and foreign commerce held another hearing on Thursday of this week on the emergency power bill, which would appropriate $200,000,000 so that the government may create additional power facilities as a war measure. The additional session was for the purpose of hearing again Eugene Meyer, Jr., and so that Mr. Gans, lawyer in the office of Felix Frankfurter of the War Labor Board who drew the bill, might explain some points.

Chairman Sims of the committee reported that when the revenue bill is disposed of in the House next week the emergency power bill will obtain the right of way.

In the meanwhile it has developed that members of the committee desire amendments which shall make clear that the bill shall not apply to water-power plants. Judge Sims says that the bill as now framed allows assistance to hydroelectric power plants or permits hydroelectric development, and he sees no objection to that, but he says that when the committee begins to vote on the bill by amendments it will probably make sure that water powers are out of the measure.

WATER-POWER BILL PASSED BY HOUSE OF REPRESENTATIVES

Measure Now in Stage of Conference Between the Committees of the House of Representatives and the Senate

The House of Representatives has passed the administration water-power bill in the form in which it was reported by the conference committee of the House. "Net investment" was retained in the recapture clause, instead of "fair value." The committee indorsed "net investment." The bill now goes to conference.

ANNUAL MEETING OF EDISON ASSOCIATION

L. L. Elden Elected President at the Gathering Held in New York for Organization Purposes This Week

At a formal meeting of the Association of Edison Illuminating Companies in the Engineering Societies Building, New York City, on Sept. 10, at which the proceedings were confined mainly to those necessary for organization purposes, L. L. Elden, Edison Electric Illuminating Company, Boston, was elected president. Other officers elected were: Vice-president, Robert Lindsay, Cleveland Electric Illuminating Company; secretary, H. T. Edgar, Edison Electric Illuminating Company, Boston; treasurer, W. W. Freeman, Union Gas & Electric Company, Cincinnati.

An executive committee was also elected, as follows: Charles L. Edgar, Edison Electric Illuminating Company, Boston; Samuel Insull, Commonwealth Edison Company, Chicago; John W. Lieb, New York Edison Company; Joseph B. McCall, Philadelphia Electric Company; W. F. Wells, Brooklyn Edison company.

NEW PREFERENCE LIST OF THE WAR INDUSTRIES BOARD

Priority of Industries Governing the Distribution of Labor, Capital, Facilities, Material, Transportation and Fuel

B. M. Baruch, chairman of the War Industries Board, has issued the new preference list of industries and plants, compiled by the Priorities Division of the board.

E. B. Parker, chairman of the Priorities Division, states that the determination of the relative importance of all industries and plants for both production and delivery by a single agency, the War Industries Board, renders it possible to maintain a well-balanced program with respect to the several factors entering into production, which includes, among other things, plant facilities, fuel supply or electrical energy, labor and transportation, without all of which production is impossible.

Judge Parker says: "The administration of priorities is calculated to bring order out of chaos and to develop an evenly balanced industrial program to meet the requirements of the military program, and at the same time supply the essential requirements (as distinguished from the mere wants or desires) of the civilian population. Now that it is understood that priority and preference cannot be purchased, the tendency is for prices to assume more nearly the normal level. It is now the public interest rather than the dollars of the purchaser that determines precedence in production and delivery."

An explanatory statement signed by Mr. Baruch and Judge Parker says in part:

For the guidance of all governmental agencies and all others interested (1) in the production and supply of fuel and electric energy, (2) in the supply of labor, and (3) in the supply of transportation service by rail, water, pipe lines or otherwise, in so far as such service contributes to production of finished products, the accompanying designated Preference List No. 2 has been adopted by the Priorities Board, superseding Preference List No. 1, adopted April 6, 1918, and all amendments and supplements thereto.

Where it is imperative not only to maintain but to stimulate and increase production to satisfy abnormal demands created by war requirements, a high rating is necessary, even though the intrinsic importance of the product may be less than that of other products placed in a lower classification because of the fact that the supply of such other products equals the demand without the stimulus of high priority. Where it is necessary to speed the production of a particular product required at a particular time to carry into effect an important program, a high priority is given although changing conditions may thereafter suggest and demand a reclassification. Certain plants produce commodities of great relative importance, but at the same time produce other commodities of less relative importance, and under such circumstances consideration and weight is given to the ratio of production between the more important and less important commodities. Instances occasionally arise where individual plants are given preference so long as they are rendering, and so long as it is in the public interest that they should render, a particular service, even though, taking the country as a whole, the supply of their product is ample to meet all demands.

The industries and plants grouped under Class 1 are only such as are of exceptional importance in connection with the prosecution of the war. Their requirements must be fully satisfied in preference to those of the three remaining classes.

Requirements of industries and plants grouped under Class 2, Class 3 and Class 4 shall have precedence over those not appearing on the preference list. As between these three classes, however, there shall be no complete or absolute preference. It is not intended that the requirements of Class 2 shall be fully satisfied before supplying any of the requirements of Class 3, or that those of Class 3 shall be fully satisfied before supplying any of those of Class 4. The classification does, however, indicate that the industries and plants grouped in Class 2 are relatively more important than those in Class 3, and that those in Class 3 are relatively more important than those in Class 4. It will often happen that after satisfying the requirements of Class 1 the remaining available supply will be less than the aggregate requirements of the other three classes, in which event such supply will be rationed to the industries and plants embraced within those classes. The Priorities Board will from time to time, after conference, and in coöperation with each of the several governmental agencies charged with the distribution thereof, determine particular principles, values and methods of application which may be followed in allocating fuel, power, transportation and labor respectively, to the end that proper reorganization and weight may as far as practicable in each case be given to the relative importance of Class 2, Class 3 and Class 4.

East plant listed as such shall not later than the fifteenth of each month file with the secretary of the Priorities Board, Washington, D. C., a report on P.L. Form No. 3, covering its activities during the preceding month. Any plant failing to file such report will be dropped from the preference list.

Priorities in the supply and distribution of raw materials, semi-finished products and finished products shall be governed by Circular No. 4, issued by the Priorities Division of the War Industries Board under date of July 1, 1918, and all amendments and supplements thereto or substitutes therefor.

This preference list shall be amended or revised from time to time by action of the Priorities Board to meet changing conditions. The Priorities Commissioner shall under the direction of and with the approval of the Priorities Board certify additional classes of industries and also certify additional plants whose operations as a war measure entitle them to preference treatment.

LIST OF INDUSTRIES

Agricultural Implements.—See "Farm Implements."

Aircraft.—Plants engaged principally in manufacturing aircraft or aircraft supplies and equipment.—1.

Ammunition.—Plants engaged principally in manufacturing same for the United States government and the Allies.—1.

Army and Navy.—Arsenals and navy yards—1.

Army and Navy.—Cantonments and camps. -1.

Arms (small).—Plants engaged principally in manufacturing same for the United States government and the Allies.—1.

Bags.—Hemp, jute and cotton Plants engaged principally in manufacturing same.—4.

Blast Furnaces.—Producing pig iron —1.

Boots and Shoes.—Plants engaged exclusively in manufacturing same.—4.

Brass and Copper.—Plants engaged principally in rolling and drawing copper brass and other copper alloys in the form of sheets, rods, wire and tubes.—2.

Buildings.—See "Public Institutions and Buildings."

Chain.—Plants engaged principally in manufacturing iron and steel chain.—3.

Chemicals.—Plants engaged principally in manufacturing chemicals for the production of military and naval explosives, ammunition and aircraft, and chemical warfare.—1.

Chemicals—Plants, not otherwise classified and listed, engaged principally in manufacturing chemicals.—4.

Coke.—Plants engaged principally in producing metallurgical coke and by-products, including toluol.—1

Coke.—Plants, not otherwise classified and listed, producing same.—2.

Copper and Brass.—See "Brass and Copper."

Cotton.—Plants engaged in the compression of cotton.—4.

Cotton Textiles.—See "Textiles."

Cranes.—Plants engaged principally in manufacturing locomotive or traveling cranes.—2.

Domestic Consumers.—Fuel and electric energy for residential consumption, including homes, apartment houses, residential flats, restaurants and hotels.—1.

Domestic Consumers.—Fuel and electric energy not otherwise specifically listed.—3.

Drugs.—Medicines and medical and surgical supplies. Plants engaged principally in manufacturing same.—4.

Electrical Equipment. — Plants engaged principally in manufacturing same.—3.

Explosives.—Plants engaged principally in manufacturing same for military and naval purposes for the United States government and the Allies.—1.

Explosives.—Plants not otherwise classified or listed, engaged principally in manufacturing same.—3.

Farm Implements.—Plants engaged principally in manufacturing agricultural implements and farm operating equipment.—4.

Feed.—Plants engaged principally in preparing or manufacturing feed or livestock and poultry.—1.

Ferro-Alloys.—Plants engaged principally in producing ferro-chrome, ferro-manganese, ferro-molybdenum, ferro-silicon, ferro-tungsten, ferro-uranium, ferro-vanadium and ferro-zirconium.—2,

Fertilizers. — Plants engaged principally in producing same.—4.

Fire Brick.—Plants engaged principally in manufacturing same.—4.

Foods.—Plants engaged principally in producing, milling, refining, preserving, refrigerating, wholesaling or storing food for human consumption embraced within the following description: all cereals and cereal products, meats, including poultry, fish, vegetables, fruit, sugar, syrups, glucose, butter, eggs, cheese, milk and cream, lard, lard compounds, oleomargarine and other substitutes for butter or lard, vegetable oils, beans, salt, coffee, baking powder, soda and yeast; also ammonia for refrigeration.—1.

Foods.—Plants engaged principally in producing, milling, preparing, refining, preserving, refrigerating or storing food for human consumption not otherwise specifically listed (excepting herefrom plants producing confectionery, soft drinks and chewing gum).—3.

Food Containers.—Plants engaged principally in manufacturing same.—4.

Foundries.—(Iron.) Plants engaged principally in the manufacture of gray iron and malleable iron castings.

Fungicides.—See "Insecticides and Fungicides."

Gas.—See "Oil and Gas," also "Public Utilities."

Guns.—(Large.) Plants engaged principally in manufacturing same for the United States government and the Allies.—1.

Hospitals.—See "Public Institutions and Buildings."

Ice.—Plants engaged principally in manufacturing same.—3.

Insecticides and Fungicides.—Plants engaged principally in manufacturing same.—4.

Laundries.—4.

Machine Tools.—Plants engaged principally in manufacturing same.—2.

Medicines.—See "Drugs and Medicines."

Mines.—Coal.—1.

Mines.—Producing metals and ferro-alloy minerals.—2.

Mines.—Plants engaged principally in manufacturing mining tools or equipment.—3.

Navy.—See "Army and Navy."

Navy Department.—See "War and Navy Departments."

Newspapers and Periodicals.—Plants engaged principally in printing newspapers or periodicals which are entered at the post office as second-class mail matter.—4.

Oil and Gas.—Plants engaged principally in producing oil or natural gas for fuel or for mechanical purposes, including refining or manufacturing oil for fuel, or for mechanical purposes.—1.

Oil and Gas.—Pipe lines and pumping stations engaged in transporting oil or natural gas.—1.

Oil and Gas.—Plants engaged principally in manufacturing equipment or supplies for producing or transporting oil or natural gas, or for refining and manufacturing oil for fuel or for mechanical purposes.—3.

Paper and Pulp.—See "Pulp and Paper."

Periodicals.—See "Newspapers and Periodicals."

Public Institutions and Buildings.—(Maintenance and operation of.) Other than hospitals and sanitariums.—3.

Public Institutions and Buildings.—(Maintenance and operation of.) Used as hospitals or sanitariums.—1.

Public Utilities.—Gas plants producing toluol.—1.

Public Utilities.—Street railways, electric lighting and power companies, gas plants not otherwise classified, telephone and telegraph companies, water-supply companies, and like general utilities.—2.

Public Utilities.—Plants engaged principally in manufacturing equipment for railways or other public utilities.—2.

Pulp and Paper.—Plants engaged exclusively in manufacturing same.—4.

Railways.—Operated by United States Railroad Administration.—1.

Railways.—Not operated by United States Railroad Administration (excluding those operated as plant facilities.)—2.

Railways.—(Street.) See "Public Utilities."

Rope.—See "Twine and Rope."

Rope Wire.—See "Wire Rope."

Sanitariums.—See "Public Institutions and Buildings."

Ships.—(Maintenance and operation of.) Excluding pleasure craft not common carriers.—1.

Ships.—Plants engaged principally in building ships, excluding (a) pleasure craft not common carriers, (b) ships not built for the United States government or the Allies nor under license from United States Shipping Board.—1.

Soap.—Plants engaged principally in manufacturing same.—4.

Steel-Making Furnaces.—Plants engaged solely in manufacturing ingots and steel castings by the open hearth, Bessemer, crucible or electric furnace process, including blooming mills, billet mills and slabbing mills for same.—1.

Steel-Plate Mills.—1.

Steel-Rail Mills.—Rolling rails fifty or more pounds per yard.—2.

Steel.—All plants operating steel rolling and drawing mills, exclusive of those taking higher classification.—3.

Surgical Supplies.—See "Drugs and Medicines."

Tanners.—Plants engaged principally in tanning leather. —4.

Tanning.—Plants engaged principally in manufacturing tanning extracts.—4.

Textiles.—Plants engaged principally in manufacturing cotton textiles, including spinning, weaving and finishing.—4.

Textiles.—Plants engaged principally in manufacturing woolen textiles, including spinners, top makers and weavers.—4.

Textiles.—Plants engaged principally in manufacturing cotton or woolen knit goods.—4.

Textiles.—Plants engaged principally in manufacturing textile machinery.—4.

Tin Plates.—Plants engaged principally in manufacturing same.—3.

Tobacco.—Only for preserving, drying, curing, packing and storing same—not for manufacturing and marketing.—4.

Toluol.—See "Coke," also "Public Utilities."

Tools. — Plants engaged principally in manufacturing small or hand tools for working wood or metal.—7.

Twine.—(Binder and Rope.) Plants engaged principally in manufacturing same.—4.

War and Navy Departments.—Construction work conducted by either the War Department or the Navy Department of the United States in embarkation ports, harbors, fortified places, flood protection operations, docks, locks, channels, inland waterways and in the maintenance and repair of same.—2.

Wire Rope and Rope Wire.—Plants engaged principally in manufacturing same.—2.

Woolen Textiles.—See "Textiles."

(The term "principally" means 75 per cent of the products mentioned.)

CONVENTION OF PENNSYLVANIA ELECTRIC ASSOCIATION

War-Time Economies and the Necessity for Increased Rates Chief Topics of Discussion at Two-Day Session

The eleventh annual meeting of the Pennsylvania Electric Association was held at Bedford Springs, Pa., Sept. 6 and 7. Reflecting the spirit of the times, the entire work of the convention was concentrated on war-time economies in the generation, distribution and use of electricity and on the financial problems entailed in the successful conduct of the business.

Routine matters, together with the reports of special committees and the address of President Henry N. Müller of Pittsburgh, were disposed of in the opening session. Owing to the draft and enlistments, the association, which is a state branch of the National Electric Light Association, has suffered a considerable decrease in membership, especially among Class B members. The work of the association has, however, gone steadily forward although in less energetic form. In his address President Müller made a plea for wider recognition and use of the geographic sections as a means for disposing of local problems confronting the utilities.

OVERHEAD-LINE CONSTRUCTION

The principal report was that of the engineering committee having to do chiefly with overhead-line construction. For years the electric light and telephone companies of the State of Pennsylvania have been discussing the joint use of poles on the public highways, but they have never been able to come to an agreement owing to the attitude of the telephone companies regarding circuits carrying potentials of 5000 volts and above. At conferences between the lighting and telephone interests the engineering committee finally recommended two separate sets of specifications for joint-pole occupancy, one dealing with voltages up to 5000 and the other with voltages above 5000. The construction is to be in conformity with the National Electric Safety Code promulgated by the Bureau of Standards. Individual consideration is to be given each particular job, and it was agreed that deliberation should center entirely on whether there should be joint occupancy or separate pole lines. Thus far no definite agreement between the telephone and electric light interests in the State of Pennsylvania has been reached. It is felt, however, that with the widely increasing use of electricity for industrial and power uses voltages above 5000 will become more and more employed so that the limitation of 5000 now insisted upon by the telephone interests will hamper the proper expansion of the electric power business. Another interesting report was made by the accounting committee, of which H. R. Kern of Philadelphia is chairman.

OPERATING PAPERS DISCUSSED

The technical session was held under the direction of the geographic section committee, of which S. C. Pohe of Clearfield is chairman. Five papers were presented as follows: "Theft of Electricity," by H. A. Heslip of Pittsburgh; "Economies in Pole Line Operation and Maintenance," by J. F. Cole of Altoona; "The Necessity for Increased Rates," by Henry Harris of Wilmerding and Ralph J. Baker of Pittsburgh; "Utilization of the Idle Hours of Station and Substation Employees," by C. W. Ward of Pittsburgh, and "Transportation Problems," by W. T. Watson of Philadelphia.

Mr. Heslip's paper dealt with the various methods discovered of tampering with meters and the steps taken by the Duquesne Light Company in detecting the fraud and bringing the guilty parties to account.

Mr. Cole's paper was based on material gathered from large and small operating companies in Pennsylvania. It dealt particularly with the importance and value of adopting standards of overhead-line material and types of construction which tend to cheapen and simplify maintenance. The necessity for careful and systematic inspection of poles was emphasized, and the advantages of other practices such as standard sizes of wire for distribution and commercial service connections, the use of different shapes and different colored insulators for different classes of service, and the replacing of small transformers with larger sized units, each of which would feed a separate network of secondary distributing mains, were enumerated. The idea brought out by the author was that not a cent's worth of material or a minute's time should be wasted.

The necessity for higher rates is, of course, generally recognized throughout the industry, the only question confronting the management of central-station companies being the size of the needed increase rather than the necessity of it. Henry Harris discussed this question from the managerial side and Ralph J. Baker from the legal side.

The draft has taken from electric lighting companies a large number of employees so that the executives are faced with the task of rendering service with more limited resources both of men and of money. Mr. Ward in his paper took up the problem of systematically utilizing the idle hours of station and substation attendants as a matter of economy. His plan is of more interest to medium-sized and large companies. Additional work suggested for filling in the time of substation attendants and others is as follows: Making tracings, repairing and testing meters, refilling fuses, reclaiming pole-line hardware, repairing street-lighting equipment, arc lamps, linemen's tools, primary cut-outs, transformer leads, etc., splicing short pieces of wire, cutting scrap wire into tie wire, burning insulation from scrap wire, cleaning windows, repairing buildings, painting, etc. Local conditions will, of course, decide what operations, if any, can be assigned advantageously to men whose time is not entirely occupied.

W. T. Watson's paper on "Transportation Problems" was devoted particularly to the advantages of the electric vehicle for central-station transportation purposes.

FUEL PROBLEMS

At the session of the evening of Sept. 6 addresses were made by W. C. Anderson of the National Electric Light Association, E. L. Cole, the director of the conservation division of the Federal Fuel Administration of Pennsylvania, and W. D. B. Ainey, chairman of the Pennsylvania Public Service Commission.

Mr. Cole told of the serious power shortage in various sections of Pennsylvania and of the steps taken by the Fuel Administration to broaden the peak load and shift the hours of labor so as to make continued employment possible, without interfering with the production of war necessities. The government has decided that coal-mining companies shall have preference in the supply of power, and yet to give the mines of Pennsylvania all the power they need would hamper other industries, a procedure which is not in accord with the policies of the Fuel Administration. By closing department stores until 10 o'clock in the morning and after 4:30 in the afternoon the railway companies of Philadelphia, for instance, are enabled to transport ship and munition workers to advantage without crippling the public utilities.

The Fuel Administration of Pennsylvania, Mr. Cole said, was also instrumental in drafting the present bill before Congress, appropriating $200,000,000 for the construction of power plants. More than half of it, it is anticipated, will be used to finance power plants in the anthracite regions, the electricity generated to be transmitted to Philadelphia, New Jersey and Maryland over the lines of existing public utilities. It is the hope of the Fuel Administration that the erection of these power plants will initiate a permanent means of conserving fuel and at the same time provide power at the lowest possible cost for manufacturers in peace times. It is expected also that the power plants will be the first of a series of plants to be erected at points where coal is produced.

Officers were elected as follows: President, Thomas Sproule, Philadelphia Electric Company; first vice-president, W. R. Kenney, West Penn Power Company, Connellsville; second vice-president, Ernest H. Davis, Lycoming Edison Company, Williamsport; treasurer, A. H. S. Cantlin, Lehigh Valley Light & Power Company, Allentown. Three members elected to the executive committee were Henry Harris, Wilmerding; H. H. Ganser, Counties Gas & Electric Company, Norristown, and John S. Wise, Hazleton, Pa.

JOINT COUNCIL OF NATIONAL ENGINEERING SOCIETIES

San Francisco Sections of Five National Societies Organize for Effective Action in Local Matters of Civic Engineering

Five national engineering societies which have San Francisco sections on Sept. 4 organized what is to be known as the Joint Council of the Engineering Societies of San Francisco. The societies represented are the American Society of Civil Engineers, the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Institute of Mining Engineers and the American Chemical Society. Four representatives from each of these societies, making twenty men in all, form the joint council, which in turn is officered by an executive committee of five. The members of this executive committee are: C. D. Marx, chairman; E. C. Jones and E. C. Hutchinson, vice-chairmen; N. A. Bowers, secretary-treasurer, and E. O. Shreve, assistant secretary.

This organization is the outcome of several meetings of the secretaries of the five societies involved at which plans for more effective inter-society coöperation have been worked out. Some of the expected advantages are a closer touch among members of the several associations, putting the several employment bureaus together in one central office, joint meetings to discuss subjects of common interest, coöperation for the sake of economy as in mailing notices, consolidating headquarters at the Engineers' Club, etc.

In a paper on this subject read at a recent joint meeting it was pointed out that "membership in a national engineering society has always carried with it a certain amount of prestige. Here in the Far West we have been content with little besides that as a return for our annual dues. In recent years local sections have taken on new importance, and it is not now uncommon to find the man who believes he can get more real benefit from his local section than from the national organization.

"Our parent societies have joined in forming the United Engineering Society, and the plan has proved eminently successful from every angle. May we not begin now to lay the foundation for branches of that organization in Western centers? Why not the San Francisco branch of the United Engineering Society? At least we may suggest this as an ultimate possibility, another incentive among the opportunities that await our pioneer joint council."

Purpose of the Organization

The joint council will have regular meetings once a month, the executive committee convening at the pleasure of its members. The constitution tentatively adopted at the Sept. 4 meeting sets forth the following as the purposes of the organization:

1. To foster closer relationship among the engineering societies of San Francisco, especially in those matters (a) where coöperation will make for more efficient "win the war" service, (b) where coöperation will make for more efficient service to the State of California, its cities and counties, and (c) where coöperation will expedite progress toward those ideals common to our several organizations.

2. To plan and carry out arrangements for joint meetings of the several societies whenever such meetings are deemed advisable and to endeavor to make joint meetings effective in developing closer relationships among members of the several societies.

3. To act generally as the clearing house for matters which involve the several societies, especially where the common good will be enhanced by working through an executive head representative of the several organizations.

The first act of the joint council, typical of the work that lies before it, was the decision to urge upon the Governor of the state the appointment of an engineer as member of the State Railroad Commission. In making this recommendation it was pointed out that "the best interest of the state would be served by the appointment of engineers as members of commissions dealing with problems the solution of which requires technical training and experience" and that the appointment of an engineer to fill one of the vacancies on the State Railroad Commission would doubtless "be regarded by the people of the state as indicating a wish to place the public service on the highest plane of efficiency and will be creditable both to the appointing power and to the engineering profession."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Rates According to Size of Communities.—Allowing higher rates for the Galva Electric Company, the Illinois Public Utilities Commission reaches also an opinion on the point set forth below: "Contention was made by representatives of the city of Galva that, on account of the fact of the larger size of the city of Galva, the rates charged for electric service should be less than those charged in other communities. There is no evidence in the record tending to substantiate this contention, and it would appear from a general knowledge of the situation quite probable that the costs of production and distribution in Galva were seriously influenced by the fact that other communities are receiving service from the same power plant. Such an influence would necessarily result in more efficient plant operation, due to the increased load factor, to the fact that the plant can operate more efficiently if producing a large quantity of energy than it could with a small quantity, and to other similar considerations. Viewing the matter from this standpoint, it would appear probable that the city of Galva might well be considered as benefiting by the fact that a large number of consumers receive service from this source with resulting economies in which all consumers should share. Basing its conclusion upon the record herein, the commission will make no distinction in the rates authorized as between Galva and the other communities."

The Need of the Present Hour.—In authorizing higher electric rates for the Oklahoma Gas & Electric Company the Oklahoma Corporation Commission says in part: "Neither the record in this case nor any information in the possession of the commission contradicts the showing in the application herein as to the need for the increase asked. The commission is convinced that the need of the present hour, instead of promising to disappear with the eventualities of the next few months, will become more urgent and imperative. The figures above considered indicate that the applicant is not immune from the operation of the economic law which governs the affairs of mankind in general, and of the American people and of the people of Oklahoma like the rest. The man who builds a house at this time finds that on account of the increase in the cost of materials and labor its cost is greater than that of a year or two ago. The man who buys groceries and clothing for his family finds it necessary to pay more for these commodities than has been his necessity heretofore. It happens that the man or corporation buying materials and labor for the manufacture of electricity is in the same position, and it seems to be inevitable that while present conditions continue the man who buys electricity must find himself confronted with the operation of the same law. It costs more to produce the commodity. Therefore the purchaser of the commodity must pay more. If this commission is to measure up to its full duty in relation to the national crisis, it must take this condition into consideration." The commission then quotes the correspondence between the Secretary of the Treasury and the President.

Interest on Consumers' Deposits.—The New Jersey Board of Public Utility Commissioners, in a case affecting the Atlantic Coast Electric Light Company, says: "The board recognizes that at seasonal resorts conditions differ from those pertaining to places where the greater part of the population maintain their residences throughout the year. It may be that the rule which requires deposits by all non-property owners as a condition of supplying service is reasonable in view of the conditions under which the company operates. The record before the board is not sufficient to decide this question. It is clear, however, that a rule such as the company has adopted results in the accumulation by it of considerable sums of money available for use before service is afforded and many of the expenses incidental thereto have been incurred. This is a distinct advantage to the company, and a disadvantage to those who for the time being part with their money without receiving service equal to its value. The company does not deny that interest should be allowed, but claims that as the highest grade of interest paid by any banking institution in the county is 4 per cent, it is not reasonable to expect it to pay more. It was testified at the hearing that the company borrows money for use in its business at 5 per cent. It seems to the board that the rate of interest a bank may allow to willing depositors on money which it loans at a profit should not be accepted without limitation as the rate a public utility should allow on deposits not made voluntarily, but as a condition of supplying service. The total operating revenues of the Atlantic Coast Electric Light Company for the year 1917, as shown by its report to this board, were $231,599; operating expenses, including taxes, $201,548. The lowest sum on deposit at any time during the year was $9,281 in the month of February. In August this sum had increased to $26,578. Surely, when the company obtains in advance from its customers so material a part of the cost of supplying service, it is not unreasonable for it to pay interest at a rate equal to that it pays for money borrowed from the bank, which appears to be 5 per cent. The board recommends that this rate be allowed."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Illinois State Association of Electrical Contractors and Dealers.—On Sept. 19 and 20 the meeting of the Illinois State Association of Electrical Contractors and Dealers will be held at Peoria.

Detroit Engineering Society.—The opening meeting of the season of the Detroit Engineering Society was held on Sept. 6. H. H. Esselstyn addressed the meeting on "the Hog Island Shipyard." On Aug. 26 the society attended a meeting called by the advisory board on fuel conservation, United States Fuel Administration, at which coal conservation as applied to industries was discussed.

A. I. E. E., Chicago Section.—The joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the War Committee of the Technical Societies of Chicago will be held on Sept. 23, 1918, in Chicago. An address will be delivered by Col. P. Junkersfeld on the subject of "Emergency Construction for the War Department in the United States." The lecture will be fully illustrated by lantern slides and possibly by motion pictures.

American Bankers' Association.—The forty-fourth annual convention of the American Bankers' Association will be held at Chicago in the week beginning Sept. 23. It will be a war convention, and the various sessions will be devoted largely to addresses on topics of the day. Among the speakers who will address the convention are W. H. Vandervoort of the Root & Vandervoort Engineering Company, East Moline, Ill., whose subject will be "Relations Between Employer and Employee." Samuel Insull, president of the Commonwealth Edison Company, will discuss the effect of the war on public utility securities.

American Gear Manufacturers' Association.—An interesting program is being arranged for the semi-annual meeting of the American Gear Manufacturers' Association, which will be held at the Onondaga Hotel, Syracuse, N. Y., on Sept. 19, 20 and 21. A portion of the program has been announced as follows: "Priority," by Charles A. Otis of the Priority Committee; "What Is the Possibility of Women Becoming a Permanent Factor in the Gear Industry?" by W. H. Diefendorf; "Trade Acceptances," by C. E. Crofoot, and "The Outlook of the Steel Supply," by C. E. Stuart, secretary and treasurer of the Central Steel Company, Massillon, Ohio.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Massachusetts Rate Advance.—The Fall River (Mass.) Electric Light Company has filed notice with the Board of Gas and Electric Light Commissioners of Massachusetts of an increase in the charge for energy for lighting purposes from 9 to 10 cents per kilowatt-hour, and of energy for power from 6 to 7 cents.

Chicago Has 500,000 Telephones.—On July 30, 1918, the Chicago Telephone Company installed the five-hundred-thousandth telephone in Chicago. It was installed for Samuel Insull, chairman of the State Council of Defense of Illinois and president of the Commonwealth Edison Company, in his Council of Defense office at 120 West Adams Street.

Christmas Buying.—The Council of National Defense has issued a statement regarding the necessity of restricting Christmas giving. Among the reasons are the necessity for saving labor and material in the manufacture and sale of Christmas gifts and of saving the transportation and delivery facilities necessarily involved in the large volume of Christmas purchases. Representatives of leading industries and retail interests concerned have agreed not to increase working forces over the average prices throughout the year and not to increase normal hours in the Christmas season. Efforts will be made to confine buying, except for young children, to useful articles and to spread the buying period over October, November and December. Economy in deliveries will also be promoted.

Rate Increase in Malden, Mass.—In announcing an increase of 1 cent per kilowatt-hour, effective on Sept. 1, J. T. Day, manager Malden (Mass.) Electric Company, says in part to consumers: "It has for a long time been the established policy of this company to reduce its rates for service as rapidly as the growth of the business and increased efficiency of operations made reductions possible. Increasing cost of coal, labor and all materials entering into the manufacture and distribution of electricity makes it necessary, however, for us to increase our rates for lighting and power service. We urge our customers, wherever possible, to limit the use of electricity as much as they reasonably can and to eliminate all wasteful uses of energy. Power users, in particular, are urged to adopt every means to utilize the electric supply efficiently, thereby assisting the Fuel Administrator in his efforts to conserve the coal throughout New England."

Steps to Prevent St. Louis Strike.—Officials of the Union Electric Light & Power Company, St. Louis, have taken steps to prevent an attempt by the Brotherhood of Electrical Workers to start a strike. They telegraphed the United States government labor authorities at Washington, in reference to the request of the War Labor Board that the company withdraw its application for an injunction against officials and members of the brotherhood, that the company proposes to carry out its legal action. "Under the circumstances," said the telegram, "we cannot consent to dismiss legal action to safeguard continuity of service to important war industries and the maintenance of the present system of industrial relaions." In this connection warning has been given against tampering with the transmission lines. "Any attempt to stop the supply of electric service to this community would be disastrous," the company says. "While the average residence might subsist for awhile on candles, electric light service is a matter of life and death in many hospitals. A shutdown of long duration," the St. Louis company goes on to point out, "would shut down many industries now working at full speed on government supplies."

Pacific Coast Fuel Oil Requirements.—The demand for crude oil in 1918 is estimated at 90,000,000 bbl. as against 96,000,000 bbl. consumed in 1917. This figure has been announced by D. M. Folsom, Petroleum Administrator for the Pacific Coast, who assigns the decrease to conservation measures, the conversion of numerous industrial plants for the use of coal, wood and electricity, and the restrictions of less essential industries. This total is also the estimated total of the expected demand for 1919, 1920 and 1921. The consumption of oil for shipping industries is expected to more than double during the next three years, so that by 1921 a total consumption of 24,000,000 bbl. is expected, as against 10,440,000 bbl. during the present year. The railroads used 34,000,000 bbl. of crude oil in 1917 and the estimated consumption this year will be 32,000,000. A total of 38,000,000 bbl. in 1921 is expected. Consumption by war industries will increase, it is estimated, to 8,000,000 bbl. in 1919 as against 2,000,000 bbl. in 1917. It is expected that this consumption will drop back to 7,000,000 bbl. in 1920 and then down to 2,000,000 bbl. in 1921. For food production in 1917, 4,650,000 bbl. were required. For that purpose during the present year the estimate is 5,160,000 bbl., with an expected increase to 5,500,000 in 1919 and 1920, and 6,000,000 in 1921. In mining and smelting operations a considerable decrease is looked for during the next three years. In 1917 for these industries 7,200,000 bbl. were consumed, the estimated demand for this year being 5,200,000 bbl. In 1919 a consumption of 4,500,000 bbl. is expected, while for 1920 the estimate is 4,000,000 bbl.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

High-Voltage Wire Insulation.—An electric light company charged with negligence in not insulating its power lines so as to protect the traveling public may, though the statute requires them to be "properly insulated," show "that no known substance thereon will prevent the escape of electricity under high voltage," the Supreme Court of Iowa held in Wells versus Chamberlain (168 N. W. 238).

Boy Has Right to Climb Trees.—In the case of John Wilke, administrator, versus S. N. Ford, receiver, heard before the Court of Appeals of Richland County, Ohio, the facts were as follows: The Mansfield Railway, Light & Power Company's wires in Mansfield, Ohio, passed through a tree on the sidewalk, and by reason of the abrasion of the limbs the insulation had worn off the wire. A boy about eleven years old while playing climbed up in the tree and came in contact with the uninsulated part of the wire and was killed. The Court of Appeals held that the boy had a right to be in the tree and that it was the duty of the light and power company so to maintain its wires as to prevent injury therefrom, and held that the approximate cause of the boy's death was the failure of the defendant company to have the wire properly insulated and that the company was liable. Judgment of the Common Pleas Court was reversed.

Water-Power Rights of Private Concerns.—Supreme Court Judge Whitmyer of Schenectady has handed down an opinion dismissing the complaint against the state filed by the West Virginia Pulp & Paper Company of Mechanicsville, N. Y., holding in substance that the fee title to the bed of the Hudson River at the point in question did not pass under the early colonial patents, but remained and remains in the state; that while the paper company by the legislative act referred to obtained a right to construct and maintain a dam at this point with crest at elevation 67.5 Barge Canal datum, it possessed no right to maintain the flashboards on the dam, and that, in any event, whatever rights it obtained under the said legislative act were subject and subservient to the reserved right of the state to do whatever was necessary to improve the navigation of the river, without responding to the paper company in damages, and that the Barge Canal improvement was such an improvement of the navigation of the Hudson River.

Men of the Industry

Changes in Personnel
and Position
Biographical Notes

R. S. Davies has been promoted to be new-business manager of the Lorain County Electric Company at Elyria, Ohio.

George H. Cook, for the past five years local manager for the Wisconsin Gas & Electric Company at Kenosha, Wis., has resigned to enter the army.

H. H. Murray has been appointed electrical engineer of the Eastern Connecticut Power Company. He was formerly employed by the General Electric Company and for six years was in charge of the electrical construction work in Barcelona, Spain.

H. C. Deffenbaugh, for the last year and a half assistant to the secretary of the Empire State Gas & Electric Association, has been commissioned first lieutenant, Corps of Engineers, United States Army, and assigned to the Searchlight Section, 56th Engineers, Washington Barracks, Washington, D. C. Prior to his connection with the association Mr. Deffenbaugh was cost engineer for the Rochester (N. Y.) Railway & Light Company, with which company he was associated since 1906.

T. F. Johnson has been promoted from superintendent of transmission and distribution of the Georgia Railway & Power Company, Atlanta, Ga., to assistant superintendent of the electrical department. Mr. Johnson was born in Savannah, Ga., in 1887 and was graduated from the Georgia School of Technology in mechanical engineering in 1908 and in electrical engineering in 1910. Since graduation he has been continuously in the employ of the former company in various positions. He is the inventor of several devices for handling live lines and for changing insulators on live lines operating on voltages as high as 110,000. Among his devices is the Johnson lamp.

P. D. Wagoner, formerly president of the General Vehicle Company, has been elected president of the Elliott-Fisher Company, Harrisburg, Pa. Mr. Wagoner was born July 24, 1876, in Somerville, N. J., and received his preparatory education in the public and high schools there. He afterward attended the Stevens School and the Stevens Institute of Technology, being graduated from the last-named institution in 1896 with the degree of mechanical engineer. After graduation he entered the students' course of the General Electric Company. After a short time he was transferred to the transformer engineering department at Lynn, Mass., where he remained until May, 1900. Thence he was sent to the company's plant at Schenectady, N. Y., where he was assigned to the office of the engineer of the supply department, specializing in transformer work. In 1901 he was delegated to organize and manage the transformer sales department. In the early part of 1908 Mr. Wagoner was transferred to the executive offices of the General Electric Company in New York City. In 1910 he was elected to the presidency of the General Vehicle Company.

Thomas Sproule, in charge of the overhead-line construction department of the Philadelphia Electric Company, is president-elect of the Pennsylvania Electric Association. Mr. Sproule was born in Philadelphia, where he received his early education, being graduated from the Central Manual Training School. He first became employed in pattern making, but later, in February, 1895, he entered the employ of the Brush Electric Company, since merged with the Philadelphia Electric Company, as draftsman. In this connection he became particularly interested in aërial and street-lighting work, and in 1902 he was promoted to be assistant to the engineer of that department. Mr. Sproule has been a member of the overhead-line committee of the N. E. L. A. since the formation of that committee and served as its chairman two years, 1914 and 1915, during which time the handbook on overhead-line construction was written and issued by the committee.

THOMAS SPROULE

Capt. R. H. Hastain, formerly with the sales department of the Mid-West Electric Company, Omaha, Neb., is now in France with the 317th Field Signal Battery, 76th Division. This is Captain Hastain's second time in the service. Early in 1903 he left the service of the Bell Telephone Company at Sedalia, Mo., and enlisted in the Signal Corps. He saw service in the Philippine Islands with the Signal Corps until 1909. After returning from the Philippine Islands he entered the sales department of the old Dean Electric Company. Upon his arrival in France he was promoted from first lieutenant to captain of his company.

H. A. Joslin, district manager of the Oregon Power Company at Dallas, Ore., has been appointed farm labor agent by the Dallas Commercial Club, acting for the United States Labor Commission. Mr. Joslin has also been appointed vice-president of the Chamber of Commerce.

Ward M. Burgess, vice-president and director of the Nebraska Power Company, Omaha, Neb., as a result of his conspicuous work in connection with the war savings investment, has been retained by the Treasury Department at Washington for further work of a broader nature. Mr. Burgess was appointed Nebraska War Savings Director by Secretary McAdoo in November, 1917. Under his leadership the work was thoroughly organized in Nebraska and pushed with such vigor that by the end of January Nebraska was leading all the states in per capita sales, and on March 22 a drive for pledges was held all over the state which resulted in an oversubscription of the state's quota and enormous cash sales. Nebraska's quota was a little less than $26,000,000 and as a result of the big drive in March about $33,000,000 was sold and pledged. Mr. Burgess was then called to Washington by the national committee to attempt by the same methods as those used in Nebraska to secure a similar result in other states. A special drive for pledges in June was organized and carried out all over the country. As a result of this campaign $211,000,000 was received by the Treasury during July from the sale of war savings stamps, while the total for the best previous month had been less than a third as large. The total cash received up to Aug. 14 was $590,940,834, representing stamps to the maturity value of $711,976,905. In addition to this amount actually sold, the national committee, from reports received from state directors, estimates that there are additional pledges to the amount of $850,000,000, making the total sales and pledges about $1,561,976,905, this being more than 78 per cent of the entire issue authorized for the year by Congress. A comparative statement issued by the national committee, following the national June campaign, showed total sales and pledges in Nebraska to the amount of 130 per cent of the state's quota, the next nearest state showing 109 per cent of its quota, and the lowest state showing only 26 per cent.

Obituary

Vilas A. Henderson, secretary and new-business manager of the Memphis Gas & Electric Company, died on Aug. 19 at Memphis, Tenn. Mr. Henderson was born on Aug. 16, 1879, at Princeton, Ill. He was a graduate of the electrical engineering school of the University of Nebraska and had been employed by central-station interests in the cities of Lincoln, Neb., and Denver, Col.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

BRIDGEPORT (CONN.) LABOR DECISION IS RENDERED

Basic Eight-Hour Day and Minimum Wage for Men and Women Established—Umpire Decides Against Changing Classification

What is probably one of the most important labor decisions that have so far been handed down by the National War Labor Board was recently made by Otto M. Eidlitz, umpire chosen by the board to decide the controversy between the managements and approximately 60,000 workers in sixty-six plants of Bridgeport, Conn. Among these plants were some engaged in producing electrical material.

The decision grants wage increases to all of the workers receiving less than 78 cents an hour and establishes a minimum wage of 42 cents an hour for all male workers skilled or unskilled, twenty-one years of age or over, and a minimum wage of 12 cents an hour for all female workers eighteen years of age or over; grants the demand of workers for the application of the basic eight-hour day in all of the manufacturing plants of Bridgeport; establishes the right of workers to bargain collectively and to join trade unions, and provides that women performing the same work as men shall receive equal pay. On the important question of classification the umpire decided against changing the method now in operation, on the ground that suddenly to order a complete readjustment of the prevailing working system would be prejudicial to the interest of the government, which is directly concerned in the output of the Bridgeport industries. With regard to classification, it was the demand of the workers in the machine shops that, in the performance of their respective duties, they be classified as toolmakers, machinists, specialists and machinists' helpers, and that minimum rates of pay be established for each of these classifications. This was a major point of difference in the controversy. The employers contended that the great variety of tasks necessary in the operation of the industries made it impossible to confine the classification within the narrow limitations demanded by the workers or to fix a flat rate of pay for workers.

In addition to the selection by the workers of committees to represent them in their dealings with the managements, the decision provided that there shall be established a local board composed of six members, three to be chosen by and to represent the workers of Bridgeport and three to be chosen by and to represent the employing companies, the function of which shall be to adjust such future differences as cannot be settled between employer and employees. The chairman of this committee is to be chosen by and to represent the Secretary of War.

Touching upon the recognition by the War Labor Board of the right to collective bargaining, the decision declares that "we have passed from the day of the individual to the day of the group, and that the will of the group shall have precedence over the will of the individual."

The decision directs the secretary of the board to appoint an examiner to supervise the application of the award.

The Bridgeport case originally was confined to a controversy between the machinists and the managements in a few of the larger plants. The entrance of the War Labor Board into the controversy presented to the other employers an opportunity to bring about the establishment of a uniform system of industrial relations applied to the whole of the community. Advantage was taken of this opportunity when the thirty-four concerns not parties to the original issue agreed voluntarily to be bound by the decision reached in the cases of the firms directly involved.

The wage increases provided for in the award are made retroactive to May 1 in certain cases, to June 26 in the case of six other plants which submitted to the board's jurisdiction on that date, and to July 1 in the cases of the thirty-four plants which voluntarily came before the board on that date. All of the companies are given until Oct. 1, 1918, to complete the back payment of wages. The award is effective for the duration of the war, except as either party may reopen the case at periods of six-month intervals for such adjustments as changed conditions may render necessary.

HANDLING GOVERNMENT ORDERS PRESENTS DIFFICULTIES

Trouble in Collecting Accounts Arises When Materials Are Shipped Without Prior Receipt of Formal Order

The jobber who is called upon by a representative of the government to supply material for war service naturally desires to meet the situation in the best possible manner. Unfortunately orders are sometimes placed orally by officers unfamiliar with business methods, and in some cases the results have been unfair to the jobber, doubtless without the least intention to work any injustice on the part of the government. Often the jobber has immediately shipped material on a war order without waiting for the formal written confirmation, or else has placed a corresponding order with the manufacturers on the strength of a telephone conversation or a personal interview with the government's representative. The pressure to get material is very great, and now and then the government's representatives "short-circuit" the jobber by issuing instructions to the manufacturer direct to ship material by means which lead to delays; the material arrives late, and when the jobber presents his bill he finds it practically out of the question to collect it because the government representative has refused to accept the shipment. In time, the jobber might collect through the courts, but the cost would be very serious. Again, a jobber not seldom receives instructions or specified conditions on the formal order which were never mentioned in the original negotiations preceding the purchase of material or its shipment, and it has happened that unless he meets these later and new requirements, he can make his collections only with great delay.

There is a belief in the trade that the jobber is justified in refusing to ship material, after a few such experiences, except upon receipt of the formal order from the government. There is often a very great gap between the official placing an order and the final authority who approves the jobber's bills for payment, and a certain amount of self-protection must be had if the jobber is going to keep in business and serve the government efficiently. A clear understanding between all parties concerned as to what is wanted, when and how it is to be supplied, and upon what terms of payment, is an important thing at this time. Immediate shipments of material from jobbers' stocks on the receipt of verbal orders are probably necessary in many cases, but for the future successful relations of the government, the manufacturers and the jobbers, it is vitally important that the delay between placing the order by word of mouth and its formal confirmation be reduced to the absolute minimum.

THE WEEK IN TRADE

GENERALLY speaking, the volume of sales is still being maintained. Nevertheless, the position of the government relative to articles made from iron, steel, copper, brass and rubber, which include almost all electrical supplies, is beginning to make itself felt with the trade. Inquiries are beginning to fall off, and in a very large number of lines a decreasing business must necessarily follow. The jobbing industry here and there is already beginning to feel this. To a certain extent, however, the trade will welcome a less feverish market.

Wire and conduit appear to be scarcer than ever, with little outlook for an early improvement. The second-hand market appears to be slowing up in the East in small apparatus.

Labor is still very unsettled and is now the greatest handicap of all to production. Wages continue to increase.

Reports from the agricultural centers are not favorable. The corn crop will be small, as will cotton and to a less degree potatoes. Wheat appears to be in a better condition than was previously reported.

On the eve of the fourth Liberty loan drive collections appear to be showing no tendency to drop off.

NEW YORK

Jobbers' stocks are reported in fair condition in the majority of cases, but uncertainty is apparent as to the future supply of some materials. Small sizes of copper wire especially are practically non-obtainable at this time. Wire manufacturers report that 95 per cent of their efforts are being directed directly to war work, and it is believed that 98 per cent of their output will shortly be given over to government work.

The procurement branch No. 3, section 3A, of the hardware and metals division of the United States Army Quartermasters' Corps announces purchases and contracts to be made this week of sixty-two individual motor-driven sewing and binding machines and sixty induction motors with ratings of less than 3-hp.

After the close of the fourth Liberty loan drive, some relief is looked for on the building situation in and around New York. It is expected that more help in the way of fuel and material is to be obtained to take care of the necessary construction requirements. The fact that the government has been taking over certain large buildings will make considerable construction necessary. In the seven months ended July 31 building construction under government curtailment in New York metropolitan districts within a radius of 100 miles from New York (excluding Philadelphia) has shown a decline of 36.6 per cent, and at the same time the demand for all kinds of space, residential, commercial, storage and industrial, has been stimulated abnormally.

WIRE.—Uncertain deliveries, especially in small sizes of wire, are causing no small concern among jobbers. The Signal Corps has changed its requirements from 10,000 miles to 65,000 miles of No. 17 seven-strand copper wire per month for outpost wire and is at the present time using some coppered steel wire. This leaves the telephone and telegraph companies without their usual copper-wire requirements and they have been required to use No. 14 hard-drawn steel wire. Insufficient capacity in stranding and binding machines is causing the trouble, and until production catches up with the government requirements jobbers will continue to have trouble getting small sizes of wire.

SECOND-HAND MACHINERY.—The demand for apparatus below 75 hp. has fallen off considerably of late. This is due to concerns being stocked up on small sizes and the gradual elimination of less essential industries. So far the lack of demand has not affected the prices of this type of machinery. The increased demand for large apparatus can be supplied with 10 per cent of orders according to several dealers.

POLE-LINE HARDWARE.—Public utilities have started placing fair-sized orders in this vicinity. The supply and stocks are reported good.

ELECTRIC APPLIANCES.—Generally speaking, the stock of household appliances in this vicinity is fair at present, although the increasing demand cannot be met. Industrial appliances appear to be low, however. Department stores are buying only in small quantities and infrequently and are not carrying stocks nearly as large as formerly. Manufacturers are eliminating certain types of vacuum cleaners as ordered by the War Industries Board.

CONDUIT.—Stocks are reported light with small chance of obtaining additional supplies in this district. Considerable time is entailed in obtaining priority orders for the purchase of this material and the railroad classification priority order for transportation.

CHICAGO

To prepare a workable plan of speedy industrial and commercial reconstruction which will be ready to operate immediately at the close of the war, a group of Chicago business associates, headed by the War Service Editorial Conference of the Chicago Trade Press Association, is planning a national convention, to be held probably on Dec. 5 and 6 in Chicago. Business men and government officials of national and international repute will speak on raw materials, credits, reconstructive merchandising, reconstruction of commodity prices, what to do with our increased production, government and business, and international relations.

In bringing nearer the answer to the question "What will be the business situation after the war?" this meeting is expected to be of real service to industry and commerce. "Prepare for reconstruction" is to be the slogan for the work.

CREDITS.—The Chicago Clearing House is expected to follow the action of the New York Clearing House in reducing the minimum charge on acceptances from out of town.

GRAPHIC METERS.—Production is so much graver a problem than sales that one prominent Middle Western manufacturer has turned over the office end of his business to his subordinates and is spending all of his time at the factory.

LIGHTING REFLECTORS.—Effective Sept. 3, the National X-Ray Reflector Company increased its prices on lighting reflectors about 10 per cent. This increase is the more interesting because the company's plan of discounts has been also changed. It now conforms with the so-called Goodwin plan, affording protection to all branches of the trade.

ROTARY CONVERTERS.—Small rotary converters are in such demand by the government for battery-charging work that one Chicago manufacturer has the converter department of his business 100 per cent on war work. His difficulty with materials may be appreciated by the fact that last week he had a shipment of steel by express from Pittsburgh.

HEATING DEVICES.—The Edison Electric Appliance Company is preparing to advertise to the public the fact that it advocates that old electrical appliances be used as long as it is possible to make them work before buying new ones. By this means the company is discouraging the waste of raw materials and fuel and at the same time urging the adoption of the electrical way of cooking and heating where, and only where, the national interest will be served.

WASHING MACHINES.—Another Chicago manufacturer has raised his prices about 10 per cent.

BOSTON

Trade continues extremely active. Collections do not show great change from week to week, but it is not thought that money will be much easier for the present, in face of the forthcoming Liberty loan campaign and of the prospective revenue law. Deliveries are still running long on many lines of supplies and equipment, owing partly to railroad congestion and partly to factories being oversold. The labor market is decidedly unsettled on account of war demands and the unknown effect of the next draft upon industry. New England jobbers are maintaining fairly good stocks, but there is a decided tendency toward shortage conditions in labor-saving appliances. Electrical contractors are doing very little new wiring outside of war-plant jobs, but some house wiring is in sight in connection with the building of homes for shipyard and munitions plant workers.

FIXTURES.—Stocks are unusually large and well assorted. While business is at a lower ebb than in normal times, there is some buying of fixtures for residential refurnishing. Prices are holding up well.

WIRE AND CABLE.—Government business continues brisk. A Rhode Island plant received an order a few days ago for 4000 miles of No. 18 twin-conductor field service wire. This looks like a large order until one realizes that it is only part of a total order of 200,000 miles of twin-conductor (400,000 miles single wire) just placed for the army and distributed among plants in different sections of the country.

CONDUIT.—Stocks are running lower. Pipe is hard to obtain, and deliveries are very long despite priority orders. Representative houses are short on all sizes.

WASHING MACHINES.—The demand continues very heavy, and jobbers are having difficulty in filling orders.

MOTORS.—Small sizes are still in vigorous demand. Stocks are in better shape than for several months, all things considered. Prices show little change.

VACUUM CLEANERS.—A brisk demand is being encountered with the opening of the fall season. Some extra war work is being handled, and one plant in Massachusetts is turning out stretchers and wigwag staffs in addition to its regular lines. Price tendencies are upward.

AUTOMOBILE SUPPLIES.—The prohibition of Sunday pleasure riding in order to save gasoline has affected the retail dealer somewhat, and the jobber will soon note a difference in trade if the curtailment is continued. Local agencies are finding it somewhat hard to obtain batteries in sufficient quantity.

LAMPS.—The situation is very satisfactory as regards meeting current demands, and there is little fear of a shortage arising this fall considering the efforts the manufacturers have made to enlarge their facilities.

INDUSTRIAL ELECTRICAL TRUCKS.—Consistent development of the field for this equipment has been rewarded, and a good deal of business is now seeking local agencies. Less canvassing of the territory for new orders is at present required. Competition is keen and deliveries are rather spotty.

ELECTRICALLY DRIVEN REFRIGERATING EQUIPMENT.—Business has been excellent this summer. One prominent manufacturer reported that the volume of work done has never been exceeded with the exception of last year. Military and naval hospitals have been buying on a considerable scale, and some cantonment sales have been made. Labor is scarcer and the cost of motors and pipe coils trends upward. Erecting mechanics of draft age are hard to procure. There is little or no stocking up at factories, and with the government orders being handled the manufacturers are about as active as their facilities make possible.

FUSES.—The demand is very large for industrial and government service.

MOLDED INSULATION.—Factories are oversold and could double their production if the necessary machinery and labor could be obtained. A good deal of this insulation is going into war supplies, notably magnetos for army trucks, aëroplanes, etc. No tendency toward lower prices is to be seen.

ATLANTA

The volume of transactions in the electrical field continues satisfactory, with the possible exception of steel products. Although government takings of steel goods and allied lines are fairly heavy, distributers have noticed a decrease in sales during the past week. Jobbers expect this line to sag off slowly owing to the Priorities Committee's ruling. The fact that electrical supplies have been put on the preferential list for essential work will tend to maintain a substantial market for these goods. No effect is visible at this time of the orders curtailing the output of certain appliances.

While there are continued reports of labor shortage on account of the draft, this shortage is due to the many thousand workmen employed at shipyards, cantonments and other government work in the Southeast.

The Emergency Fleet Corporation had decided on an expenditure of $1,250,000 for building a 10,000-ton dry dock with accompanying facilities at New Orleans, employing 400 men. The St. Petersburgh (Fla.) Maritime & Construction Company has been recently organized. A large plant for the manufacture of silicon alloy is contemplated by the Chattanooga (Tenn.) Electro-Metals Company. Eight camps in the Southeast will be equipped with electrically operated laundries costing approximately $160,000 each.

Although light showers have fallen on the watersheds serving the water-power plants of the Georgia Railway & Power Company, the drought remains unbroken, and the lack of power is so serious that the Building Managers' Association of Atlanta has agreed to curtail elevator service 50 per cent. All hydroelectric customers and retail users of 25 hp. and above have discontinued power service, with th exception of the very essential industries and plants on 100 per cent war work

CONDUIT.—It is becoming more difficult each day to secure conduit. A few weeks ago reasonable quantities could be obtained by making proper affidavits, but the latest indications are that domestic stock may be commandeered for government use. For those who can produce a class AA or A classification the problem is not so serious. Jobbers report stocks as being lower at present than they have been in a long time.

STEEL-ARMORED CABLE.—There appears to be a moderate stock of this material on hand.

PANELBOARDS.—The demand for panelboards remains steady. The volume of business transacted is, however, handled mostly through government channels.

SEATTLE—PORTLAND

Business remains steady with the usual heavy sales volumes to shipyards and allied industrials. There were few large orders during the past week, but total sales were a shade heavier. This applied particularly to the Seattle field. Seattle jobbers report that power apparatus the past week moved faster, while Portland states that the activity was confined largely to motor sales of 50 hp. or less. This size is going rapidly. Power apparatus is coming through only on government orders, but Northwestern jobbers are fairly successful in securing stock. An important feature in Seattle is the threatened shortage of rubber-covered wire. The demand is very heavy and the shortage is becoming daily more acute in all sizes. Permission is being sought to use wire on knobs in downtown structures under erection owing to present scarcity of conduit. Much difficulty is being experienced in securing conduit for other essential building.

The Pacific Coast Steel Company, Portland, has placed an order for an 800-hp., 2200-volt induction motor for a plant under construction. Six months' delivery is promised. Specifications are expected in Portland shortly for a proposed spruce division cut-up plant to be operated in Toledo, Ore.

Jobbers report that large supplies of motors, transformers and other electrical supplies are on hand at the present time. They also state that very little effect is felt thus far by jobbers and manufacturers relative to placing of electrical goods on the preferred list. Fears of an oil-fuel shortage in the Northwest are gradually being dissipated as a result of well-sounded assurances from California. To date the More Homes Bureau, Seattle, has secured pledges for the erection of nearly 4000 dwellings before Jan. 1. The aggregate value of houses pledged is more than $87,000,000. More buildings in prospect for Camp Lewis include officers' quarters, addition to hospital and less important structures. It is reported that $750,000 additional will be added to the housing fund for accommodations of war workers at the Puget Sound Navy Yard, Bremerton. Portland authorities state that activity and demand for homes has never been better. The labor situation is daily becoming more complicated. There is said to be a shortage of 20,000 men in Seattle and the various Puget Sound cities alone.

FARM-LIGHTING PLANTS.—These are beginning to move, the demand during the past two weeks having been highly satisfactory. No campaigns are being conducted, except demonstrations at fairs. Stocks on hand are ample for present demand.

DOMESTIC APPLIANCES.—Sales are holding up well, but stocks are increasingly hard to secure. Washing machines are easily the leader.

LAMPS.—Portland jobbers report that lamp stocks are gradually improving, although there is still a real shortage in miniature sizes. Orders for 60-watt "mazdas" have exceeded stocks, but replacement stocks are now in transit from the Oakland factory. Shipments of 400-watt floodlighting lamps are slow. Seattle jobbers state that the shortage in small sizes has been overcome, but large sizes are hard to obtain. The demand for larger sizes has exceeded supply. With the approach of winter sales are showing a noticeable increase in shipbuilding and industrial centers, floodlamps experiencing a healthy movement.

COLLECTIONS.—The War Savings Stamp drive and the approaching fourth Liberty loan campaign are having no bad effect on collections, which are reported very good.

SAN FRANCISCO

There have been an unusually large number of bids received by local jobbers during this past week, presaging a winter drive on new factories, extensions and alterations. It is expected that the new draft registration will take a very large number of electrical men to assist in essential industries.

The United States government announces the construction of a one-hundred-and-fifty-thousand-dollar laundry at Camp Kearny, stating that nearly $6,000,000 has already been expended for such laundries in all the United States camps. A repair shop for the Quartermasters' Department is also building at Camp Kearny. A meat-packing plant at Modesto, a fruit-packing house at Redlands, a bean warehouse at Santa Maria, fish canneries near Los Angeles, schools and hospitals in Oakland, a state warehouse for Phoenix, Ariz., and a million-dollar construction job at Clyde, near Bay Point, where three, four and five room cottages are to be built, are items of new construction that are announced.

RANGES.—It is possible that electric ranges will be installed in the industrial cottage scheme near Bay Point referred to above, where 350 cottages are contemplated, and a number of firms are figuring on the installation. The power company is not yet selected. The only other competing fuel would necessitate the construction of a 13-mile line of gas mains.

FARM-LIGHTING SETS.—The Western Electric, Lally and Delco plants report big sales. These firms were all represented in attractive booths at the California State Fair, held recently in Sacramento and largely attended by farmers and orchardists. The increasing number of sales has rendered local stocks of 32-volt appliances for them necessary. Stocks and deliveries are good.

HAND LANTERNS.—Electric hand lanterns, especially the kind using two dry batteries of standard size, are in demand. An almost incalculable amount of damage has been done by agitators and pro-Germans, and protective patrolling of orchards, vineyards and wheat fields is necessary.

SPARK COILS.—Sales of gas engines for pumping plants and as prime movers for 32-volt plants have produced a big demand for spark coils. All of the gas-engine factories have been very busy. Prices have remained constant during the year.

INSULATING MATERIALS.—Further drastic advances of from 15 to 25 per cent in mica and tapes are reported, with uncertain deliveries. The latest impetus to the sale of this material is the requirement of essential industry orders or priority certificates on sales of all new motors, and repaired motors are in great demand.

METAL MARKET SITUATION

Tin Continues to Fall Off £2 per Ton in English Market—Producers Controlling Lead Supply

Copper during the past week has shown no change. The demand is still large and production is off owing to labor trouble. A tremendous shortage of rolled brass has come to light, and manufacturers must now limit their sales to essential industries.

Tin continues to fall in price in the English market about £2 per ton daily. This is taken to be in preparation for a lower fixed government price. Recent cables would lead buyers to expect £300 per ton as the fixed price. Present quotations are ruling at about £40 higher. Already the Inter-Allied Tin Executive Committee has established sittings in London.

A report from Washington on Wednesday was to the effect that two-thirds of the pig-tin supply of the world is to be received by the United States under a pooling arrangement made at a recent conference in London between representatives of the United States, Great Britain, France and Italy. Shipments to be made to this country will be consigned to the American Iron and Steel Institute, which will distribute the material at regulated prices to consumers.

Lead is now controlled by the producers' committee, through which all pig lead will be cleared or allotted. Scrap metals show no change.

NEW YORK METAL MARKET PRICES

	Sept. 3	Sept. 10
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26 00	Govt. price 26 00
Electrolytic	Govt. price 26 00	Govt. price 26 00
Casting	Govt. price 26 00	Govt. price 26 00
Wire base	29 25	29 25
Lead, trust price	8 05	8.05
Antimony	14 12½	14 00
Nickel, ingot	40 00	40 00
Sheet zinc, f.o.b. smelter	15 00	15 70
Spelter, spot	9 50	9 70
Tin, Chinese *	No quotations	No quotations
Aluminum, 98 to 99 per cent	Govt. price †33 10	Govt. price †33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	23 50 to 24 50	23 50 to 24 50
Brass, heavy	14 50 to 15 00	14 50 to 15 00
Brass, light	11 50 to 12 25	11 50 to 12 25
Lead, heavy	7.50 to 7.75	7 50 to 7 75
Zinc, old scrap	6.50 to 6.75	6.50 to 6 75

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* No Straits offering. † In 50-ton lots or more; carload, 33 10 cents per lb. 1-ton to 14-ton lots, 33 20 cents per lb.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List Per 1000 Ft
No. 14 solid	$61 00
No. 12 solid	71 00
No. 10 solid	90 00
No. 8 solid	106 00
No. 6 solid	145 00
No 10 stranded	95 00
No. 8 stranded	115 00
No. 6 stranded	160 00
No. 4 stranded	205 00
No. 2 stranded	266 00
No. 1 stranded	315 00

Twin-Conductor

No. 14 solid	104 00
No. 12 solid	135 00
No. 10 solid	185 00
No. 8 stranded	235 00
No. 6 stranded	370 00
No. 4 stranded	575 00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	12½%—57 25

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	12½%—66 75

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	12½% 97 75

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	12½%—126 80

DISCOUNT - CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20% to List
Coil to 1000 ft	5% to 15%

	No 12 Solid
Less than coil	+20% to List
Coil to 1000 ft	5% to 15%

Twin-Conductor

	No 14 Solid
Less than coil	+5% to $80 00
Coil to 1000 ft	5% to 75 00

	No. 12 Solid
Less than coil	+20% to +5%
Coil to 1000 ft	5%

ATTACHMENT PLUGS

List ranges from $0 22 to $0 30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std pkg.	12%
1/5 to std. pkg	20%
Std pkg	44%

DISCOUNT—CHICAGO

Less than 1/5 std pkg	+20% to 12%
1/5 to std. pkg	List to 20%
Std pkg	25% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 40	$0 40
12 to 50	35— 36	35— 36
50 to barrel	31— 32	32— 33
Barrel lots	28— 289	.29— 299

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No 6 Ignitor
Less than 12	$0 40	$0 40
12 to 50	35	35
50 to barrel	319 to 322	329 to 33
Barrel lots	289 to 292	299 to .302

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft per Coil	List per 100 Ft
5/16	250	$5 00
⅜	250	7 50
½	100	10 00
¾	50	13 00
1	50	21 00
1¼	50	26 00
1½	25 50	35 00
2	25–50	45 00
2½	25-50	52 00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft
⅜-in single strip	$75 00	$63 75— 69.75
⅜-in. double strip.	75 00— 82 50	72 00— 75 00
½-in. single strip	100 00	85 00— 93 00
½-in. double strip	100 00 – 110 00	96 00—100 00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75 00	$63 75 to $64 25
⅜-in double strip	78 25 to $78 75	71 25
½-in single strip	100 00	75 00 to 85 00
½-in. double strip	105 00	93 00 to 95 00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In	List per Foot	Size, In.	List per Foot
7/32	$0 05½	1	$0.25
¼	06	1¼	33
⅜	09	1½	40
½	12	1¾	47
⅝	.15	2	55
¾	18	2¼	65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	25 00 55 00	24 00–24 45	21 50–23 00
¼-in.—	30 00 60 00	27 00-28 00	23 50–26 00

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in —	$60 00	$30 00	$26 50
¼-in.—	65 00	33 50	29 00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
¼	$0 08½
⅜	08½
½	08½
¾	11½
1	.17
1¼	23
1½	27½
2	37½
2½	58½
3	76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0 05	$0 19
⅜	06	19
½	.07	19
¾	10	.25
1	13	.37
1¼	.17	.45
1½	21	50
2	28	1 10
2½	40	1 80
3	60	4 80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	7% to 12%	9% to 14%
2500 to 5000 lb.	10% to 15%	12% to 17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb.	1 5% to 6 8%	3.5% to 8 8%
2500 to 5000 lb.	4 5 to 10.7%	6 5% to 12.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5.00 to $6 00
Discount	30%

CHICAGO

List price	$6 00 to $7 00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std Pkg	List
3-amp. to 30-amp	100	$0 25
35-amp. to 60-amp	100	.35
65-amp to 100-amp	50	90
110-amp to 200-amp	25	2 00
225-amp. to 400-amp	25	3 60
450-amp to 600-amp	10	5 50
600-Volt		
3-amp to 30-amp	100	$0 40
35-amp to 60-amp	100	60
65-amp. to 100-amp	50	1 50
110-amp to 200-amp	25	2 50
225-amp. to 400-amp	25	5 50
450 amp to 600-amp	10	8 00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30% to 31%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std pkg	$5 00 to $5 50
1/5 to std pkg	4 50 to 4 75

Standard packages, 500. List, each $0 07

CHICAGO

	Per 100 Net
Less than 1/5 std pkg	$7 00
1/5 to std pkg	5.75

Standard packages, 500 List, each, $0.07

LAMPS, MAZDA OR TUNGSTEN

105 to 125 Volts

Regular, Clear:	Std Pkg.	List, Each
10 to 40-watt—B	100	$0 30
60-watt—B	100	35
100-watt—B	24	70
75-watt—C	50	70
100-watt—C	24	1 10
200-watt—C	24	2 20
300-watt—C	24	3 25
Round Bulbs, 3½-in., Frosted:		
15-watt—G 25	50	53
25-watt—G 25	50	.55
40-watt—G 25	50	55
Round Bulbs, 3¾-in., Frosted		
60-watt—G 30	24	77
Round Bulbs, 4¼-in., Frosted		
100-watt—G 35	24	1 10

DISCOUNT—NEW YORK

Less than std pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft Net
Less than coil (250 ft.)	$20 20—$35 90
Coil to 1000 ft	26 95— 27 18

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$35 00
Coil to 1000 ft	26 00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24 00

CHICAGO

Net per 100	$21 75 to $30 00

OUTLET BOXES

Nos.	List, Per 100
101—A, A1½, 4 S.C., 6200, 320	$30 00
102—B.A., 6200, S.E., 300, A X., 1½, 4 S	30 00
103—C.A., 9, 4R, B 1½	25 00
106—F.A., 7, C.S., 1½, 3 R	20 00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10 00 list	25% to 33%	20% to 27%
$10 00 to $50 00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Glavanized
Less than $10 00 list	30% to 40%	20% to 35%
$10 00 to $50 00 list	40% to 50%	30% to 45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std pkg.	10%
1/5 to std. pkg.	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg	20%
Std. pkg	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$21 00 to $38.00
1/5 to std. pkg.	17 85 to 19 00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std pkg.	$16.80
1/5 to std. pkg.	15 80

Standard package, 2200. List per 1000, $20 00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std Pkg 3500 5½ N C	Std Pkg 4000 Solid Nail-it—N C.
Less than 1/5 std pkg	$16 00 to $20 20	$32 00
1/5 to std pkg	13 60 to 15 60	27 20

CHICAGO

Per 1000 Net	Std Pkg 3500. 5½ N C	Std Pkg 4000 Solid Nail-it—N C
Less than 1/5 std. pkg	$11 70 to $24 00	$33 85
1/5 to std. pkg	10 15 to 20 00	26 60

SOCKETS AND RECEPTACLES

	Std Pkg	List
½-in. cap key and push sockets.	500	$0 33
½-in. cap keyless socket	500	30
½-in. cap pull socket	250	60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+10% to 10%
1/5 to std pkg	5% to 8%

DISCOUNT—CHICAGO

Less than 1/5 std pkg.	List
1/5 std. pkg.	16⅔%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0 80
60-amp. S. P. S. T	1 20
100-amp. S. P. S. T.	2 25
200-amp. S. P. S. T.	3 48
300-amp. S. P. S. T.	5 34
30-amp. D. P. S. T	1 20
60-amp. D. P. S. T.	1 78
100-amp. D. P. S. T.	3 38
200-amp. D. P. S. T.	5 20
300-amp. D. P. S. T.	8 00
30-amp. 3 P. S. T.	1 80
60-amp. 3 P. S. T.	2 68
100-amp. 3 P. S. T.	5 08
200-amp. 3 P. S. T.	7 80
300-amp. 3 P. S. T.	12 00
Low Grade:	
30-amp. S. P. S. T.	$0 42
60-amp. S. P. S. T.	.74
100-amp. S. P. S. T.	1 50
200-amp. S. P. S. T.	2 70
30-amp. D. P. S. T.	68
60-amp. D. P. S. T.	1 22
100-amp. D. P. S. T.	2 50
200-amp. D. P. S. T.	4 50
30-amp. 3 P. S. T.	1 02
60-amp. 3 P. S. T	1 84
100-amp. 3 P. S. T	3 76
200-amp. 3 P. S. T.	6 76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+5% to Net
$10 to $25 list	11% to 15%
$25 to $50 list	14% to 20%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16% to 25%
$15 to $50 list	24% to 28%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+15% to +5%
$10 to $25 list	List to 11%
$25 to $50 list	5% to 14%
	Low Grade
Less than $10 list	+5% to 5%
$10 to $25 list	8% to 16%
$25 to $50 list	16% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0. 28
5-amp. single-pole, ind	250	.32
10-amp. single-pole	100	48
10-amp. single-pole, ind	100	54
5-amp. three-point	100	54
10-amp. three-point	50	76
10-amp., 250-volt, D P	100	66

10-Amp., 250-Volt Push-Button Switches

	Std Pkg.	List
10-amp. single-pole	100	$0 45
10-amp. three-way	50	70
10-amp. double-pole	50	70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+10%
1/5 to std. pkg	5% to 8%
Std pkg	23% to 25%

DISCOUNT—CHICAGO

Less than 1/5 std pkg	+ 20% to 10%
1/5 to std. pkg	List to 16⅔%
Std pkg	25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No 155	$0 34
No. 160	60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2 00 list	Net to 40%	Net to 30%
$2.00 to $10.00 list.	10% to 50%	5% to 40%
$10.00 to $50.00 list	20% to 60%	10% to 52%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2 00 list.	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50 00 list.	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6 00
Discount	30%

CHICAGO

List price	$6 35 to $7 00
Discount	25% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0 434—$0 51
No. 18, full spools	384— .49

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0 65 to $0 69
No. 18, full spools	.55 to 575

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15 00–$20 00	$12 75–$15 00	–$11 25
12	21 29– 27 10	19 35– 23 20	$17 05– 17 42
10	29 70– 37.80	27 00– 32 40	23 75– 24 30
8	41.91– 53 35	38 10– 45 70	33 35– 34 29
6	60 30– 84 40	54 27– 72 35	51 55– 53 05

CHICAGO

	Price per 1000 Ft Net		
No.	Less than 500 Ft	500 to 2500 Ft.	2500 to 5000 Ft
14	$21 00–$22 00	$16 00–$22 00	$13 25–$16 50
12	28.70– 29 46	28 70– 29 46	24 50– 25 54
10	40 10– 41 10	40 10– 41 10	34 23– 34 62
8	56 50– 57 90	48 23– 57 90	41 34– 50 18
6	85 31– 91 18	77 84– 85 31	66 72– 72 27

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4 0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$37 75 to $38 40
25 to 50 lb.	36 40 to 37 75
50 to 100 lb	32 40 to 36 75

CHICAGO

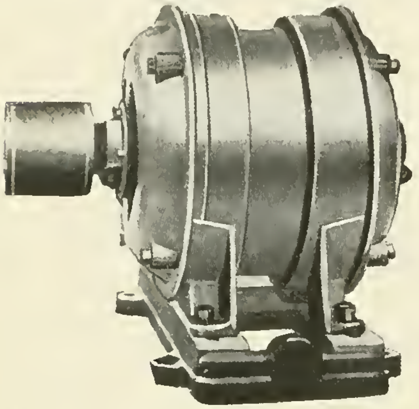
	Per 100 Lb. Net
Less than 25 lb.	$37 00 to $39 72
25 to 50 lb.	36 00 to 38.72
50 to 100 lb	35 00 to 37 72

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Ball-Bearing Alternating-Current Motor

By the use of ball bearings in its alternating-current motors the Stamford Electric & Manufacturing Company, Stamford, Conn., has been able to decrease the maintenance. This is due to the use of a small air gap. Also the rubbing of rotor and stator after the motor has been in use some time is said to be eliminated. Motors that are mounted in various positions will operate satisfactorily owing to the bearing construction, says the manufacturer. This rugged motor, it is claimed, stands the severest service conditions and is so constructed that dirt, dust, lint, etc., cannot enter the motor readily and clog the bearings.



SMALL AIR GAP BETTERS THE OPERATION OF MOTOR

Safety-First Induction Motor Panel

In manufacturing operations safety and efficiency are usually so related that an improvement in either must effect an improvement in the other. The panel illustrated herewith promotes safety because it is adapted particularly to the control of alternating-current feeder or motor circuits in capacities up to 300 amp. and 2500 volts.

This unit comprises a General Electric type FK-20 oil circuit breaker mounted on a pedestal constructed of steel plates and angle iron, the former holding the latter in position and serving as mountings for the apparatus in the interior of the pedestal. The compartment immediately beneath the breaker and surrounded by the steel plates is used for mounting the potential and current transformers. The space above the switch serves as a housing for the disconnecting switch, and also provides a location for either voltmeter or ammeter or both when desirable. Other instruments such as watt-hour meters, etc., may be mounted on the sheet-steel front of the panel. The back of the pedestal is also a sheet-steel plate removable to allow access to the interior.

Back of the instruments in the interior of the housing are spring contacts which make contact with the instrument studs, so that after removing the holding screws the instruments can be removed from their support without disconnecting the leads. When the instruments are replaced, the connections to them are made automatically. The instrument resistances are mounted behind the instruments.

The oil circuit breaker is operated in the usual manner by an iron handle from the front. Automatic protection is obtained by two series overload coils provided with dashpot time-limit trips. The under-voltage release weight hangs in the small space in the panel. The oil circuit breaker can be operated only when the disconnecting switch is closed.

FOR CONTROL OF ALTERNATING-CURRENT FEEDER OR MOTOR CIRCUITS

The disconnecting switch is operated from the front of the pedestal by a removable handle so interlocked with the oil circuit breaker that the disconnecting switch can be operated only when the breaker is open.

The breaker can thus be cut out of service at any time when open, and can be inspected or repaired without danger. The oil tank cannot be taken off the breaker, nor can the cover over the disconnecting switch be removed unless the disconnecting switch is open.

The disconnecting switch and the oil circuit breaker can both be locked open by removing the disconnecting switch handle. This handle can be removed or attached only when the disconnecting switch is open.

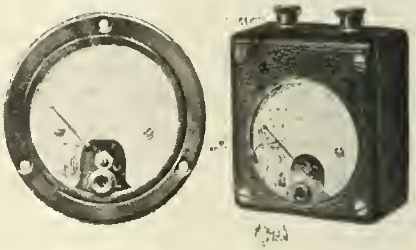
Meters for Wireless and High-Frequency Work

A high-grade hot-wire measuring instrument designed particularly for wireless and other high-frequency work, depending for its operation upon the expansion of a metal strip which is heated by the current to be measured, has been developed by the Westinghouse Electric & Manufacturing Company. The slight sag in this conducting strip is magnified several hundred times on the scale by means of a combination of wires and a deflecting spring.

The conducting strip is made of special non-corrosive material. The separating posts, according to the maker, have the same temperature coefficient of expansion as the conducting strip, so that the changes in room temperature do not cause an error in the reading of the instrument.

The instruments are furnished in two forms, for flush mounting and portable. Similar instruments for switchboard mounting are also supplied.

The flush-mounting form, known as type EH, is of the round open-face type. The face is 3 in. (7.6 cm.) in diameter, and the diameter outside the flange is 3¾ in. (9.5 cm.). It has a black "rubberoid" case and rim, with white dial. The portable form, known as type PH, is mounted in a morocco-leather-covered wooden case with heavy glass over the dial. The case is 3¾ in. by 4⅜ in. by 2 in. (9.5 cm. by 11.1 cm. by 5 cm.).



SWITCHBOARD AND PORTABLE METERS FOR HIGH-FREQUENCY WORK

The scale plate is made of metal, and the scale subtends an arc of 90 deg., being 2⅜ in. (6 cm.) long. The type EH meters have a guaranteed accuracy of 2 per cent, while the type PH, with hand-marked scale, can be expected to show an accuracy within 1 per cent of full scale. Standard meters are for 1, 2 and 5 amp.

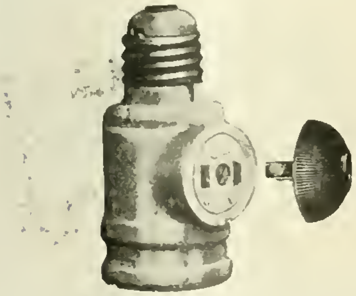
Watertight Deck or Ceiling Fixture

Extreme ruggedness for use on shipboard, where the service demands not only that it be watertight but that it withstand the shock and stress of severe weather, is claimed to be obtained in a watertight marine fixture with screw globe and protecting guard recently placed upon the market by the Benjamin Electric Manufacturing Company, 806 West Washington Boulevard, Chicago, Ill. The electrical parts are heavy, the socket base being made of molded insulating material. The gaskets are standard merchant marine material. Globes are furnished with the navy standard thread and both in rough and colored glass.

WILL WITHSTAND THE SHOCK AND STRESS OF SEVERE WEATHER

Side-Outlet Current Taps

A short time ago the Cutler-Hammer Manufacturing Company of Milwaukee placed on the market a new porcelain side-outlet "standard" current tap, having an Edison lamp shell and screw base. The side outlet, which is made with both multiple and series connections, has two parallel protected contacts. The arrangement of these contacts and the attaching cap employed conforms to the "standard" for plugs and receptacles adopted by six leading electrical manufacturers who by this move made the attaching devices interchangeable. The "C-H" current tap is furnished either with or without a "Standard" cap. The cap is made of "Thermoplax" insulation—a heat-resisting material, which has ample strength to permit riveting of the contact blades. The contact blades remain in permanent alignment and the appearance of the knurled finish is not spoiled by use.



CONTACT BLOCKS REMAIN IN PERFECT ALIGNMENT

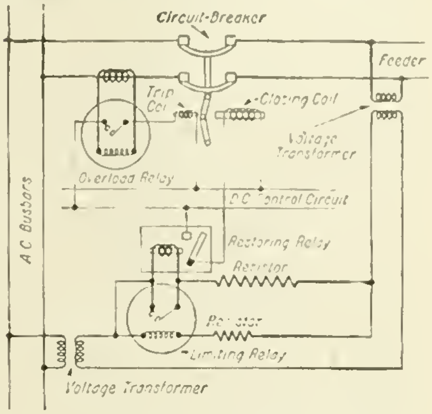
Radiant Air Heater with Cone-Shaped Element

Efficient reflection of the heat rays is claimed for a "radiant air heater" manufactured by the Estate Stove Company, Hamilton, Ohio. This heater has a cone-shaped element the heat rays from which are reflected by a highly polished coppered reflector. This reflector has a swiveled connection which allows the focus of the reflector to be altered in any direction. The element is protected from injury by a substantial wire guard, as shown in the accompanying illustration. This "Estate" heater is regularly equipped with 7 ft. (2.1 m.) of cable, ready to be attached to any lamp socket. It enables the user to have heat almost instantly in any location. The heater is said to be portable, ornamental and effective and especially adapted for use in the living room, bedroom, bathroom or office. The dimensions of this heater are 17 in. (43 cm.) in height, 8 in. (20.3 cm.) diameter of base and 9½ in. (24.1 cm.) for the reflector proper.

PORTABLE, ORNAMENTAL AND EFFECTIVE RADIANT AIR HEATER

Service-Restoring Relay System

Service-restoring relay systems have been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., which will minimize interruptions caused by transient short circuits that clear themselves as soon as the circuit breaker has been opened, thus permitting the feeders to be put back into service immediately. If the circuit breaker is reclosed automatically within a second after the transient trouble has occurred, the service will be restored in time to prevent induction motors from stalling. The service-restoring relay system performs this operation in the shortest possible time, according to the maker, and thus reduces all disturbances to a minimum and improves the lighting service. Should a permanent defect occur, the system will allow the breaker to remain open until the defect is cleared. A schematic diagram of operation of this system is shown in the accompanying illustration. Any type of overload relay may be employed to trip the circuit breaker. A voltage transformer on the feeder outside the circuit breaker is connected so that its potential opposes that of another voltage transformer connected to the busbars. The restoring relay, which is similar to a magnet switch, is connected in series with these two voltage transformers. Before a short circuit occurs both voltage transformers are subjected to the same conditions so that no current will flow through the restoring relay, but when a short circuit occurs and the circuit breaker has been opened by the overload relay current will be forced by the busbar transformer into the feeder transformer through the restoring relay. The restoring relay will then close its contacts, which in turn will close the circuit breaker.



CONNECTIONS OF SERVICE-RESTORING RELAY SYSTEM

In case of a permanent defect on the feeder, the restoring relay would continue to close the circuit breaker when it was opened by the defect. To prevent this, a limiting relay, similar to the Westinghouse type "CV" overvoltage relay, but equipped with weaker spring and heavier damping magnets so that its action is sluggish, is connected in such a manner that while the circuit breaker is open it is subjected to the same difference of potential that is operating the restoring relay. Each time the circuit breaker opens the limiting relay contacts begin to close, and, owing to its heavy damping, they do not return to the starting point immediately after the circuit breaker is closed. After the circuit breaker has opened and closed a predetermined number of times, this relay closes its contacts, thus short-circuiting the restoring relay and preventing further operation.

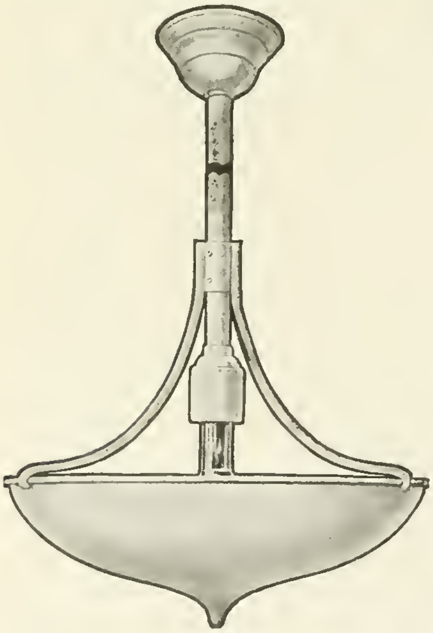
When this system is installed at substations having no attendant, it is often found advisable to have an indicating device that will show when the service has been momentarily interrupted. For this purpose a graphic ammeter is placed in the direct-current control circuit of the circuit breaker, which indicates whenever the breaker has been closed by automatic means. A special control switch is used which contains one dragging contact so arranged that when the circuit breaker is tripped manually the switch automatically opens the circuit between the two voltage transformers.

This relay is said to decrease power interruptions and thus economizes the time of switchboard and other station attendants, or in some cases releases some of these men for other purposes.

Indirect-Lighting Unit for Industrial Uses

For use where it is desirable to sacrifice the higher efficiency of the direct-lighting unit for the shadowless quality of indirect illumination in offices, drafting rooms, textile mills and hospitals, the Holophane Glass Company, Inc., 340 Madison Avenue, New York City, has recently put on the market an indirect-lighting unit.

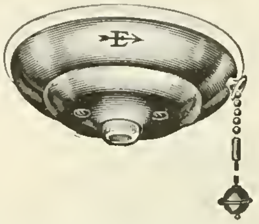
The bowl is 20 in. (50.8 cm.) in diameter and is drawn from seamless steel covered both inside and out with a white porcelain enamel of high reflecting properties. The contour of the bowl, which has been designed to conform to a theoretical curve, is said to produce an extremely high-efficiency illumination. It is so constructed that the lamp may be left in the socket when cleaning the bowl without danger of breaking the lamp tip. The bowl-holding device is made not unlike the principle used in ice hooks which tightens the grip of the holder as the weight of the bowl or other downward pull increases. The bowl can be removed for cleaning and replaced with one hand in a second's time, say the manufacturers. The holder is finished in white enamel to match the bowl. Any type of tungsten or gas-filled lamp from 75 to 1000 watts can be used in this unit because by a slight adjustment to the holder the correct lamp position is always maintained.



BOWL MAY BE ADJUSTED FOR SEVERAL SIZES OF LAMPS

Brass-Covered Pull-Switch Rosettes

Specifications for modern industrial housing usually show a preference for brass-covered devices for concealed work suitable for attaching directly to a ceiling or outlet box. Such units are decorative and economical, as they can take the place of a more or less elaborate fixture. In order to extend the line of keyless receptacles, pull receptacles and plain rosettes with brass covers now on the market, the Arrow Electric Company, Hartford, Conn., is manufacturing a pull-switch rosette shown in the accompanying illustration. This rosette, the manufacturer claims, is compact and strong, the cover being firmly attached to the rosette by screws. It is designed for loop wiring, and each rosette is equipped with a long cord and the porcelain is recessed to allow room for a fixture loop.



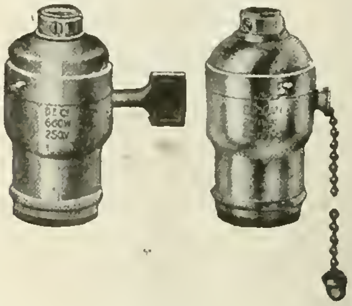
BRASS-COVERED ROSETTE TAKES THE PLACE OF ELABORATE FIXTURE

Storage Battery with Five-Year Guarantee

Storage batteries, to give the best service, must have plates with a surface which prevents washing down, according to the Monarch Storage Battery Company of 113 Campau Avenue, S. W., Grand Rapids, Mich. This firm is manufacturing a type of battery for automobile starting and lighting and for farm-lighting outfits which has a thick plate with a hard surface but with sufficient porosity to allow it to take the charge easily. The jars are of sufficient size to permit enough space between the bottom of the jar and the bottom of the plate. They also have ample headroom and are arranged to contain a quantity of electrolyte which makes frequent refilling unnecessary. These large jars also give the appearance of a massive outfit and show up to good advantage, especially where the sale is being made as a replacement proposition in connection with an already installed farm-lighting plant.

Key and Pull-Chain Sockets

Sockets which are particularly adaptable for fixture work are now being manufactured by the Duncan Electrical Company, Ltd., 1665 St. James Street, Montreal, Canada. This is accomplished by means of a narrow groove in the neck of the cap which permits a wide turning of the socket even after it is firmly fitted on the stem. The holding catches of the shell and cap are so arranged as to warrant a maximum of strength and rigidity. This socket is rated at 660 watts, has a snap cap, and is of quick make-and-break socket mechanism. This company also manufactures the pull-chain socket illustrated, which has the same shell and locking device used on the key socket. All sockets and receptacle shells are furnished in brushed brass, unless otherwise specified.



SOCKET ADAPTED FOR FIXTURE WORK

Reflectors for Floodlight Projector

Three reflectors have been developed by the National X-Ray Reflector Company, Chicago, for use in its No. 60 floodlight projector, described on page 648 of the March 23, 1918, issue of the Electrical World. The No. 845 reflector illustrated at the top is corrugated and gives a wide diffused beam of light when used with this projector. The halftone in the middle shows the

THESE REFLECTORS MEET A NUMBER OF REQUIREMENTS FOR FLOOD LIGHTING

No. 835 reflector, which produces a beam of light of varying spread of from 12 deg. to 30 deg. The reflector at the bottom is listed as No. 840 and produces an extremely concentrated beam.

Ball-Bearing Electric Washer

Speed and efficiency are two of the features claimed for a washing machine that is being manufactured by the Knoll Manufacturing Company, 124 Maple Street, Reading, Pa. The wringer of this machine swings to three positions and has an 11-in. (27.9-cm.) roll.

MOTOR MOUNTED UNDERNEATH STAND OF WASHING MACHINE

The washer is driven by a ⅙-hp. motor mounted underneath the machine. The tub can be lifted off the stand and stored away to keep from drying out if necessary.

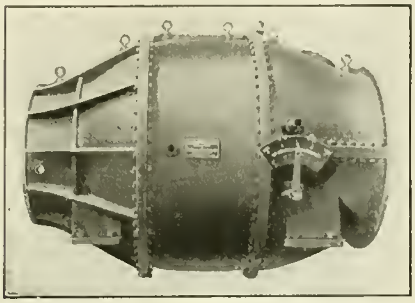
Electrically Controlled Hydraulic Valve

Electrical operation by means of two small 110-volt direct-current solenoids without the use of motors or limit switches is one of the main features of a hydraulic valve that is being manufactured by the Larner-Johnson Valve & Engineering Company, Philadelphia. The valve consists essentially of a circular body containing an internal concentric cylinder supported by ribs and closed at one end in which there is a differential plunger with a conical nose which is seated inside the neck of the valve body. The differential plunger divides the internal plunger into two operating chambers, a central or closing chamber and an annular or opening chamber. The plunger is closed by admitting pressure from the pipe line to the closing chamber and exhausting the opening chamber to the atmosphere. It is opened by reversing this operation. The supply and discharge of pressure to and from the operating chambers are governed by a control valve outside the valve body.

The adaptability of the Johnson valve to remote electrical control makes it especially suitable for use in pumping plants, distributing stations and filtration plants where a number of valves are required to operate from a central switchboard. A battery of these valves under electrical control is very convenient.

The main and branch pipe lines are diagrammed in outline on the switchboard, together with the positions of the various valves. Each valve is represented by a rotary switch with an opaque diaphragm having a transparent slot illuminated by an incandescent bulb at the rear. When the slot stands lengthwise with the pipe the switch is set to open the valve, and when it stands crosswise it is set to close. When a valve is standing in either position the slot of the corresponding switch is illuminated and the operator can see at a glance the position of every valve in the station. When the switch is turned to a new position the light immediately goes out and does not light up again until the valve has followed the switch, or, in other words, has performed the operation for which the switch is set. Thus, if the switch is turned from shut to open, the light goes out and does not light up again until the valve is wide open. At this point the circuit to the solenoid which operates the valve is automatically broken. The switch is therefore not only a switch but a position indicator and a trouble detector as well.

If the light goes out and after an interval lights up again, the operator knows that the valve has performed its function. If it does not light up again, he knows something is out of order. If the slots of all the switches on the board are illuminated, the operator knows not only the position of all the valves in the station but also that they are all in working order.



BATTERY OF VALVES MAY BE OPERATED FROM CENTRAL SWITCHBOARD

The electrical control is simple. A 110-volt direct current is used, and the only parts other than the cables are two small solenoids which operate the control valve, two spring push-buttons on the indicator mechanism of the valve, and the control switch for the switchboard.

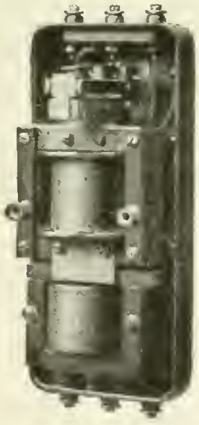
Rugged Lightning Arrester

Graded selective discharge is claimed to be one of the features of a lightning arrester manufactured by the Bowie Switch Company, Nevada Bank Building, San Francisco, Cal. This is accomplished by means of a bow-shaped arrester which also assures the permanence of the gap and thus makes it suitable for isolated locations as well as for attendant stations. The discharge point is independent of the frequency, which is said to insure the operation at any time. Other features of the lightning arrester are free path to ground, inductance minimized, all parts visible and open to inspection, operation unaffected by changes in temperature, no daily attention required, no housing necessary, ample radiation for repeated or severe discharge, and efficiency and reliability.

Transfer Relay for Alternating Current

Although it is designed for use with Westinghouse type CO and CR relays, the type BT transfer relay recently developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., can be applied to any make of circuit-closing relay of similar characteristics. This breaker operates solely through the current transformer and the relays, and when there is no fault on the line the trip coil of the breaker is mechanically and electrically isolated from the circuit, thus, according to the makers, avoiding possibility of tripping due to imperfection in the relay contacts ordinarily shunting the trip coil.

The relay consists of two series coils, an upper or operating coil and a lower or holding coil. The holding coil holds down the armature core until a third coil, wound on the same magnetic circuit and known as the releasing coil, is short-circuited by the protective relay. The releasing coil acts as a secondary of a transformer, and when short-circuited a current flows through it, demagnetizing the core. The holding coil therefore allows the operating coil to raise the core which operates the transfer switch, thus closing the trip-coil circuit. The transfer switch and other current-carrying parts of the relay are designed to carry 5 amp. continuously, but during times of short circuit it is said that the switch may be called on to handle as much as 100 amp. or 200 amp. Only one trip coil is required for use on a polyphase circuit, but if the breaker is equipped with as many trip coils as there are relays, it is advisable to connect each trip coil to its corresponding relay.



NO CHANCE FOR RELAY TO TRIP BECAUSE OF IMPERFECTION

Trade Notes

Government Contracts

The following contracts are reported as having been placed by the various departments of the government for electrical supplies:

HARDWARE AND METALS DIVISION, QUARTERMASTERS' DEPARTMENT.—Aug. 12 and 13, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., electric irons, electric motor.

BUREAU OF AIRCRAFT PRODUCTION.—Aug. 3, Simplex Wire & Cable Company, Boston, Mass., 3000 miles field wire. Aug. 6, Splitdorf Electrical Company, Newark, N. J., 40 sets Dixie D800 magnetos and spare parts to be used in connection with all Hispano-Suiza engines, using one right-hand and one left-hand magneto. Aug. 14, Collieries Supply & Equipment Company, Philadelphia, Pa., 48 electrical engineers' chests. Aug. 20, Splitdorf Electrical Company, Newark, N. J., magneto parts.

NAVY DEPARTMENT, BUREAU OF SUPPLIES AND ACCOUNTS.—Aug. 12, American Electrical Heater Copnmany, Detroit, Mich., electric glue pots; Cutler-Hammer Manufacturing Company, New York City, door switches. Aug. 13, Willard Storage Battery Company, Cleveland, Ohio, batteries; Taylor Instruments Company, Rochester, N. Y., battery sets; U. S. Light & Heat Corporation, Niagara Falls, N. Y., storage batteries; Philadelphia Storage Battery Company, Philadelphia, Pa., storage batteries. Aug. 14, Dayton Engineering Laboratory, Dayton, Ohio, lighting plants; American Conduit Manufacturing Company, New Kingston, Pa., conduit steel; Snyder Electrical Heating Company, Cambridge, Mass., electrically heated clothing.

GENERAL ENGINEER DEPOT.—Aug. 9, U. S. Rubber Company, New York City, conductor cables; Aug. 10, General Electric Company, Schenectady, N. Y., spares for motor; Western Electric Company, New York City, stage cable. Aug. 13, Acme Wire Company, New Haven, Conn., "enamelite" copper wires; General Electric Company, Schenectady, N. Y., crane protective panels, searchlights, dark-room lamps; National Carbon Company, Cleveland, Ohio, searchlight carbons; Cutler-Hammer Manufacturing Company, New York City, battery switches; Western Electric Company, New York City, ball recording sets; Safety Insulated Wire Company, New York City, rubber-insulated cable; National Machinery & Wrecking Company, Cleveland, Ohio, motor-generator sets; Power Equipment Company, Chicago, Ill., motor-generator sets. Aug. 14, Evansville Battery Corporation, Boston, Mass., batteries. Aug. 15, Cooper Hewitt Electric Company, Hoboken, N. J., mercury-vapor lamps; General Electric Company, Schenectady, N. Y., motors. Aug. 16, Western Electric Company, New York City, switching sets. Aug. 19, Sperry Gyroscope Company, Brooklyn, N. Y., searchlights.

ACCEPTANCES.—The Guaranty Trust Company, New York City, has recently issued a booklet entitled "Acceptance" dealing with trade acceptances.

EFFECT OF WAR ON GLASS INDUSTRY.—Tariff Information Series No. 5 under title "The Glass Industry as Affected by the War" has just been published. Certain parts of the volume deal with lighting glassware.

ROBBINS & MYERS ON EIGHT-HOUR DAY.—Beginning Sept. 3, the Robbins & Myers Company, Springfield, Ohio, placed its plant on an eight-hour-day basis. Employees wil work the same length of time as formerly, but will receive overtime for time in excess of eight hours.

ELECTRICAL IMPORTS INTO CHINA.—The imports of electrical goods into China during 1916 and 1917 are reported by Consul-General Thomas Sammons as follows: Electrical materials and fittings, 1916, $2,842,372; 1917, $4,107,788; telephone and telegraph materials, 1916, $506,209; 1917, $662,501. It might be noted that the export of all electrical goods from the United States to China was $415,107 for the year ended June 30, 1916, and $1,125,072 for the year ended June 30, 1917. Included in these figures are telegraph and telephone material to the amount of $15,685 for the former year and $131,312 for the latter.

THE INDUSTRIAL EMPLOYMENT OF WOMEN.—The September issue of the *Westinghouse Electric News*, published by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is devoted largely to the employment of women in the different departments of the company.

ACCEPTANCES.—"How the Merchant Can Use Acceptances" is the title of a pamphlet issued by Bernhard Scholle & Company, 14 Wall Street, New York. An illustration of how these acceptances can be used is shown and the advantages of their use and the law involved are stated. Forms are produced and various letters of credit and acceptance agreements are shown.

ORDER TOTALING 45,000 KW.—The Westinghouse Electric & Manufacturing Company has been awarded contracts for three 15,000-kw. generators for a generating plant which will cost approximately $5,000,000 to erect. This plant will operate in connection with the government ordnance plant now being built in Neville Island. The contracts were awarded by the United States Steel Corporation, which acted for the United States government.

ARROW ELECTRIC COMPANY STRONG IN WAR SERVICE WORK.—Patriotism runs high at the factory of the Arrow Electric Company, Hartford, Conn. Fifty-three of the 600 employees of the company are in the army or navy, and one of these, Sebastiano Barbari, of the plating department, has made the supreme sacrifice for the cause of liberty. Besides enlisting on his own account this gallant young soldier induced no less than twenty-three of his countrymen to don uniforms. At the Arrow factory about two-thirds of the employees are young women and Red Cross work is being pushed with enthusiasm and sustained interest. The company's manager, Edward R. Grier, has set apart a "war room" in the office section in which all sorts of war activities center, and where weekly evening meetings are held in the interest of Red Cross and other war work. This room is equipped with motor-operated sewing machines, a large circular table, comfortable chairs, and a victrola, and is decorated with flags and photographs of war interest, including portraits of employees in the national service and a bulletin board carrying letters from boys at the front clippings, etc., of special note. This company has an enviable record in its contribution to war causes. In the first three Liberty Loans the company and its employees subscribed to $116,000 worth of bonds, nine rallies being held in this interest. The company prepared a float and used it in one of the later Liberty loan campaigns. Substantial contributions have been given to all the important war funds, employees and company alike taking part in these good works. The Red Cross chapter at the factory has adopted two French orphans and an older boy. Entertainments have been given to raise money for Knights of Columbus and other funds, and one of the veterans of General Pershing's army, on a trip to America for instruction purposes, recently addressed the girls. The welfare work of the company is being "tied in" closely with its war activities. A large percentage of the production of the Arrow company goes into the government service sooner or later, so that both in working hours and in periods ordinarily devoted to relaxation the staff and the employees in general are working hard to help win the war.

THE PREST-O-LITE COMPANY, Indianapolis, Ind., is planning for the erection of a new plant on property recently acquired on Colgate Avenue, Buffalo, N. Y., to comprise four one-story buildings for charging and other operations.

MAZDA LAMP WAR WINDOW DISPLAYS.—E. F. Newkirk, who is in charge of the window display service of the Edison Lamp Works of the General Electric Company at Harrison, N. J., has been appointed chairman of the committee on window displays for the Mazda lamp industries. The work of this committee will be carried on in coöperation with the national war service committee on window displays, the purpose being to supply all agents and distributers of Mazda lamps with patriotic window trimming material in furtherance of the government's efforts in the various war activities. Most Mazda lamp merchants have made some effort individually along these lines, but with a chairman in charge who will coöperate with them, this work can now be carried out more effectively.

REGULATION GOVERNING THE APPLICATION FOR AND ISSUANCE OF EXPORT LICENSES.—Effective Sept. 20, 1918, licenses may be granted by the War Trade Board only upon application of the consignor and only to corporations, residents, foreign partnerships with a member who is resident, foreign corporations actually maintaining in any state, territory or possession of the United States or in the District of Columbia an established branch or agency for the regular transaction of business, any foreign government, the traffic executive of Great Britain, France, Italy or the Consul for Belgium, or any official firm or corporation appointed by any department or agency of the United States government to act in its behalf. Applications for export licenses and supplemental information sheets and any other supplementary documents or letters relating thereto will be considered by the War Trade Board only when filed by such corporations, firms or individuals and only when signed in ink by a duly authorized person.

MADAGASCAR MARKET FOR ELECTRICAL GOODS.—Consul James G. Carter makes the following report on Madagascar as a market for electrical goods: "Only two electrical plants have been installed thus far in Madagascar. These are: L'Energie Industrielle, Réseau de Madagascar, for lighting the town of Tananarive, the capital, and for supplying power to industrial motors, European headquarters, 94 Rue St. Lazare, Paris, France; Barriquand & Orsini, Majunga, Madagascar. The latter plant is also used for lighting the town of Majunga. There are no tramway companies in Madagascar. The published customs statistics do not specify the quantities of electrical material imported into Madagascar, but I have been able to obtain from the local customs authorities figures giving the total quantities of dynamo armatures and detached parts, including all classes of electrical apparatus, ,as follows, for the past five years: 1913, 1658 lb.; 1914, 9243 lb.; 1915, 13,788 lb.; 1916, 34,092 lb.; 1917, 2752 lb. Although the statistics do not specify the various classes of electrical material imported, the above figures would appear to include principally material used for lighting purposes in Tananarive and Majunga, and for use in connection with 100 or more industrial motors in operation, principally in these two towns."

THE LAKEWOOD ENGINEERING COMPANY announces the opening of new offices in Chicago, in the Lumber Exchange Building.

THE BOSTON ECONOMY LAMP DIVISION, National Lamp Works of General Electric Company, announces that its new permanent address is 43 Hospital Street, Providence, R. I.

THOMAS A. EDISON, INC., West Orange, N. J., has appointed W. Stephens, 10 Fifth Avenue, New York, representative of the company in connection with incorporation interests.

THE ELECTRIC FURNACE COMPANY, Alliance, Ohio, has opened an office at Park Row, New York City. Dwight Miller, formerly of the Society for Electrical Development, is manager.

THE NATIONAL INDIA RUBBER COMPANY, Bristol, R. I., has announced the appointment of William E. Barker as general sales manager of the wire division of the United States Rubber Company.

WARREN C. DRAKE, who for the past twelve years has been connected with the stoker-engineering department of the Westinghouse Electric Manufacturing Company, New York, has entered into partnership wth H. S. Sleicher, and has opened an office in New York, under the firm name of Sleicher & Drake, for the handling of power-plant equipment.

CLARENCE B. HARLOW, who has been sales engineer for several years for the Benjamin Electric Manufacturing Company, Chicago, has taken charge of the entire sales work for the central district in addition to his former duties in connection with industrial and marine signaling apparatus. Mr. Harlow takes the place of G. B. Weber, to whom an extended leave of absence has been granted.

THE BOOTH-HALL COMPANY, Chicago, electric furnace builder and metallurgist, has moved its sales and administrative offices from 565 West Washington Boulevard to 2309 Archer Avenue, where only the engineering and construction departments have heretofore been located. By this change all departments of the business are combined and the furnaces in course of construction are at all times under the inspection of the officials of the company.

THE SQUARE D COMPANY, Detroit, Mich., manufacturer of safety switches, has found it necessary to open a district office in Chicago in order to cope with the big increase in the volume of business. E. A. Printz, who has represented the company in Illinois for some time, is in charge, his office being at No. 1303 Manhattan Building. W. E. Wollgamott, former city electrician of Peoria, and T. C. Walsh, lately of the Electric Appliance Company, Chicago, are associated with Mr. Printz.

THE ILLINOIS TESTING LABORATORIES, formerly at 565 West Washington Boulevard, Chicago, have moved to larger quarters at 9 South Clinton Street. This move was necessitated by the increased volume of business in repairing and testing electrical instruments. The firm specializes in meter and instrument testing and repairing, inspection of electrical material, electrical and experimental development work, motor, generator, transformer and power-plant testing and general consulting practice. J. A. Obermaier is in charge.

THE BELDEN MANUFACTURING COMPANY, Twenty-third Street and Western Avenue, Chicago, in order to overcome delays of L. C. L. freight deliveries from Chicago to Eastern customers and to meet the government's restrictions on L. C. L. shipments, has opened a warehouse and distributing station at Metuchen, N. J. This warehouse is in charge of S. C. Schenck, Eastern manager of the company, and a small emergency stock of all insulations and sizes of magnet wire will be carried for immediate or urgent shipment. Shipments from this stock will be billed f.o.b. Metuchen at an advance of ¾ cent a pound over the Chicago price. It is also the intention of the company, so far as possible, to pack shipments from Chicago for Eastern customers in its cars from Chicago to Metuchen, to be reshipped from there. The freight will be prepaid through to destination and an additional charge made on the invoice equivalent to the L. C. L. rate from Chicago to destination. However, if shipments are desired direct from Chicago, they will be made on request. All orders for magnet wire hereafter should be mailed to the Belden Manufacturing Company, Metuchen, N. J.

Trade Publications

ELECTRIC HEATERS.—The Willis Manufacturing Company, Cleveland, Ohio, has issued a folder describing and telling the uses of its Torid portable electric heater.

ORNAMENTAL LAMP.—The Beardslee Chandelier Manufacturing Company, 216 South Jefferson Street, Chicago, has issued a circular describing and illustrating its ornamental service lamp.

ARC-WELDING OUTFIT.—The Electric Arc Cutting & Welding Company, 222 Halsey Street, Newark, N. J., has issued a circular giving advantages and uses of its alternating-current electric arc cutter.

ELECTRIC WASHING MACHINE.—The guarantee of the United Engine Company, Lansing, Mich., is made one of the features of the striking bulletin on motor-driven and engine-driven washers issued by this company.

FARM-LIGHTING PLANTS. — The United Engine Company, Lansing, Mich., has issued an attractive colored broadside, illustrating and describing its electric farm-lighting plant and many small power-driven devices for farm use.

ELECTRIC WASHING MACHINE.—The Grinnell Washing Machine Company, Grinnell, Iowa, has issued an envelope stuffer describing and illustrating in attractive colors the Laundry Queen washing machine with copper tub and swinging wringer top.

ELECTRIC WASHING MACHINE.—A folder issued by the Maytag Company, Newton, Iowa, is designed in such colors and of such a size that it is suitable for a window display poster. It features the convenience and economy of Maytag motor-driven washers.

FARM-LIGHTING PLANTS. — "Mor-Lite" is the title of a bulletin on the self-starting, self-stopping farm-lighting plants of Fairbanks, Morse & Company. The bulletin gives an attractive picture of a cross-section of the plant which adequately indicates its features.

PUMPS.—The Viking Pump Company of Cedar Falls, Iowa, has issued an illustrated catalog showing pumps of many sizes and for a variety of uses, ranging from small pumps such as are used on ½-in. pipe for vacuum heating plants with motor drive to large pumps for pumping oil and water.

POWER-PLANT SPECIALTIES.—Governors, stop valves, reducing valves, back-pressure valves, balanced-lever valves, float valves, tank controller and other governors and regulating devices for pumps, as well as other power-house specialties, are described and illustrated in a catalog issued by the Fisher Governor Company of Marshalltown, Iowa.

ELECTRIC RANGES.—"Fifteen War-Time Cooking Suggestions" are contained in a bulletin describing Acorn electric ranges, manufactured by the Rathbone-Sard Electric Company, Albany, N. Y. These cooking suggestions were formulated by Alice Bradley, who is an authority on cooking. Copies of this bulletin will be sent by the company on request.

FIRE DETECTERS.—Automatic fire detecters are described in bulletin No. 5 issued by the Relic Equipment Corporation, fire alarm division, 52 Vanderbilt Avenue, New York City. The manufacturers claim that these detecters are built on an entirely new system which works on the principle of expansion of air in a small chamber. The expansion of the air where needed closes an electrical contact which gives an alarm on an electric bell or annunciator or both.

DISCUSSION OF FUEL LOSSES.—The H. W. Johns-Manville Company of New York City has issued a comprehensive booklet on "Fuel Waste in the Power Plant." The bulletin discusses the subjects of where to look for fuel losses and how to reduce and improve power-plant efficiency. It lists certain common but preventable causes of fuel wastage which can be corrected by the use of Johns-Manville or similiar material. The book urges that those in authority in the power plants make personal inspections in the boiler and engine rooms and of distributing pipe lines, adopt proved methods of saving wherever consistent, and see that plant engineers, firemen and operatives receive proper incentives for saving coal and adequate means of achieving the saving. The booklet is divided into four parts, which are headed as follows: "Preventable Losses in the Boiler Room," "Preventable Losses from Steam Pipes," "Preventable Losses in the Engine Room" and "Preventable Losses in Factory Buildings." Under the first section air leakage in boiler settings, door frames, boiler walls and blow-off piping is discussed and methods of detecting it are given. The heat radiation of steam pipes is discussed in detail, and specifications of thickness of insulation for different steam temperatures and pressures are given. A table is produced showing the loss due to steam leakage in pipes and pipe flanges. Excessive packing friction is discussed as a preventable loss in the engine room. Curves showing the value of electric energy consumed by an electrically driven triplex pump during a period of one year with different kinds of packing are reproduced. Radiation, steam-trap losses and outdoor distributing lines are also treated under this section. The form tabulating data when testing steam pipes to determine whether or not the trap leaks steam is shown in detail.

New Incorporations

THE BIG INDIAN POWER COMPANY of Marshallvile, Ga., has been incorpated with a capital stock of $30,000 by H. A. and J. J. Murphy and F. M. Mullino.

THE CHARLESTON (S. C.) ELECTRIC SERVICE COMPANY has been incorporated with a capital stock of $20,000 by L. A. Edwards and Augustine T. Smythe.

THE BLOCK ENGINEERING & STORAGE BATTERY COMPANY of Cincinnati, Ohio, has been chartered with a capital stock of $3000 by Ralph Block and others.

THE PEABODY BATTERY & STARTER COMPANY of Muskogee, Okla., has been incorporated with a capital stock of $7,500 by A. D. Peabody, S. O. Wood and F. H. Geben.

THE O. K. LIGHT & POWER COMPANY of Hardtner, Kan., has been incorporated with a capital stock of $25,000 by J. H. Hudson of Caprion; G. B. Darling and I. C. Vaniman of Hardtner.

THE SEMINOLE PUBLIC SERVICE COMPANY of Shawnee, Okla., has been incorporated by George A. Henshaw, A. Carey Hough of Oklahoma City, and W. A. Bacher, of Chicago, Ill. The company is capitalized at $100,000.

THE H. G. FERGUSON COMPANY, 6523 Euclid Avenue, Cleveland, Ohio, has been organized to do general engineering and construction work, specializing on shops, factories and power houses. H. G. Ferguson, formerly secretary of the Austin Company of Cleveland, is president.

THE ELECTRIC APPLIANCE COMPANY of Bellaire, Ohio, has been incorporated by S. J. Watterson, N. F. Yoho, William F. Watterson, C. W. Dickens and W. H. Reitz, all of Bellaire. The company is capitalized at $10,000 and proposes to deal in and sell electrical appliances.

A. P. MUNNING & COMPANY, 202 Emmet Street, Newark, N. J., has been incorporated by Julian Gregory, 84 Carleton Street, East Orange, and John G. Daniel, 40 Clinton Street, Brooklyn, N. Y. The company is capitalized at $500,000 and proposes to manufacture electrical machinery and equipment.

THE AJAX ELECTRIC SPECIALTY COMPANY, 1408 Morgan Street, St. Louis, Mo., has been incorporated with a capital stock of $10,000 to manufacture flashlights, telephones and plural plug sockets. The officers are: Ernest Alschuler, president and manager; J. S. Cumings, vice-president; Oscar Walters, secretary.

LES MINOTERES ELECTRIQUES DE METABETCHOUAN, LTD., of Metabetchouan, Que., has been incorporated by A. Tremblay, E. Gagne, O. Tremblay and others. The company is capitalized at $99,900 and proposes to generate electricity for lamps, heat and motors, and to manufacture electrical machinery and equipment.

THE CHATTANOOGA ELECTRO-METALS COMPANY, Chattanooga, Tenn., has been organized with a capital stock of $200,000 to manufacture silicon alloy. The officers are: Paul J. Kruesi, president and treasurer; N. Thayer Montague, vice-president and secretary; G. L. Davidson, second vice-president and manager, and Arthur Raymo, general superintendent.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

BRISTOL MILLS, ME.—The new electric generating plant of the Lincoln County Power Company has been put into operation. At present a 100-kw. machine is being operated. Orders have been placed for a 250-kw. generating unit. A duplicate transmission line is now being erected from Bristol Mills to Boothbay Harbor, which when completed will enable the company to supply power from either Damariscotta Mills or Bristol Mills in Boothbay Harbor. Improvements and repairs will be made to the old transmission line upon completion of the new line.

QUINCY, MASS.—Contract has been awarded to the Andrews Electric Company of Brockton for wiring the twenty-one large dormitories and additional buildings in process of construction for the government in Quincy. The George Howard & Sons Company of Brockton has the general contract.

DANBURY, CONN.—Negotiations are under way between the Danbury & Bethel Gas & Electric Company and the Danbury & Bethel Street Railway Company whereby the former will lease the power plant of the latter. The large generator ordered by the lighting company before the war has been taken over by the United States government for war purposes. As the company is in need of additional facilities and as it is impossible to secure electrical equipment, it proposes to lease the power plant of the street railway company and operate it in connection with its own plant, furnishing power to operate the railway system.

BRIDGEPORT, CONN.—The Bridgeport Housing Company, 886 Main Street, is planning to build a group of two-and-a-half-story houses, to cost about $3,000,000. The United States government will provide $3,000,000 additional.

HARTFORD, CONN.—Bids are being taken by the Hartford Electric Light Company for the construction of a repair shop, 40 ft. by 186 ft., one-story, to cost about $25,000.

Middle Atlantic States

BORDER CITY, N. Y.—The local plant of the Empire Gas & Electric Company of Auburn was recently destroyed by fire, causing a loss of about $30,000. C. F. Brunt of Geneva is local manager.

HOFFMANS, N. Y.—Arrangements have been made with the Schenectady Illuminating Company to extend its service to Hoffmans. The company will install a new lighting system along the highway from the Hatcher greenhouses to the schoolhouse on the turnpike.

ILION, N. Y.—Bids are being received by the Remington Arms Company for the extensions to its plant on East Main Street, consisting of dry kiln and boiler house and storage building, to cost about $75,000.

LITTLE FALLS, N. Y.—Work, it is reported, has started on the erection of an electric transmission line from the plant of the Caroga Light & Power Company through the towns of Oppenheim, Manheim, Fairfield and Little Falls by the East Creek Power Company. This line will run into the Small Gulf power house between Little Falls and Herkimer and will furnish additional power for the New York State Railways. Extensive improvements, it is stated, are to be made at the East Creek power plant to enable it to supply more power to the industries in Schenectady, Amsterdam and Fulton County.

MALONE, N. Y.—The capital stock of the Malone Light & Power Company has been increased from $194,000 to $300,000, the proceeds to be used for extension to system.

ROCKAWAY, N. Y.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is considering the construction of a hydro-cylinder house in Rockaway, to cost about $40,000.

ROCHESTER, N. Y.—The Menihan Company is planning to erect an engine and boiler plant at its works on Portland Avenue.

UTICA, N. Y.—A permit has been granted the Utica Gas & Electric Company for the erection of a new switch house on Snipe Street at the foot of Washington Street, to cost about $100,000. Contract has been awarded for construction of building. The new switch house will be used for switching energy from the hydroelectric plant at Trenton Falls and is to be used in conjunction with the new double-circuit, 44,000-volt steel tower transmission line from Trenton Falls, to Utica. The purpose of the switch house primarily is to supply power to the munition plants in Utica and Ilion.

DOVER, N. J.—Plans are under consideration by the Board of Water Commissioners for the installation of an electrically operated pumping unit at the municipal pumping plant.

JERSEY CITY, N. J.—Swift & Company are reported to be planning the erection of a boiler plant at their works on Henderson Street.

NEWARK, N. J.—The Public Service Corporation of New Jersey, up to the present time, has received a total appropriation of $2,317,895 from the United States government for extensions to the Public Service Railway Company's system and electric lines as follows: New traction lines to Newark Bay, with additional cars, $21,739; extensions in traction lines at Camden and Gloucester City, including 33 cars, extensions to electric lines, etc., $1,240,780, and for electric construction and development work for the New York Shipbuilding Corporation at the recently established Yorkship Village, Gloucester City, $215,000, and for new electric feeders and other work at Kearney, $39,586.

DIXMONT, PA.—Contract has been awarded by the Board of Trustees of the Dixmont Hospital for the Insane, to D. T. Riffle, Keeman Building, Pittsburgh, for the erection of an electric power plant at the institution.

HOOVERSVILLE, PA.—The Public Service Commission has granted the petition of the borough of Hooversville to institute condemnation proceedings to acquire the local plant of the United Light, Heat & Power Company of Stoyestown. The borough will issue bonds to cover the cost of acquiring the plant and will purchase energy from the Penn Public Service Company, a subsidiary of the Citizens' Light, Heat & Power Company of Johnstown.

JOHNSONBURG, PA.—Arrangements have been made by the Johnsonburg Light & Power Company to issue $45,000 in capital stock and $25,000 in bonds, the proceeds to be used for extensions and improvements.

PHILADELPHIA, PA.—The Department of Public Works is considering remodeling the boiler plant and coal conveying system at Lardner's Point, involving an expenditure of about $50,000.

PHILADELPHIA, PA.—Plans are under consideration by the Emergency Fleet Corporation for the construction of a steam-driven electric power plant at the Hog Island shipyards.

PHILADELPHIA, PA.—Plans, it is reported, are under consideration by the Otis Elevator Company, Sixteenth and Sansom Streets, for the construction of a two-story addition, 80 ft. by 155 ft., on Shackamaxon Street, to cost about $50,000.

ST. MARY'S, PA.—The St. Mary's Electric Light Company has increased its capital stock by $225,000 and issued $100,000 in bonds. The proceeds, it is understood, will be used for extensions to its electric power plant and distributing system.

SCRANTON, PA.—The linking together of all electric generating plants of the coal fields, particularly of Lackawanna and Luzerne Counties, is reported to be under consideration. Investigations are now being made by F. C. Cole, state director of conservation for the federal Fuel Administrator, for the electric generating plants in both counties. The plan as outlined would mean the connecting up of the various plants and an interchange of service.

WILMINGTON, DEL.—Arrangements have been made by the Pennsylvania Electric Company, Du Pont Building, Wilmington, for an issue of $1,500,000 in notes, the proceeds to be used for extensions, improvements, etc. The company operates the Citizens' Light, Heat & Power Company of Johnstown, Pa.; the Penn Electric Service of Somerset, Pa., and the Penn Public Service Company of Clearfield.

SWISS, W. VA.—The Kanawha Collieries Company, Charleston National Bank Building, Charleston, recently organized, is now developing 1200 acres of coal land and plans to develop 2700 acres eventually. Complete equipment will be installed, including conveyor or incline cars, tipple machinery, railway and electrical machinery.

ST. JULIEN'S, VA.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for construction of a power house at St. Julien to Johansen & Kierman, Norfolk, at $12,963.

WASHINGTON, D. C.—Contract has been awarded by the Thomas Jefferson Hotel Company to the George A. Fuller Company, Munsey Building, for the construction of an apartment hotel, at Fourteenth and Q Streets, N. W., including three electric elevators, electric lighting, steam heating, etc., to cost about $400,000.

WASHINGTON, D. C.—Contract has been awarded by the United States Housing Corporation to Richardson & Burgess, Inc., Colorado Building, construction of dormitories, etc., for housing navy yard employees, at Seventeenth and D Streets, to cost $125,000; heating plant, $45,000, and electric lighting $7500.

WASHINGTON, D. C.—Bids will be received at the General Engineer Depot, United States Army, 1438 You Street, Washington, until Sept. 17, under Proposal 1098, for furnishing 604 transformers. Bids will be received until Sept. 20 under Circular 1107, for 60,000 ft. two-conductor cable and 50 reels. Further information may be obtained upon application to the purchasing officer at the above office.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Until Sept. 19, Gloucester, N. J., Schedule 5790½—storage batteries. Until Sept. 20, Eastern delivery, Schedule 5811½—mechanical engine telegraph systems. Until Sept. 27, Puget Sound, Wash., Schedule 5850½—threading machine, six bench drills, two direct-current motors, one magneto chuck and two turret lathes. Bids will also soon be asked for the following supplies: Puget Sound, Wash., Schedule 5845½—seven switchboards; Schedule 5846½—fourteen turbo-generator sets. Mare Island, Cal., Schedule 5847½—1,000,000 ft. silicon bronze wire and 3300 ft. bronze wire; also 3300 ft. bronze wire for Philadelphia, Pa. Yorkton, Va., Schedule 5853½—generating equipment; Schedule 5853½—two or more boilers. Brooklyn, N. Y., Schedule 5854½—one motor-generator set. Iona Island, N. Y., Schedule 5856½—four electrical hoists. Cape May, N. J., Schedule 5857½—electrical equipment. Application for proposal blanks should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Norfolk, Va., Specification 3309—four 10-ton electric traveling cranes of the overhead bridge type, equipped with two 5-ton trolleys, to be delivered at Hampton Roads. Cape May, N. J., Specification 3386—heating water supply and electric system, estimated to cost about $80,000. Indian Head, Md., Specification 3365—construction of nitrate plant, to cost about $180,000. Until Sept. 16, Hampton Roads, Va., Specification 3292—boiler plant building, to cost about $150,000. Philadelphia, Pa., Specification 3297—construction of hospital building at Gray's Ferry Hospital, date extended from Aug. 29 to Sept. 16; Specification 3367—elevator for Gray's Ferry Naval Hospital; Specification 3368—laundry equipment for Gray's Ferry Hospital, to cost about $12,000. Melville, R. I., Specification 3391—radio building, masts and towers, to cost about $66,000. Application for proposal blanks should designate the specification desired by number.

North Central States

ESCANABA, MICH.—The City Council is considering extending the lighting district on Four River Road.

VERMONTVILLE, MICH.—One of the large transformers in the local substation of the Thornapple Gas & Electric Company of Hastings was recently destroyed by fire.

CINCINNATI, OHIO.—The Procter & Gamble Company is contemplating an extension to its power plant, to cost about $65,000.

HAMILTON, OHIO.—The Ford Company has petitioned for permission to erect a wire on the city poles from the plant of the Hamilton & Ross Hydraulic Company to its new plant at the north end of Fifth Street. This is only a temporary arrangement, as the company will have its power plant.

TOLEDO, OHIO.—The United States government has taken over the entire construction of the nitrate plant to be erected near Toledo. Under the original plan the plant was to be erected and operated by the Air Nitrate Corporation of New York for the government. The reason for taking over the plant by the government is that it can be built more quickly and cheaper than a private company which cannot commandeer material, labor, transportation, etc.

TOLEDO, OHIO.—The construction of several buildings, including a machine shop, laboratory, storehouse, pipe shop and benzol laboratory, is under consideration by the Toledo Furnace Company. F. C. Warner, Hippodrome Building, Cleveland, is architect.

TOLEDO, OHIO.—The Doehler Die Castings Company of Toledo has begun work on an extension to its machine shop, 50 ft. by 160 ft., four stories and basement, and extension to foundry, 50 ft. by 120 ft. The extensions will be used for the manufacture of airplane bearings and other war products.

LOUISVILLE, KY.—At the request of the Board of Public Works the Louisville Gas & Electric Company has begun a survey of the City Hall and annex with a view of preparing an estimate of supplying the buildings with electricity. Heretofore the City Hall and other municipal buildings have been supplied with power by the city power plant in the basement. The inability to secure competent help is given as the cause for asking the company for estimates.

LOUISVILLE, KY.—Contract has been awarded to Chester & Fleming, of Pittsburgh, Pa., for construction of the new cantonment to be established by the Ordnance Department, Washington, D. C., at Camp Knox. An electric lighting system, pumping plant, water-works and sewerage systems will be installed. The cost of the entire work is estimated at over $20,000,000.

LOUISVILLE, KY.—Thomas L. Barrett, 123 Third Street, Louisville, is asking prices on a 100-kw., three-phase, 60-cycle, 2300-volt generator, a belt-driven machine preferred.

STITHTON, KY.—Plans, it is reported, have been completed by the Louisville Gas & Electric Company for extending its electric transmission lines to Stithton to supply electricity for lamps and motors at the new artillery camp here. The cost of the extension, it is understood, will be paid by the United States government.

GREENCASTLE, IND.—The Wabash Valley Electric Company of Clinton has petitioned the Commissioners of Putnam County for a franchise to erect an electric transmission line through Madison and Greencastle Townships. The company, which recently purchased the local plant, will transmit electricity from its Clinton plant to operate the local system and will probably close down the power house here.

PERU, IND.—Bonds to the amount of $15,000 have been sold, the proceeds to be used for the installation of a new power unit at the municipal electric light and power plant.

CHICAGO, ILL.—Plans have been prepared by Armour & Company for the erection of a nine-story cooler and storage building at Packers Avenue and Forty-fourth Street, to cost about $1,500,000. R. C. Clark is architect for the company.

CHICAGO, ILL.—Preparations are being made by Swift & Company for the erection of a five-story cold-storage plant at Forty-second and Cook Streets, to cost about $350,000. The company has been granted a permit to build a six-story soap-manufacturing building, to cost about $30,000.

EAST ST. LOUIS, ILL.—The American Manufacturing Company, South Eleventh Street, St. Louis, Mo., is erecting a new power plant, 50 ft. by 90 ft., in East St. Louis, to cost about $40,000.

TYLER, MINN.—The municipal electric plant was wrecked by a cyclone on Aug. 22.

CAMP DODGE, IOWA.—Work will soon begin on the construction of 700 additional buildings, including barracks for 8537 men, at Camp Dodge, to cost about $2,500,000.

EARLHAM, IOWA.—The Madison County Mutual Rural Electric Company, No. 2, has been granted a franchise by the Board of Railroad Commissioners to erect and maintain an electric transmission line on certain roads and highways in Madison County. Electricity for operating the system will be obtained from the municipal electric plant at Earlham. M. A. Tharp is interested in the company.

FORT MADISON, IOWA.—Plans have been completed by the Atchison, Topeka & Sante Fé Railroad Company for the construction of a power plant at Shopton, Iowa, near Fort Madison. The company will also build extensive freight and passenger facilities at Tulsa, Okla.

HARRISONVILLE, MO.—The taxpayers have voted to accept the proposal of L. K. Green & Sons of Pleasant Hill, to lease the municipal electric plant for a period of ten years. It is proposed to dismantle the local plant and furnish electricity from the electric plant at Pleasant Hill. Work on the erection of the transmission line between Harrisonville and Pleasant Hill is under way. L. K. Green of Pleasant Hill is president of the company.

KANSAS CITY, MO.—Joseph F. Porter, president of the Kansas City Light & Power Company, has announced that the government has released sufficient steel to complete the new power house of the company, now under construction at the foot of Brooklyn Avenue. It is expected to have the new plant in operation by next spring.

ST. LOUIS, MO.—Work has begun on the construction of a new plant for the Oliver Electric & Manufacturing Company.

ST. LOUIS, MO.—The Ajax Electric Specialty Company, 1101 Morgan Street, recently organized, it is reported, would like to receive prices on machinery for the manufacture of flashlights, telephones, and plural plug sockets. Ernest Alschuler is president.

UNIVERSITY, N. D.—Rose & Harris, 471 Auditorium Building, Minneapolis, Minn., have been engaged to prepare preliminary plans for a power plant for the State University, to cost about $150,000.

NEBRASKA CITY, NEB.—The Lincoln Telephone & Telegraph Company has purchased a site in Nebraska City on which it proposes to erect a telephone exchange building.

CONCORDIA, KAN. — The Concordia Electric Light Company, which recently installed an electric lighting system in Agenda is contemplating extending its service to the town of Cuba.

GLEN ELDER, KAN.—The local electric light plant was recently destroyed by fire.

Southern States

BELHAVEN, N. C.—Bonds to the amount of $25,000 have been issued for the installation of an electric lighting system in Belhaven.

WILMINGTON, N. C.—Extensive additions and improvements, it is reported, are contemplated by the Tidewater Power Company, including doubling the output of its power plants, installation of new equipment, doubling street-car tracks, etc.

JACKSON, GA.—The Citizens' Ice & Cold Storage Company, recently organized, is planning to build an ice plant of 10 tons daily capacity. The plant will be equipped with electrically driven machinery and cold-storage facilities. W. E. Merck is interested in the project.

COLUMBUS, MISS.—An appropriation of $24,500 has been made for repairs and improvements at the Mississippi Industrial Institute and College, of which $10,000 will be used for the installation of new boilers at the power house.

BIRMINGHAM, ALA.—Contracts have been awarded by the Birmingham Steel Corporation for construction of plant (initial unit), to cost $1,000,000, including the erection of buildings and furnishing machinery. The mechanical equipment include power plant, shears, punches, benders, etc. The plans provide for future increase costing between $15,000,000 and $20,000,000. Henry L. Brittain of New York, N. Y., is president.

OKMULGEE, OKLA.—Bids will be received at the office of R. H. Jenness, city commissioner of finance, Okmulgee, until Sept. 25, for waterworks improvements, including repairs to present dam, building retaining wall, constructing intake chamber, pumping station building, filter house, machinery foundations; filter equipment consisting of four 1,000,000-gal. units, installed; one 3,500,000-gal. direct-acting, triple-expansion pumping engine, and two boiler-feed pumps; two 150-hp. water-tube boilers, heater, gas and oil burners, breeching, etc.; one 100-kva. engine-driven generating set and switchboard; one 48-in. by 100-ft. chimney, erected; including installation work, sluiceways, suction and discharge piping, installation of pumps, boilers, engine and generator, wiring switchboard, electrical connections, rebuilding transmission lines, etc.; also for cast-iron pipe, fire hydrants and furnishing material and constructing extensions to sewer system, construction of ejector station and sewage treatment plants, etc., Burns & McDonnell, Interstate Building, Kansas City, Mo., are engineers.

Pacific and Mountain States

CHEHALIS, WASH.—The Superior Coal Company is installing electrical equipment at its mine in Chehalis. Electricity will be furnished by the North Coast Power Company. D. W. Proebstel, electrical engineer of Portland, Ore., has charge of the installation.

USK, WASH.—The Mountain States Power Company is contemplating the erection of an electric transmission line from Usk to Chelewah, a distance of 25 miles, to supply electricity in the latter plant. The cost of the work is estimated at $90,000. G. N. Rooker is manager of the power company.

YAKIMA, WASH.—A movement is on foot to irrigate thousands of acres of arid land in Walla Walla and Franklin Counties. The proposed project includes the construction of a large dam at Five Mile Rapids on Snake River and construction of a hydroelectric power plant. Investigations are being made by R. K. Tiffany, project manager of the government systems in the Yakima Valley, and A. P. Davis, director and chief engineer of the United States Reclamation Department.

GAZELLE, CAL.—Application has been made to the State Water Commission by Edward C. Latchem to utilize 12 sec.ft. of water in Grouse Creek to be used for power purposes. The company is planning to develop 400 hp. of electrical power for its mining properties.

GLENDALE, CAL.—The city of Glendale has been advised that the Capital Issues Committee of San Francisco has approved the bond issue recently voted in Improvement District No. 2 for $44,000 to purchase the distributing system of the Southern California Company there.

INGOT, CAL.—The construction of an electrolytic plant at its mines is reported to be under consideration by the Afterthought Copper Company.

LOS ANGELES, CAL.—Plans have been approved by the City Power Commission for the construction of power plant No. 2 of the municipal power system along the route of the aqueduct, at San Francisquito Canyon, to cost about $1,400,000. The plans provide for a development of 28,000 hp. E. F. Scattergood is electrical engineer.

LOS ANGELES, CAL.—The Board of County Supervisors has granted the Southern California Edison Company a franchise for the erection of a new electric transmission line on a portion of the county highways to connect with the present system. A franchise has also been granted for the construction of a distributing system in connection with the new transmission line.

MANHATTAN BEACH, CAL.—The installation of new ornamental lamp standards and appliances on Neptune Avenue and other streets is under consideration by the City Trustees.

MONROVIA, CAL.—Plans have been prepared by the Southern California Edison Company for the erection of a new station, 60 ft. by 100 ft., to be located at Myrtle and Walnut Avenues. Joseph F. Rhodes, Central Building, Los Angeles, is architect.

SAN FRANCISCO, CAL.—The supervisors have passed an ordinance authorizing the Board of Public Works to enter into a contract for furnishing and installing an 8-in. centrifugal pump and motor at the Commercial Street pumping station.

SANTA BARBARA, CAL.—Plans are under consideration by the City Council for the installation of an electric lighting system on Anapamu Street from State to Anacapa Street.

SAN FERNANDO, CAL.—The San Fernando Canning Company is planning to construct a new plant in San Fernando, at a cost of about $45,000. The proposed plant will be equipped for electrical operation and large boilers will be installed.

MINIDOKA, IDAHO.—Bids will be received by the United States Reclamation Service, Department of the Interior, Denver, Col., until Oct. 1, for extension of power plant and furnishing hydraulic turbine and generator for the Minidoka reclamation project.

GLOBE, ARIZ.—The Iron Cap Copper Company, it is reported, is considering improvements to its property, including the installation of an electric power plant.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until Sept. 28, for furnishing, under circular No. 1230, cut-outs, electric switches, sockets, truck, lights, magnesia pipe covering, etc.

Record of Electrical Patents

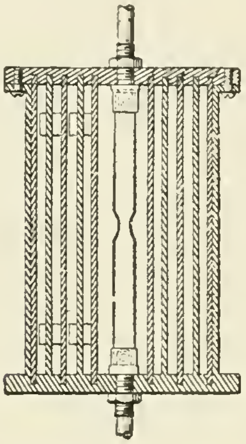
Notes on United States Patents

1,275,110. Electric Fuse. Walter W. Walsh, Wilkinsburg, Pa. App. filed June 27, 1916. Fuse casing which, although strong and durable, may be easily and quickly opened to renew the fusible element.

1,275,124. Sanitary Mouthpiece Cover for Telephone Transmitters; George W. Bulley, Chicago, Ill. App. filed Sept. 9, 1916. Simple, durable and reliable in construction, effective and efficient in operation, and cheap to manufacture.

1,275,141. Telephone-Exchange Apparatus and System; John Erickson, Chicago, Ill. App. filed July 16, 1906. Applicable to automatic telephone-exchange systems of that particular type in which automatic selectors and connectors are employed at the exchange or central station.

1,275,142. Telephone-Exchange Apparatus and System; John Erickson, Chicago, Ill. App. filed July 19, 1906. Automatic or semi-automatic telephone systems in which electrically propelled and step-by-step-actuated switching machines are employed at the exchange or central station.



1,275,110—Electric Fuse

1,275,151. Protective Means for Electrical Apparatus; Frank C. Green, Pittsfield, Mass. App. filed Dec. 4, 1916. Acting as secondary windings, they may absorb high-frequency energy impressed on the windings to which they are inductively related by changing into heat the electrical energy induced in them by the high-frequency currents traversing the winding they are to protect.

1,275,161. Process of Electrically Producing Iron; Axel T. C. Estelle, Hagen, Germany. App. filed Nov. 22, 1916. Production of iron by the electrolytic disassociation of a solution comprising a caustic alkali and a ferric hydrate.

1 275,170. Coil Case and Terminal; John L. Milton, Cleveland, Ohio. App. filed Aug. 17, 1917. With a terminal fitting which is at once efficient, durable, producible at a low cost and adapted to be readily secured to the wall of the case.

1,275,179. Electric Signal; William M. Bowles, Sapulpa, Okla. App. filed Dec. 31, 1915. Provision of means for giving both an audible and visible signal in the event of the vent pipe being struck by lightning and the safety valve becoming closed, so that the attendant may be appraised of the closing of the said safety valve within the pipe and may restore the device to its normal condition.

1,275,186. Automatic Telephone System; Willis E. Lamb, Los Angeles, Cal. App. filed June 26, 1912. Systems which employ primary and secondary line switches.

1,275,195. Armature Construction for Dynamo-Electric Machines; Vincent G. Apple, Dayton, Ohio. App. filed Nov. 19, 1914. Highly efficient in operation and sturdy and rugged in construction.

1,275,200. Electric Switch; Thomas E Barnum, Milwaukee, Wis. App. filed Dec. 15, 1914. To control apparatus automatically in accordance with predetermined governing pressures.

1,275,201. Self-Propelled Vehicle; Ralph H. Beach, New York, N. Y. App. filed Sept. 15, 1911. Combines a prime mover and a secondary battery in such manner that a vehicle is provided wherein the objections inherent or existing in the use of either alone are largely obviated.

1,275,206. Electrical Induction Furnace. Oluf C. Bockman, Notodden, Norway. App. filed May 3, 1918. To regulate the load of an induction furnace independently of the current passing through the coils of the same.

1,275,234. Registering Mechanism; James D. Elson, Chicago, Ill. App. filed March 1, 1912. For use in connection with electrically propelled vehicles for registering the number of stops made by the vehicle.

1,275,261. Filling Device or Valve for Storage Batteries or Other Receptacles; Miller R. Hutchinson, West Orange, N. J. App. filed July 18, 1914. For filling or replenishing cells of storage batteries equipped with safety devices or traps.

1,275,279. Conduit or Conductor; George A. Lutz, Cranford, N. J. App. filed Jan. 25, 1915. An insulated conductor or cable with a metallic covering substantially in the form of spiral-like winding secured together against longitudinal displacement.

1,275,292. Ignition and Lighting Apparatus; Alfons H. Neuland, San Francisco, Cal. App. filed Sept. 19, 1916. For providing ignition for internal-combustion engines and also for providing electric current for lighting or other purposes.

1,275,294. Combined Internal-Combustion Engine and Magneto; Richard A. Oglesby, South Bend, Ind. App. filed Jan. 5, 1917. To provide a crankcase head that shall at the same time support a magneto armature and provide a bearing for the crank shaft.

1,275,305. Electric Incandescent Lamp; Howard B. Rand, Merrimac, Mass. App. filed Dec. 18, 1917. The neck or base of an incandescent lamp may be readily converted from a double to a single contact base, and from a single to a double contact base, without change in the number of component parts.

1,275,309. Switch; John Schneider, New York, N. Y. App. filed April 13, 1914. For the control of high-tension electric currents.

1,275,326. Air-Break Switch; John R. Townsend, Chicago, Ill. App. filed Nov. 26, 1915. To open a high-tension circuit quickly and surely without the formation of a destructive arc and without danger of enabling the current to strike from one of the parallel conductors or phases to another, thus causing short-circuiting of the system.

1,275,391. Cut-Out; Robert C. Cole, Hartford, Conn. App. filed Oct. 3, 1917. Adapted for use between main lines and transformer or branch circuits.

1,275,407. Automatic Limit Switch; Edward L. Dunn, Worcester, Mass. App. filed Sept. 18, 1913. For drum elevator machines wherein the circuits are automatically opened as the car approaches either limit, in order to prevent overrunning.

1,275,408. Art or Method of Etching Steel or Other Like Plates; William S. Eaton, Sag Harbor, N. Y. App. filed Nov. 28, 1916. To facilitate the rapid production of accurate master or pattern plates for use upon pantographic engraving or other similar machines.

1,275,417. Apparatus for Preserving Organic Materials by the Use of X-Rays; App. filed April 14, 1917. To sterilize insects and prevent the further propagation of their species, and also to destroy any eggs that they may have already laid.

1,275,442. Cartridge Fuse; Oscar H. Jung, Milwaukee, Wis. App. filed May 19, 1917. To produce an inexpensive and simply constructed refillable fuse in which the fusible strip is inclosed.

1,275,448. Electric Accumulator; Henry Leitner, Westminster, London, Eng. App. filed Feb. 1, 1918. Makes use of a nonconducting support of wood, or wood-pulp, or other preparation of wood which is preferably of a porous nature.

1,275,451. Warmer for Footwear; William W. Lillard, Irvington, N. J. App. filed Nov. 2, 1917. To permit of readily applying the warmer to the footwear.

1,275,458. Brush Holder for Commutator Mechanism; Charles R. Meston and Herbert I. Finch, St. Louis, Mo. App. filed May 16, 1917. To provide a commutator brush holder which contributes to economy, both in manufacturing cost and in operating cost.

1,275,468. Condenser and Method of Making the Same; Albert Pruessman, Berwyn, Ill. App. filed July 27, 1917. To prevent a permanent change in their electric constants as a result of normal temperature changes.

1,275,469. Flexible Conductor; Albert Pruessman, Berwyn, Ill. App. filed Oct. 17, 1917. Used in making tinsel cords for connecting telephones in circuit, making connections at telephone switchboards and other similar indoor uses.

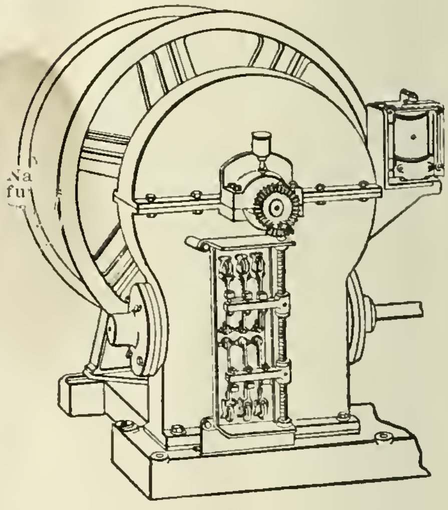
1,275,474. Telegraphic Printing Apparatus; Matia B. Rodriguez, London, Eng. App. filed March 20, 1916. Transmitted messages are recorded by printing mechanism incorporated in the receiving apparatus.

1,275,480. Electrical System for Controlling Boats or Torpedoes; James M. Seymour, Newark, N. J. App. filed April 26, 1917. For discharging or exploding at will an explosive charge carried by the boat or torpedo.

1,275,501. Apparatus for Stringing Wires; Theodore Turanyez, Goodeve, Saskatchewan, Canada. App. filed April 19, 1917. For telephones and telegraphs.

1,275,524. Electric Connector for Securely Retaining Plugs; Victor Henri Broc, Levallois-Perret, France. App. filed April 13, 1918. Made for industrial purposes, and especially for motor cars and flying machines.

1,275,536. Protective Device for Motor Compressors; Philip L. Crittenden, Edgewood, Pa. App. filed April 21, 1915. To provide means for automatically cutting out the motors, in case either one of the motors becomes disabled.



1,275,407—Automatic Limit Switch

1,275,541. Circuit Controller; Merritt Drane, Louisville, Ky. App. filed Dec. 23, 1916. For an electrically operated signal device.

1,275,542. Cathode for X-Ray Tubes. Francis J. Farrelly and Alfred Greiner, Hartford, Conn. App. filed Dec. 28, 1914. Will increase the life of the X-ray tube by eliminating to a large extent the danger of cracking the glass at what is termed the cathode neck.

1,275,552. Automatic Switch for Electric Irons; John C. Griesel, Pottsville, Pa. App. filed Feb. 20, 1918. To provide a switch which, when the iron is placed upon a suitable stand, automatically causes the opening of the circuit, and when the iron is removed from the stand the circuit becomes automatically closed.

1,275,559. Auxiliary Signal Arrangement for Printing-Telegraph Systems; Walter A. Houghtaling, Dunellen, N. J. App. filed May 8, 1915. Means whereby the more usual service signals such as "start," "stop," "rerun," "repunch," ets., and like service signals of frequent occurrence, may be transmitted easily and rapidly and with minimum of interference with the regular operation of the circuit.

HELLO!

THIS IS LIBERTY SPEAKING——
BILLIONS OF DOLLARS ARE NEEDED
AND NEEDED NOW

Electrical
World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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War Man Power in the Industry

THE new call upon the man power of the nation applies to many individuals who are now rendering service of great value in the war work of essential branches of the electrical industry. It includes executives and workers who are highly useful in keeping the production of manufacturing plants and generating stations and the distribution facilities in the industry at top-notch efficiency. With the national need for complete control of the physically fit man power, the industry sympathizes fully. It is with the government in the large program for vigorous prosecution of the war to victory; it knows that the millions of our splendid troops will speed the restoration of righteous conditions in the world; it appreciates that sacrifices have to be made. The electrical industry will not stand selfishly alone demanding preferential consideration greater than that which is accorded to other industries whose output is of equal importance to the country in the emergency.

It appears, however, that coördination of the different points of view among the Washington authorities is most desirable. The War Department says rightly that it must have men, and of course it is entitled to the first call on all that it considers in the national interest should go to the front. The government Director General of Railroads on his part sends word to his subordinates to claim exemption for general officers and workers vitally needed to keep traffic moving, and we should not want to say that he is not right from his standpoint too, because supplies must be transported to seaports and thence to the fast-increasing armies overseas. But in order that the supplies may be moved they must first have been produced, and in that production the workers in the electrical industries have an indispensable function. The Shipping Board must keep its quota of labor for shipbuilding; coal mines and producers of foodstuffs must have workers and power, but electricity is a large factor in economical quantity output in all of those activities. In fact, there is not a single place in the war program where electrical apparatus and supplies and electrical energy do not enter to promote efficiency and economy, to increase production. The thing that causes concern, therefore, is not whether the government, seeking the best interests of the nation as a whole, shall decide that this man or that man is more useful as a soldier than in his normal work, but how the industry can maintain the required volume and quality of production if its labor situation is changed materially.

The ultimate decision as to the disposal of man power is with the Washington authorities, and the industry looks to them with confidence that their judgment as a whole will best serve the national interest. The specific acute problem that arises, however, when a manufacturer is devoting say 90 per cent of his activities to government work is one that he cannot solve without assistance. If his trained men, whether salaried executives or wage workers, are called for other service, his ability to produce government supplies is lessened. If the men who have done the work in the past are not there, the work cannot be done unless their places are filled by others capable of doing it as well. Part of the answer will be supplied by the use of women, part will undoubtedly be given by the exemption of men held indispensable, and perhaps it may even be assumed that the government will allot competent workers, in uniform or otherwise, to the vital basic industries. In any event, the question of men or women who will produce the necessary electrical apparatus, supplies and energy in unending streams for the support of the troops at the front is inseparable from the rest of the military problem.

The Call of Liberty

ARNOLD VON WINKELRIED was a Swiss hero outrivaled in popularity only by that other mountaineer, William Tell. His fame rests on the story that at a critical moment in the great battle of Sempach he rushed toward the Austrians and with outstretched arms gathered a number of their spears together against his breast, crying, "Make way for liberty!" By this means he opened a way through the hostile ranks for his fellow countrymen—though at the price of his own life. Less dramatic and hazardous but just as patriotic service can be rendered the cause of liberty by every man, woman and child in the United States. Not all may fight. Most of us must stay at home and do our share in keeping our men at the front supplied with food, clothing and the wherewithal to overcome the enemy. It requires money to do this—money to buy material and to pay for labor. The government is obliged to raise a large part of this money through bonds. Better securities never were issued because the United States guarantees the principal and pays the interest. It is a privilege to buy and an honor to keep these securities. Liberty calls for the fourth time, "Billions of dollars are needed and needed now." No American will ring off without answering the summons to buy. With this issue is a Liberty bond cartoon. You may serve your country first by displaying it in a conspicuous place and then by investing in the bonds yourself.

Electrical Power Supply at the Front

THE paper from our staff correspondent, Mr. Tomlin, on the electrical developments undertaken by the American Expeditionary Forces gives an exceedingly striking view of the energy and resourcefulness with which American engineers have dealt with a difficult situation. We have been very fortunate in the extremely able and efficient engineer force which our country has been able to place overseas. In planning, building or fighting it has always been ready to meet any emergency. When one considers that there is demand for 50,000 kw. or 60,000 kw. for the use of our forces in France even now, with the prospect of this being greatly increased in the near future, it will be seen that the electrical branch of the service is an important one. When the returns are all in the amount of building of docks and warehouses, factories and workshops which the American forces have accomplished in less than a year will rise to a stupendous aggregate. For all these purposes electric light and power are a fundamental necessity, and the sources from which they can be obtained furnish the first really difficult problem.

In so far as is possible the policy has been carried out of obtaining power from French central stations rather than by undertaking new constructions. So far as the capacity of these stations is adequate, electric supply merely means a running of transmission lines, which to our engineering forces is a comparatively trivial matter. They have built already between 130 and 140 miles of lines at 30,000 volts to 40,000 volts, to say nothing of the accompanying distributions. When the French stations prove to be short of capacity new equipment is added, when possible, before the installation of entirely new plants is undertaken. Conditions in the electrical industry in France make prompt supply of material by no means easy, but yet still manageable, when one considers the time of transport which has to be added to that of manufacture in getting machinery from home.

The technical board having matters in charge has proved to be very alert and efficient in dealing with the continual difficulties which face attempts at speedy work on a considerable scale. One of the most interesting features of the situation is the development of water powers where the conditions are reasonably favorable. Several steam-driven power stations have already been erected, and the water power is just coming under the hand of our forces. Half a dozen projects are under way involving the installation of a true outdoor type of generating station such as has been already described in our columns. These plants can be worked efficiently during the war and perhaps later developed into stations of more usual and conventional type, although we have a well-defined idea that if an outdoor station is well built in the first place there will be small need of elaborating it. Taken altogether, the electrical work accomplished and under way is of striking magnitude, and the projects undertaken have been put through with a speed and efficiency which is a credit to the service and to the great body of patriotic engineers who are working overseas to bring victory to the army of liberty.

Pound-Foolish Lighting Curtailment

WE NOTE with regret signs of another raid on electric lighting in the alleged interest of fuel conservation. The time has come to speak plainly on this matter in order that the public may understand just what the real effect of lighting curtailment is likely to be. It has been repeatedly shown in these columns that the actual amount of fuel used for the production of electric light is relatively very small, amounting to not much more than 2 per cent of the total fuel consumption of the country. It has also been pointed out that on the whole this fuel is efficiently utilized, and that the benefits of its consumption are shared by a very large number of people who should not be deprived of its use for trivial reasons. As we have many times reiterated, the lighting industry as a business is not seriously worried about the matter except in so far as it desires to protect users of electric light from unnecessary infringement of their privileges. The call for electrical energy is so great and increasing so rapidly that any practical reduction in the amount of lighting will be rapidly made up by the growth of other uses for energy.

If one looks over the field of electric lighting it will be seen, as the published data show, that roughly two-thirds of the entire lighting output is for industrial, commercial and domestic uses, in not far from equal proportions at the present time. It is well known to engineers that the first class of service cannot be materially reduced without grave injury to industrial efficiency. Most plants are under-lighted rather than over-lighted, and the saving which can be made without injury to the output is in the improvement of utilization, which should all the time and everywhere be encouraged. The time has come when any industry which in the exigency of war should be permitted to operate at all by artificial light should be free to light its works so as to secure the best utilization of labor and material. We have been suspiciously tender of non-essential industries in this country up to the present time, and apparently are still disposed to cherish them even at the expense of those which are necessary. It is well within the bounds of fact to say that industrial lighting cannot be curtailed to any material extent, save in so far as needless industries are in part or in whole eliminated.

With respect to commercial lighting a somewhat similar situation exists. If it be really a case of national necessity to save fuel at the expense of light, and the powers that be are willing to take the responsibility of shutting down commercial establishments for this purpose, so be it; the responsibility rests upon those who issue the orders. The only reduction which can be made while retaining shops in operation is a diminution in the amount of display lighting which belongs to advertising rather than to necessity. The domestic user of light, owing to stimulus of rising prices and to daylight saving, has already cut his consumption very considerably and from motives of personal economy will continue to do so. A reduction in the amount of energy allotted to domestic supply would fall most heavily on the electrical appliances, and the disuse of these will, so far as fuel conservation is concerned, produce exactly the wrong effect. If people stop using electric irons and the like, they will not abandon ironing, but will light up exceedingly wasteful stoves and ranges to accomplish the same work at a considerable increase in fuel consumption. Street lighting is, save for occasional "white way" efforts, at a point where any material diminution would mean the approval of the Highwaymen's Protective Association and the Burglars' Union more than of the long-suffering public. There remain divers minor departments of electric lighting in which petty economies might be made. The proprietors of "movies" would doubtless be glad to see restrictions on theater lighting; restaurants and cafés could be pinched down materially if the menus were printed in larger type for the assistance of the patrons; churches could be reduced to more than the usual gloom, and halls and corridors could be left in semi-darkness. All told, the practicable reductions in the use of electric light without grave inconvenience and some danger to the public are wretchedly small.

But the phase of the matter to which we want to call the vigorous attention of the enduring public is that the conspicuous quality of semi-darkness is no reason for enforcing it unless there is to be a considerable and genuine saving accomplished. It is all very well to prattle about the "psychological effect" of such economies, but in the long run that effect is going to react seriously against those who are responsible to the public for real rather than apparent economies. There has been far too much in the way of gags for the gallery passed out under the name of conservation. Most Americans are perfectly willing to suffer great inconvenience if necessary for the carrying on of the war, but one cannot fool all of them all the time, as Lincoln wisely remarked. The government has the right, the power and the duty to seize without ceremony all fuel that is necessary for carrying on the war efficiently. If its representatives, having this power, fail to commandeer fuel sufficient for these imperative needs, they face a responsibility dangerously near to treason, but until all industries not necessary to the war are curtailed with a rigorous hand, even if need be to the point of extinction, it ill becomes the authorities to indulge in cheap and noisy buncombe to secure inconsequential results. Frankly, we regard the hue and cry about lighting curtailment as a species of smoke barrage concealing the emptiness of the efforts which retreat from the plain duty of turning American industries into rigorously necessary work, a duty which our Allies have long since accepted without hesitation.

Fourth Call—Are You Ready?

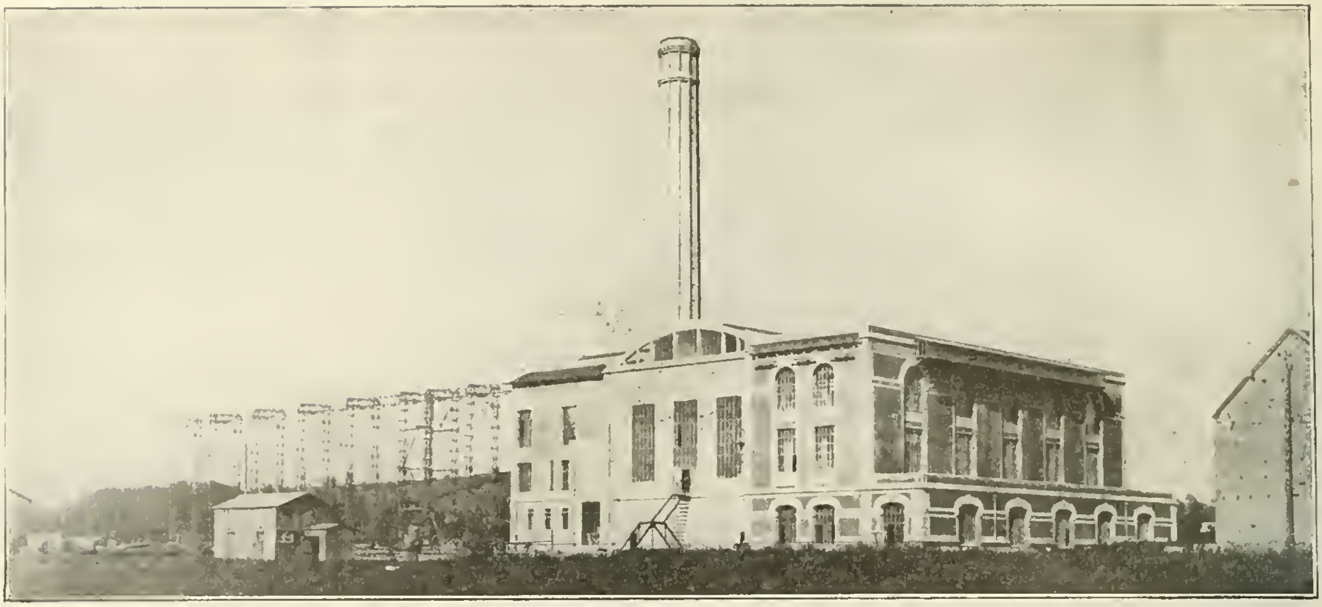
Female Substation Operators

A PEEP into the Roslindale substation of the Boston Edison company nowadays would give a grandmother of the late nineties one of the greatest surprises of her life. Even the central-station man, accustomed to progress in all branches of the industry, is inclined to rub his eyes a bit when he sees an installation like this operated entirely by young women of trim, alert competence, who not only can speak the electrical language but can deal with concrete apparatus with a skillful assurance born of an intensive training and practice. That a young woman with no previous electrical knowledge can be transformed into a reliable assistant operator in the short space of a month, and that she can be fitted in two months' total time to take entire charge of an operating shift, is little less than amazing; but it is one more evidence of American adaptability when confronted with a really acute problem.

Young women have been successfully trained for central-station service in England during the last few years, and the Boston company of course knew this in establishing its training plan for female substation operators. At the same time, its program was largely experimental, and there was little time in which to theorize as to the fitness of American girls for such work and the best methods of intensive instruction. This is the first instance in America of a substation taken over for exclusive operation by women, and it is significant that the Boston company is going ahead rapidly with its classes of girls in training to take the places of male operators as fast as conditions may require. There appears to be no difficulty in obtaining applicants of desirable type for the service required; the short but concentrated instruction given appears to be absorbed with readiness and even enthusiasm, and the actual handling of the installation in routine and emergency duty compares very favorably indeed with the work of men attendants. By selecting applicants from women having well-poised nerves and self-control, a reasonable measure of physical strength and an intelligent interest in this new and responsible work as the training unfolds its scope, the company has supplied itself with operators who are not stampeded by the opening of a high-tension switch under an overload or by the burning out of this or that piece of auxiliary apparatus by lightning. The "housekeeping" side of substation service, including the reading of instruments, preparation of log-sheet records and maintenance of cleanliness, is looked after with traditional pride and faithfulness, and the effect of the work upon the health of the operators seems to be excellent.

The Coming Issues

MORE employers of power-plant labor are beginning to realize that improvement of plant economy depends as much, if not more, on the training and handling of the labor as on the equipment used. Supplementing what has already been said in the Electrical World, there will be another article on "How Best to Educate Power-Plant Operators." The second installment of the article on conductor heating will also appear in an early issue. One means of economy that has not been talked much about is prolonging the life of line poles. This subject will be considered from the viewpoint of arresting decay that has already started. The economical loading of transformers, the construction of war-time outdoor substations and industrial applications of electricity will also be discussed. Besides data on the power consumption, speed and efficacy of spot welding, some very instructive suggestions will be given on maintaining induction motors and speeding production with graphic meters.



15,000-KW. STEAM GENERATING STATION CONSTRUCTED EXCLUSIVELY FOR AMERICAN EXPEDITIONARY FORCES

Electrical Developments for American Army

Present Plans for the Troops in France Provide for 50,000 Kw.—Technical Board, Newly Created, Controls Supplies and Co-ordinates Work of Design and Construction—Electrical Machinery Difficult to Get.

BY R. K. TOMLIN, JR.
Staff Correspondent in France

"WHAT are the electric power requirements of the American Expeditionary Forces and what is being done to meet them?"

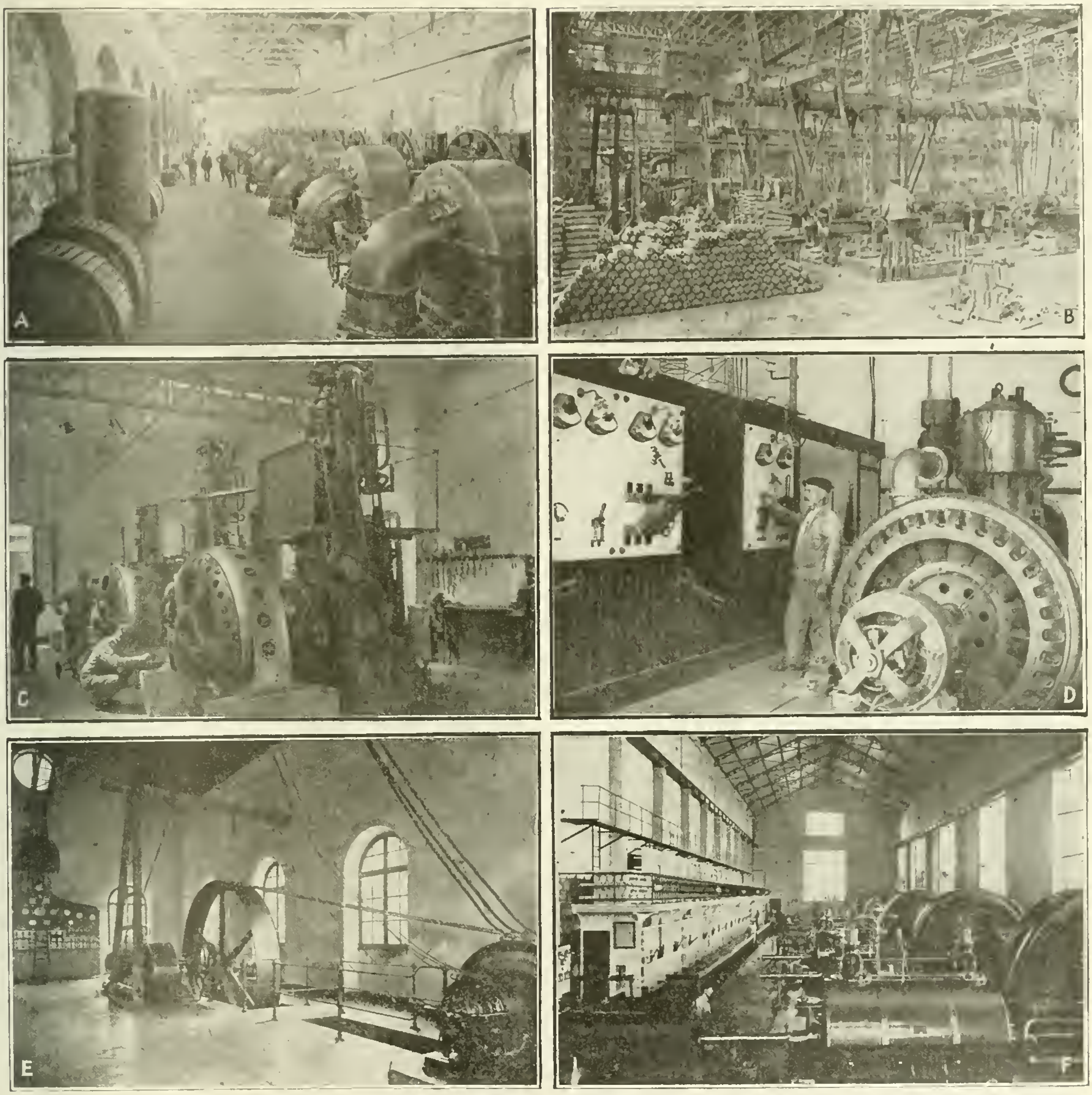
This is, in substance, the question I put to a captain of engineers at the headquarters of our Services of Supply in France who, since giving up his position in civil life with the Commonwealth Edison Company of Chicago, has been in responsible charge of electrical matters for our armies overseas. As a result of this interview it is possible to discuss in a general way the situation with which our electrical engineers in the American Expeditionary Forces are dealing.

It should be understood, however, that there is nothing of finality in what follows. Conditions change rapidly. One day an electrical engineer officer may be completing plans for the development of a certain amount of power at a certain place; the next week he may be faced with the problem of doubling the output originally contemplated. It generally works this way, that is, increase rather than decrease in the amount of work to be done. Then, too, sites where no provision of power was ever anticipated may suddenly become important centers of activity at which electric installations must be made or to which transmission lines must be built. It is nothing new for a 10,000-bed hospital project to spring up almost overnight.

Coupled with these conditions of uncertainty and change—conditions inherent in the engineering work of war as distinguished from that of peace—are others which make the job of the electrical engineer anything but a sinecure. The chief of these is the scarcity of electrical material and equipment available for quick delivery. It is well to recollect that we are working in a country that has seen four years of war. Industry has been mobilized. Electrical equipment of all sorts which was of use to the Allied armies early in the campaign has long since been rounded up and placed in service, leaving little new stock on hand for the man who arrives upon the scene three years or more after hostilities commenced.

"My best guess as to the electric power demands of the American forces at the present time in France," said one of my informants, "is from 50,000 kw. to 60,000 kw. What the future will bring forth no one can tell. Certainly we shall have to be prepared to meet additional requirements. Strung along between the seacoast and the front are scores of places which are calling upon us to provide electricity for lighting and for the operation of machinery. In the first category come the hospitals, many of them equivalent to fair-sized towns. Some are already built; many are now under construction; still more are contemplated. They present no complicated problem for the electrical engineer. The hospitals generally mean merely interior wiring, for frequently the sites are within reach of existing central stations.

More difficult situations from the point of view of the engineer who is called upon to furnish electric power are presented at such installations as repair shops for mechanical equipment and ordnance, docks and refrigerating plants. There are also aviation production centers containing large numbers of machine tools requiring power for their operation. In France to-day there are thousands of American army motor trucks, and their repair centers demand the installation of power plants. Then, too, there are the several



GENERATING ROOMS AND A MUNITION WORKSHOP IN FRENCH GOVERNMENT PLANTS (FROM OFFICIAL FRENCH PHOTOGRAPHS)

storage and supply depots where the lighting problem is no small matter. Our water supply service is engaged upon many projects which call for the furnishing of electric power for pumping. It is apparent, therefore, that the demands made for electricity are extremely varied. Another factor which adds difficulty to the work is that power requirements must be met at many widely scattered points. It is not a question of equipping and putting into operation one or two big central stations, but rather of providing numerous segregated plants.

As a general policy governing the operations of the Technical Board and the electrical division of the Services of Supply, it has been considered best, wherever possible, to make additions to existing French central stations rather than to build new ones of our own, although a certain amount of new work has been undertaken. The fuel situation demands careful economy of coal, and transportation conditions likewise make it necessary to conserve freight cars. Any large scale new central-station construction by the American army would necessarily involve more railroad track, more cars and more fuel.

Realizing fully the importance of these factors, our electrical engineers, when called upon to furnish power at some point, first make an investigation to see whether some existing French plant cannot be enlarged to do the work. Under present conditions, I was told, the policy is wherever possible to put in additional boilers, generators and transmission lines at a French power station rather than to embark upon new projects.

Sometimes the building of transmission lines from an existing station is the only new work required. It is true that the normal commercial load on many

French central stations has been greatly reduced since the outbreak of war, owing to restrictions in the use of electricity for lighting and for private enterprises of all sorts, but this reduction is more than compensated for by the increased demand of the war factories. The French stations are very carefully mobilized, and a close surveillance is kept over the sale of electricity. French power-plant operators cannot secure fuel except with the approval of a bureau of the Ministère de l'Armement, and not a kilowatt-hour can be delivered without a written authorization.

Another reason for making use of existing central stations, either in their present condition or enlarged, is the difficulty of securing skilled operators. Even when enlarged, these plants can be run by adding a few additional members to the force already on the job, which is, of course, a much simpler proposition than building a new plant and training a new operating crew. At present there is a great shortage of skilled labor available for central plant operation. Several large plants are now operated exclusively by women who work on heavy repairs and even fire boilers.

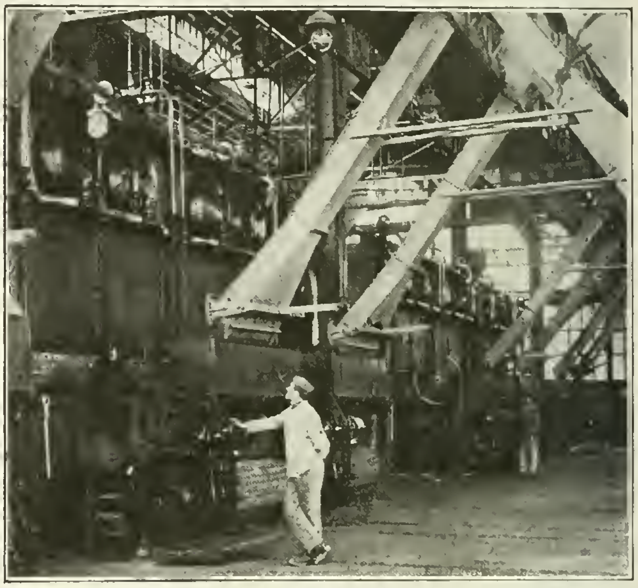
Purchases of French Equipment

As to equipment and supplies, our policy is to purchase as much as possible from the French. Deliveries from America under present shipping conditions involve uncertainty and delay. To provide and coördinate plans for projects and the purchasing of electrical equipment, there was created some time ago the Technical Board, with headquarters in Paris. On this board are serving electrical engineers of well-known professional standing. To them demands from the field come, and it is their duty to find out where the machinery can be secured most quickly. At the present time there is a decided shortage in transformers and the various miscellaneous supplies urgently needed in the electrical work of the American Expeditionary Forces.

There is no comparison between the situation here and the one affecting the purchase of electrical equipment in normal times in the United States. The supply of stock material in the plants of French manufacturers has long since been exhausted, and at the present time raw materials can be secured by them only after a requisition has been approved by the proper governmental authorities. Practically everything must be built to order. The obvious result of this situation is delay in delivery. A manufacturer must wait until he receives a specific government-approved order for electrical equipment for use in the American army, or, for that matter, elsewhere, before he can commence manufacture. Under present conditions the manufacture of a transformer, for example, is not a matter of merely a few weeks but rather of several months.

Assume, for example, that a French manufacturer of electrical material receives an order for a generator. Before he can take any action he must submit to the Ministère de l'Armement a bill of the raw materials required. This bill of raw materials and the purpose for which the machine is required must then be investigated. If the order is considered justified from the point of view of the national defense, it is approved and goes back to the manufacturer, who is then permitted to secure his raw material and commence manufacture. This recital of the various steps which must be taken before a transformer—or, in fact, any other piece of electrical machinery—can be delivered on the job for use will serve to indicate the true conditions which our electrical engineers are facing in their effort to meet the demands for power in the areas occupied by the American Expeditionary Forces. The minimum time for building transformers of, say 150 kw. rating is about four months. Raw materials in the plants of electrical companies are placed on schedule for filling orders months in advance. A specific case will serve to illustrate. One central station sent to a manufacturer in June an order for a transformer urgently needed but which could not possibly be built before December.

In the matter of insulators the shortage is still worse. Much of the clay used in the manufacture of insulators comes from England, and deliveries have fallen off considerably. Special arrangements with manufacturers, providing for coal and clay, however, are now under way.


FURNACE ROOM IN FRENCH WAR PLANT (FROM OFFICIAL FRENCH PHOTOGRAPH)

Referring to the matter of power-plant enlargement, the captain of the Engineer Corps explained to me that the French central stations at present have little money for extensions. No equivalent of the American "new-business" department exists in France. Such enlargements as are being made for use by the American Expeditionary Forces are being paid for by the United States. This same thing applies to transmission-line construction. Our policy is to adopt overhead construction entirely in connection with the distribution of electrical energy. We are paying for all the lines we build, and the understanding with the French government is that they are the property of the United States. When the war is over it will be possible for us to recover the material we have put into this work or, through some board of appraisal, negotiate with the French for its purchase if desired. Any policy which would have included an extensive amount of underground work would, it is clear, have resulted in various complications as to the final disposal of the material.

As for transmission lines, we have already built, or have planned to build, 220 km.—equal to about 137 miles. As a general rule, we use on these lines a voltage of 30,000. The highest voltage employed is 40,000. At the time of my visit to our Services of Supply transmission lines were under construction to supply four hospital sites, supply depots, an ordnance repair shop and special services such as gas manufacture.

The situation affecting the installation of electric power plants and transmission lines for the American armies is different from that of the French. This difference is accounted for, in some measure, by the temperament and customs of the two peoples. One enters a French "caserne," or barracks, and there is not an electric light to be seen. The men get along with lamps and candles. In marked contrast are the American barracks, most of which in the zones back from the immediate fighting fronts are wired and equipped with electric lamps.

The Technical Board

At the present time our electric service has trained men stationed at the various important centers of France where American troops are to be found. These men report to the electrical department at the Services of Supply, where construction and operation of the various field projects are centralized. This department, as noted before, works in very close coöperation with the Technical Board in Paris in all matters involving new projects and, particularly, in the purchase and delivery of machines and supplies.

The Technical Board, in so far as electrical matters are concerned, is the outgrowth of special conditions affecting the use of electric power by the American army in France. Early this year it became apparent that some agency would have to be created to handle the broad administrative problems involved, to determine policies, to pass upon and coördinate designs for individual installations, and to act in the dual capacity of consulting engineers and liaison officers in all situations of official contact between French and American interests. Obviously, the character of the work mapped out for the Technical Board demanded for its personnel men of exceptional qualifications, men combining a thorough understanding of the technical features of the electric generation and distribution with vision, tact and proved administrative capacity. Here was a place, of all others, where outgrown military usages and practices and the legacy of old army traditions, ill-adapted to the large-scale business and engineering problems of war as it is carried on to-day, had to be relegated at once to the scrap heap. The job of the Technical Board, which began its work last March, is to secure machinery, see that the electric power demands of the American forces at widely scattered centers in France are met—and met just as speedily as business methods can achieve this end—and, what is particularly important, maintain a complete and amicable understanding with the French government, through its Ministère de l'Armement, on all questions of electric generation and distribution.

This latter phase of the situation is one of big proportions. While our engineers are working at present to supply the immediate needs of the American Expeditionary Forces, it is absolutely essential now to look ahead to the time when a declaration of peace will release for commercial use the vast number of sources of electric power which have been or are being developed to-day strictly for the business of waging war.

In central France there are being built for American army use more than a score of so-called "usines"—manufacturing plants of one sort or another—required for the production or repair of war material. All of these plants call for electric power installations. The situation, therefore, is one which involves planning in order that present enterprises may be adapted to after-the-war conditions. Upon this after-the-war objective, as well as the immediate business of the armies, the Technical Board is focusing its vision. It is working in close coöperation with the French authorities, and our engineers in America may rest assured that in matters of electric power development in France our Technical Board is, in reality, constructing a sort of double-barreled gun—one barrel for the immediate use in war work, and the other for the industrial offensive which will begin just as soon as the artillery at the front is silent.

Water-Power Development

In addition to several steam-electric power stations which have been built by American labor in France, we have under consideration half a dozen projects for the utilization of water power by means of the "out-door type" of electric generating station described in the Electrical World of Jan. 19, 1918, by Alexander C. Clogher and Victor F. Hammel. In fact, it has been largely through the instrumentality of this article, I am told, that the French authorities have become convinced of the desirability of immediately beginning work on stations of this sort. The design provides for the utmost simplicity in construction—merely a water-wheel and generator on substantial foundations housed under a rough shed of some sort. However, the idea is ultimately to make these hydroelectric plants permanent. They will be left in their rough state for the duration of the war and will then be inclosed in a permanent masonry structure designed by French architects to meet the requirements as to exterior appearance, which are a matter of more concern over here than in the United States. Hydroelectric plants of this type now under consideration are rated at from 2000 kw. to 8000 kw. and will operate under moderate heads. For the initiative in introducing this "out-door" type of unit the Technical Board is directly responsible.

In contrast to these installations is another hydroelectric development of 9000 kw. which has been partially completed by the French. It is probable that the American forces will take over this work, finish it and operate the completed plant. In so far as possible the American-built and French-built systems of electric power transmission will be interconnected.

In view of present shipping conditions, where tonnage is being reserved for fighting men and their food rather than for other supplies, the Technical Board is endeavoring to procure practically all electrical equipment in France. There are, it was explained to me, two good reasons for this policy. In the first place, shipments of American-made products needed for power development are difficult, if not impossible, to secure. In the second place, the French equipment, built to conform to current French practice, is in many cases practically obligatory, especially in view of the fact that it must be used not only for present military needs but also for commercial service after the war.

On many details of electrical power development and transmission French and American practices are at variance, and certain American equipment would be practically useless over here. The French employ almost no direct current, the almost universal preference being for 50-cycle, three-phase currents. American equipment of either 60 or 25 cycles cannot be employed. Then, too, the distributing voltage in France is 3000 volts or 5000 volts; the American standard of 2300 volts does not exist in France.

Glass Insulators

I have referred before to the shortage in clay for insulators. The French have succeeded in producing a glass insulator suitable for service on 35,000-volt lines. For the manufacture of these insulators the French have developed skilled artisans, and the quality of glass, I was informed, is far better than anything which has been produced on a commercial scale in the United States. In fact, the electrical engineer who spoke to me about them was so well impressed with their quality that he said he would not hesitate to use French-made glass insulators on lines carrying voltages of 50,000 or even 60,000.

There is at present a pronounced shortage in the American Expeditionary Forces of electrical engineers available for the work immediately in hand. This condition has loaded upon the shoulders of the men now assigned to electrical duties a very heavy burden. At the present writing one region in France has been selected where four steam generating stations and one hydroelectric station are under construction by American forces aggregating 38,000 kw. in rating. All of these stations are to be linked into a single system with a voltage of 30,000, which will later be raised to 65,000 volts.

While the work of electric power development for the army in France is complicated by the shortage of machinery and equipment and other situations not encountered in peace-time operations, there are compensating advantages. The chief of these is the thorough way in which the French Ministère de l'Armement has mobilized the central stations, controlled the supply of fuel and regulated the distribution of energy. Not a kilowatt of electric energy can be produced without the authority of the Ministère de l'Armement. On all matters electrical its word is law. It is vested with powers which greatly simplify the putting into effect of such projects as are required for the uses of the American Expeditionary Forces. Close coöperation with the French, therefore, is accomplishing two big objects. First, it is giving us the necessary help in speedily carrying out the projects immediately demanded by military requirements, and, second, it is laying the foundations for an industrial renaissance in which electric power will assume a place in France never dreamed of before the war.

SUBSTANTIAL SAVING IS MADE BY INTERCONNECTION

Fifty Thousand Dollars' Worth of Coal Is Saved in the First Year's Operation of Massachusetts Transmission Tie Line

Six thousand three hundred and eighty-three tons of coal were saved by the first year's operation of the Salem-Malden-Revere transmission tie line of the Eastern Massachusetts Electric Company through taking advantage of the diversity factors in the central-station system in the above cities. This line, which has been described in the Electrical World, consists of two circuits rated at 5000 kw. each, carried in part on steel towers and in part underground and operated at 22,000 volts. It connects the largest plant of Charles H. Tenney & Company in eastern Massachusetts, at Salem, with plants operated by the same syndicate in Malden and Revere, and enables the two latter stations to be shut down at times when sufficient reserve capacity is available in Salem.

VIEW ON EASTERN MASSACHUSETTS TIE LINE

The rating of the Salem station is 17,000 kw., and the maximum load in 1917 was 11,250 kw. Of the latter, 4500 kw. was taken by the Naumkeag Steam Cotton Company's plant in Salem and 4500 kw. by the tie line. The fuel saved the first year through the tie line, with its provision for the economic balance of loads, exceeds $50,000 in value, and the total cost of the tie line with terminal houses and equipment was about $305,000.

The Outdoor Substation in War Service

Through Its Use the Sudden Demands for Power to Supply War Industries Have Been Promptly Met with a Resulting Conservation of Material and Labor—Outdoor Stations Have Come to Stay

BY E. B. MEYER
Assistant to Chief Engineer, Public Service Electric Company of New Jersey

ON ACCOUNT of the rapidity with which most of the materials covered by war contracts must be delivered, industrial companies have found that the building of isolated plants is out of the question, not only because of the time necessary for erection, but because of the low rates and excellent service furnished by utility companies. As a result central-station companies have had to make numerous extensions to their plants to take care of the demands imposed upon them by the war industries. The difficulty of obtaining material on short-time delivery, the speed with which the installations have to be made at the present time, and the need of conserving funds, all make it imperative that all central-station equipment be utilized to the best advantage. With this idea in mind, many central-station companies have adopted the practice of providing outdoor substations for serving the various war industries which are depending upon them for power.

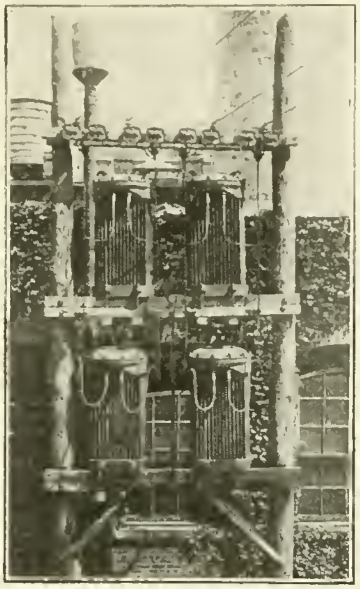


FIG. 1—WOODEN STRUCTURE SUPPORTING OUTDOOR TRANSFORMER ON POLES

The development of electrical apparatus and equipment has been such in recent years that at the present time it need no longer be operated indoors. The use of outdoor substations, therefore, has been one of the means of hastening the end of the war in that it is no longer necessary to provide costly fireproof structures for the housing of electrical equipment. Outdoor installations can be made at a greatly reduced cost and the saving in both labor and material for use in connection with other work having a more direct bearing on the war is therefore an item which should not be overlooked.

For small outputs and comparatively low voltages the transformers are usually hung from a substantial pole directly underneath the transmission line (Fig. 1), the switching equipment being mounted on cross-arms between the line and the transformer, and the transmission line carried on the top of the pole. Transformers of larger output or higher voltages are mounted on platforms, sometimes arranged on steel towers (Fig. 2), and at other times on wooden structures supported between two or more poles, while the switching equipment is usually carried immediately above the transformer. For the largest outdoor substations the transformers are mounted on guarded concrete platforms (Fig. 3), while the switching equipment and transmission lines are carried on steel towers of strong construction.

Substations of the portable type, with the apparatus mounted on wagons, floats or railway cars, are particularly adapted for breakdown auxiliary service, temporary peak loads, construction work or any of the other numerous war-time demands made upon the central-station companies.

It was originally supposed that the outdoor station created a greater hazard to the public than one in which all the equipment is housed, but this fear is groundless since with the property inclosed by a substantial fence the danger to the public is eliminated. With the outdoor substation there should always be less danger from fire, provided proper precautions are taken against the accumulation of inflammable material on the property.

REQUIREMENTS OF AN OUTDOOR STATION

In the design of an outdoor substation it is desirable that the installation be as neat and compact as possible. Usually elaborate switching equipment is not necessary to provide immunity from interruption as in most cases interruptions are so infrequent that the cost of providing duplicate and expensive equipment is not warranted. The outdoor installation, as well as all

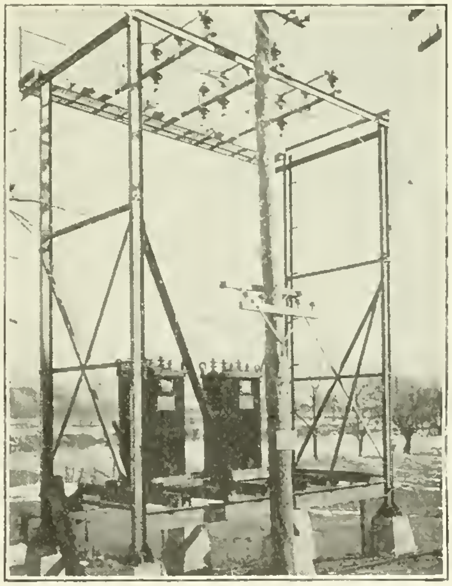


FIG. 2—HIGH-VOLTAGE TRANSFORMER MOUNTED ON STEEL STRUCTURE WITH TRANSMISSION LINE AND SWITCHING EQUIPMENT ABOVE

other forms of high-tension installations, should be so arranged as to make the operation as simple as possible and at the same time provide ample protection to the operators and repair crews.

In a number of outdoor substations steel structures are used for mounting the buses, disconnecting switches and other equipment. The difficulty at this time of obtaining delivery on structural steel and the advisability of conserving this material for shipbuilding and other important war needs has made it necessary to look about for some other type of construction. Heavy wood poles and timber construction may be used to good advantage and at the same time reduce the cost considerably. In Fig. 4 is shown an outdoor installation for 26,000-volt operation in which all of the equipment is mounted on a wood structure. The main electrical connections of this installation are shown in Fig. 5.

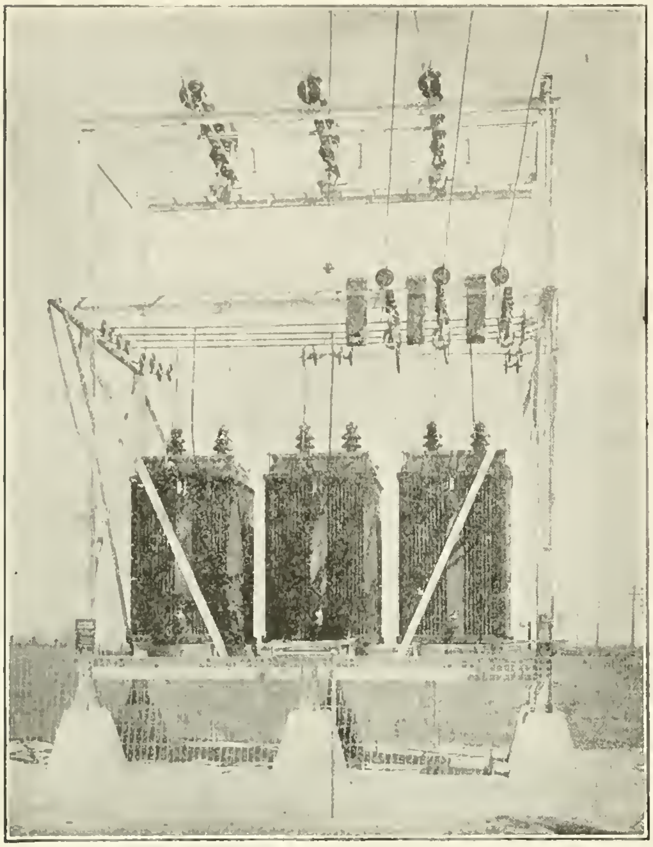


FIG. 3—OUTDOOR TRANSFORMERS MOUNTED ON GUARDED CONCRETE AND STEEL PIERS

In Fig. 6 is shown what might be called a semi-outdoor installation. This substation is located in a factory district where real estate was readily obtainable at low cost and where it was contemplated to change the transmission voltage from 13,200 to 26,400 volts, which change necessitated an entire new substation design. The water-cooled transformers, high-tension oil switches, aluminum-cell arresters and buses are installed outdoors. The automatic induction feeder regulators, switchboard, 2400-volt double bus and 2400-volt electrically operated oil switches are installed indoors. The arrangement selected necessitated a building approximately 25 ft. (7.6 m.) wide, whereas a design with all of the equipment installed indoors would have increased the width to approximately 50 ft. (15.2 m.) in order to obtain proper clearances for 26,400-volt operation. A longitudinal section of the building and outdoor equipment is shown in Fig. 7. From this substation to the customer there are three 250,000-circ. mil. cables feeding a common bus. As automatic regulation was required on these feeders, it was necessary to mechanically interlock the three single-phase regulators, one of which was used on each phase.

The outdoor arrangement worked out very satisfactorily from both first-cost and operating standpoints and it has resulted in the adoption of this particular design in other locations. Between the transformers and the outdoor installation running parallel to the substation wall is a track which leads to a small house in which transformers may be repaired. The repair house is provided with a hoist so that the transformer coils may be readily removed and the casing placed outdoors while repairs are being made to the winding without interference from bad weather. It was because this substation is situated in a section remote from other properties of the central-station company that it was thought advisable to provide ready means for repairs.

Where outdoor equipments are built adjacent to existing stations, it is not necessary to provide a separate repair house, as in such installations cranes and other facilities are usually at hand to take care of emergency repairs. An installation of this kind is shown in Fig. 8. Where repairs are necessary, the transformer is moved into the station building either by means of a track or skids and all work carried on indoors where overhead cranes are provided.

Storage of Oil During Transformer Repair

In installations where large capacity oil and water-cooled transformers are used it is sometimes necessary to provide a tank for storing the oil from transformers under repair. Oil tanks are usually built of boiler plate, but as this class of material is one of those on the list which must be conserved for war purposes, it is neces-

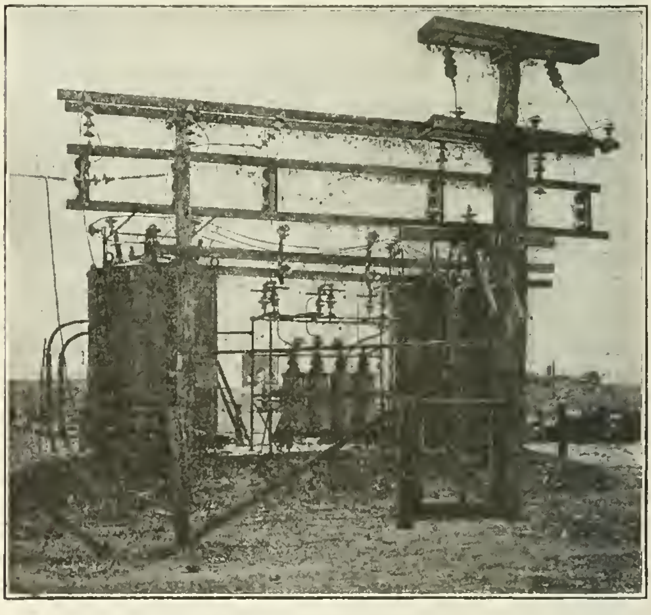


FIG. 4—INEXPENSIVE HIGH-VOLTAGE OUTDOOR INSTALLATION

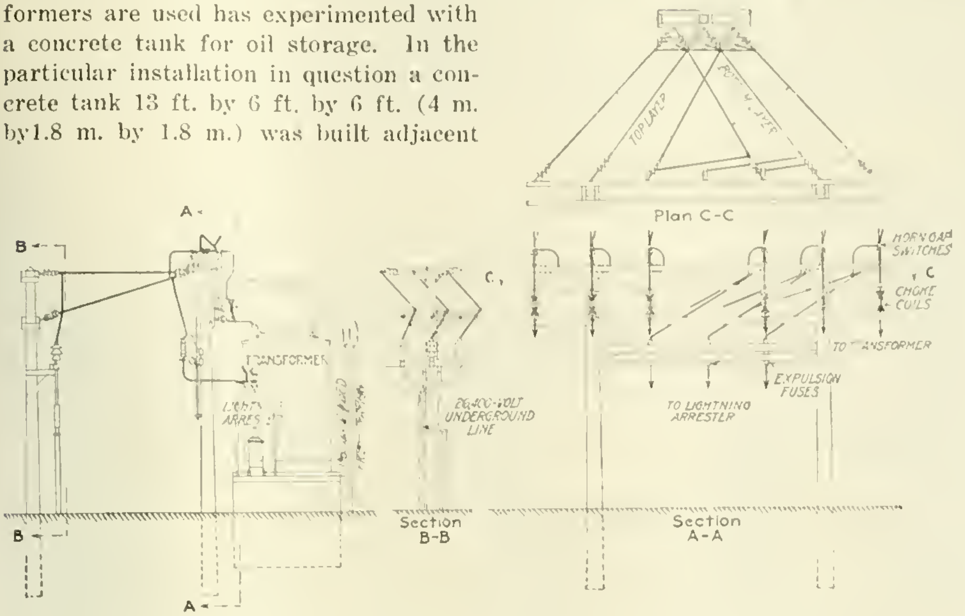


FIG. 5—SECTION AND PLAN OF OUTDOOR STATION SHOWN IN FIG. 4

sary to provide some other form of construction as a substitute. One large central-station company where a number of high-capacity oil and water-cooled transformers are used has experimented with a concrete tank for oil storage. In the particular installation in question a concrete tank 13 ft. by 6 ft. by 6 ft. (4 m. by 1.8 m. by 1.8 m.) was built adjacent to the outdoor installations and so arranged that the oil can be drained from the transformers directly into the tank. The tank is built with a mixture of one part cement, two parts sand and four parts broken stone and reinforced rods to make a structure of sufficient strength to withstand the oil pressure. The interior of the tank is plastered with a waterproof compound, over which are applied several coatings of silicate of soda. An airtight cover is provided on the top of the tank and the necessary provisions are made to allow pumping the oil back into the transformers when repairs have been completed. It is not expected that the oil will have to remain in the concrete tank for any great length of time so that the leakage, if there is any, will be practically negligible. The matter of providing proper housing for repairs and storage of oil may at first seem to be somewhat of a refinement; it nevertheless is important in large installations if it is desired to keep the cost of repairs at a minimum and at the same time avoid delays in placing equipment back into service. In many instances lack of attention to the matter of repair facilities has resulted in delays, with a consequent loss in revenue to the central-station company. It must not be inferred, however, that making repairs constitutes a serious difficulty, as with reliable apparatus and proper accessibility it is often easier to make repairs outdoors than indoors, where lack of room sometimes handicaps the repair men.

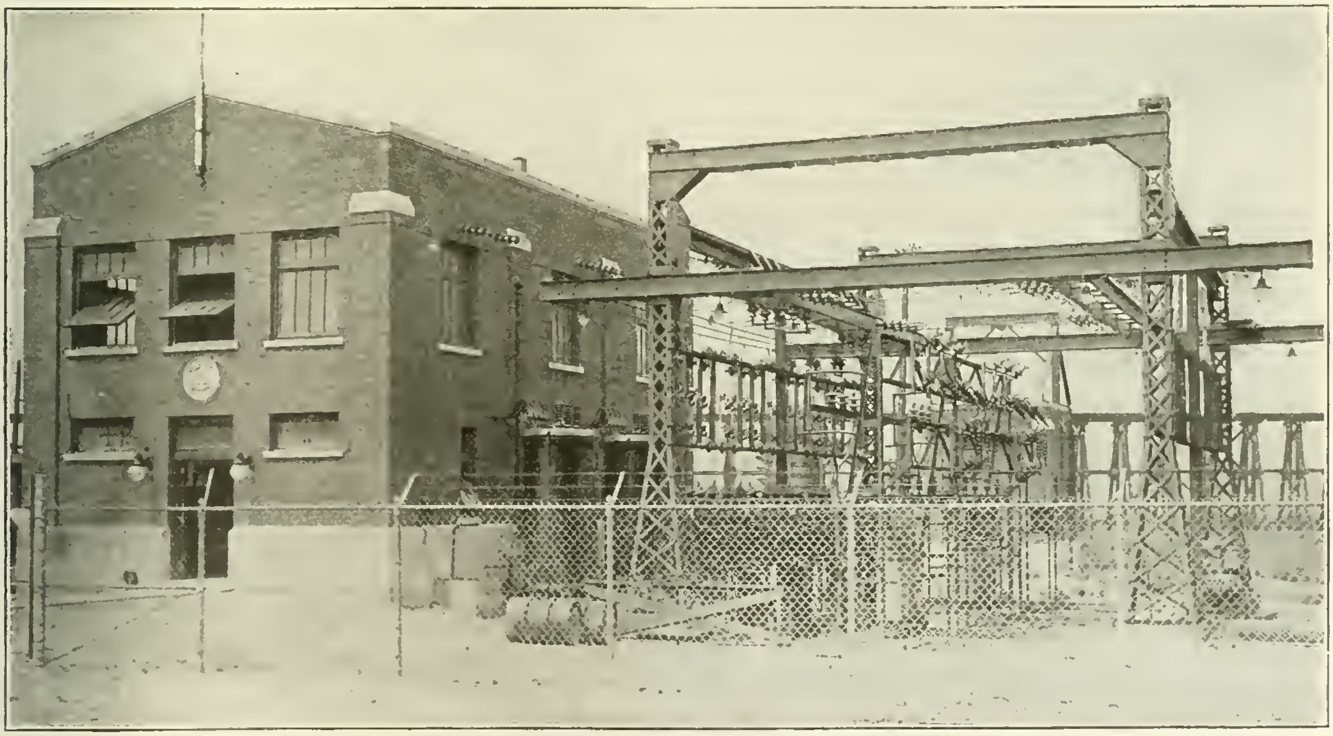


FIG. 6—SEMI-OUTDOOR INSTALLATION

COOLING TRANSFORMERS

Adequate cooling may be provided for transformers by three different methods: (1) Cooling tower; (2) spray pond; (3) deep-well pumping outfit. The objection to the spray pond is the amount of room required for this type of installation, as in order to obtain sufficient spraying surface an area 50 ft. by 50 ft (15.2 m. by 15.2 m.) is required for even a moderate-sized installation. A cooling tower may be of two types, one commonly called the forced-draft cooling tower and the other the atmospheric cooling tower.

What might appear to be an objection to both the spray pond and cooling towers is the fact that in the hottest months when the greatest amount of cooling is needed the relative humidity is also greatest, consequently the theoretical dew point is raised so high that it becomes a rather difficult matter to bring the circulating water temperature down to the required value. In one installation, in order to overcome this difficulty a deep well was driven, and the water supply obtained from this well was practically constant all the year at a temperature of 52 deg. Fahr. (11.2 deg. C.). To dispose of the water a second deep well was driven and the circulating water pumped back into it and allowed to seep into the ground through the various earth strata.

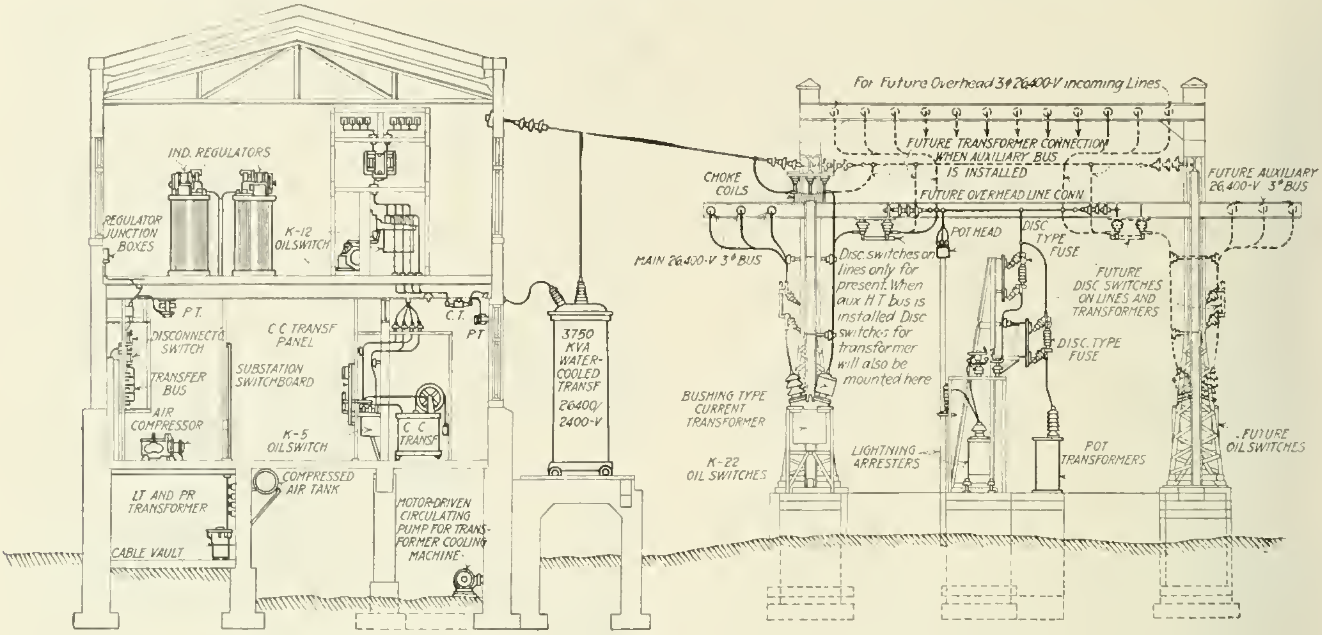
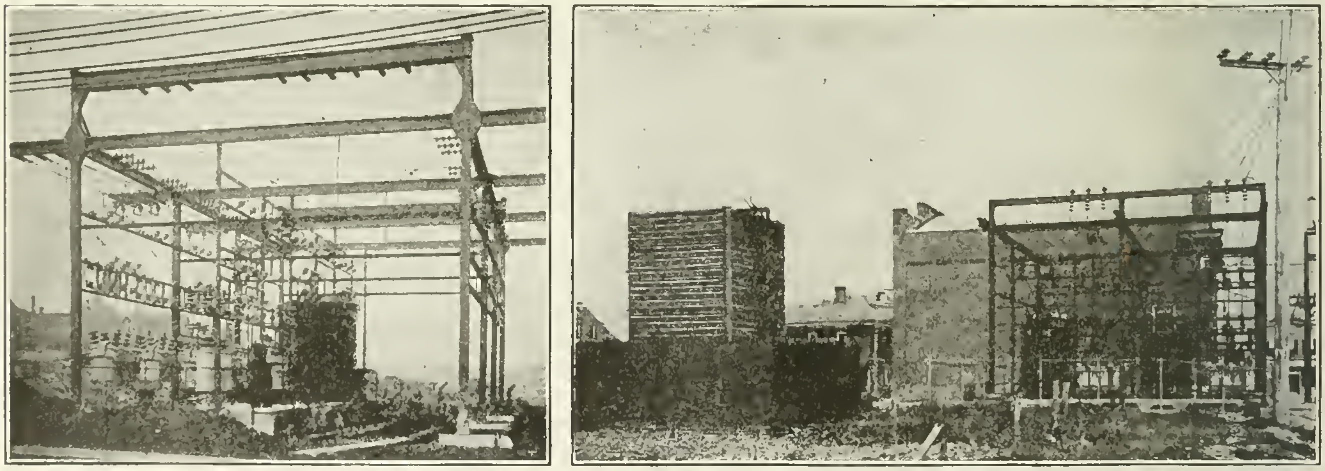

IND. REGULATORS
REGULATOR JUNCTION BOXES
K-12 OILSWITCH
P.T.
DISCONNECT'G SWITCH
C C TRANSF PANEL
C.T.
PT
TRANSFER BUS
SUBSTATION SWITCHBOARD
AIR COMPRESSOR
K-5 OILSWITCH
C C TRANSF
3750 KVA WATER-COOLED TRANSF 26400/2400-V
LT AND PR TRANSFORMER
CABLE VAULT
COMPRESSED AIR TANK
MOTOR-DRIVEN CIRCULATING PUMP FOR TRANSFORMER COOLING MACHINE
For Future Overhead 3φ 26,400-V incoming Lines
FUTURE TRANSFORMER CONNECTION WHEN AUXILIARY BUS IS INSTALLED
CHOKE COILS
FUTURE OVERHEAD LINE CONN
FUTURE AUXILIARY 26,400-V 3φ BUS
MAIN 26,400-V 3φ BUS
POT HEAD
DISC TYPE FUSE
Disc. switches on lines only for present. When aux H T bus is installed Disc switches for transformer will also be mounted here
FUTURE DISC SWITCHES ON LINES AND TRANSFORMERS
DISC. TYPE FUSE
BUSHING TYPE CURRENT TRANSFORMER
K-22 OIL SWITCHES
LIGHTNING ARRESTERS
POT TRANSFORMERS
FUTURE OIL SWITCHES

FIG. 7—LONGITUDINAL SECTION AND MAIN CONNECTIONS OF SEMI-OUTDOOR INSTALLATION SHOWN IN FIG. 6

In Fig. 9 is shown an outdoor installation with an atmospheric cooling tower on one side of the property. The tower has a capacity of 50 gal. (189.3 l.) per minute, occupies a space 7 ft. by 11 ft. (2.1 m. by 3.4 m.) and is 15 ft. (4.6 m.) high. The cooling surfaces or decks consist of drip bars and the louvers inclose the tower on all sides and are constructed of No. 22 galvanized corrugated steel plate.



FIGS. 8 AND 9—26,000-VOLT OUTDOOR INSTALLATION ADJACENT TO EXISTING GENERATING STATION, AND OUTDOOR SUBSTATION WITH COOLING TOWER CONNECTED WITH TRANSFORMERS

The guarantee conditions for the tower are based on average weather conditions for the place of installation, the hottest month being chosen as representing most severe operating conditions.

The following figures were used in calculating temperature range for a tower on the Atlantic seaboard:

Mean July temperature (deg. Fahr.)	73.5
Mean July wet bulb (deg. Fahr.)	67
Mean July humidity (per cent)	71

Assuming water leaving the transformer coils at 100 deg. Fahr. (37.8 deg. C.), the temperature of water leaving the tower is obtained by substituting in the formula $T_1 = (T + 2t_1 + t) \div 4$.

t = temperature of atmosphere

t_1 = temperature of wet-bulb

T = temperature of water on tower

T_1 = temperature of water off tower

$T_1 = (90 + 134 + 73.5) \div 4$

$T_1 = 74.4$ deg. Fahr.

During winter weather considerable trouble may be experienced due to freezing of the water in the pans, but by installing a by-pass valve and piping so as to utilize only the bottom tray the freezing is eliminated.

In conclusion it may be said that the modern up-to-date outdoor substation has come to stay and its evolution has gone steadily forward. The outdoor equipment is well adapted for furnishing both the small rural load and the more important industrial centers. It is far more simple than the indoor type and more space may be occupied with less money expenditure both in structures and equipment, with the resultant advantage that no needless expenditure has been made on useless inclosures and barriers.

The problem of cooling the equipment has been solved in both the small and large size installations so that it is no longer necessary to provide expensive housing for large capacity transformers.

High-tension insulators, terminals and switches have been developed to such an extent that they may be as safely operated outdoors as when installed under cover, free from the action of the elements.

The development of the outdoor substation has been one of the most important factors in the interconnection of high-tension electrical systems and by its means considerable fuel saving may be accomplished in that the most economical generating units may be employed for long-hour use for serving the transmission lines through outdoor substations feeding concentrated industrial centers.

In these days of conservation of labor and building material, the outdoor substation is a step in the right direction as its construction not only releases the experienced labor employed in building construction but also releases cars and barges which may be used to better advantage in the transporting of coal and other materials which are of vital importance in hastening the victory of the Allies.

Present War Production Made Possible by Utilities

Central Stations Provided Power Without Delay, Affording War Industries an Opportunity to Study Other Production Problems—Financing New Extensions Is Now a Serious Problem That Confronts the Companies

When the full story of this great war is written, at least so far as this country's participation is concerned, the vital part which the public service companies have played should receive thorough recognition. It is not too much to say that the United States would have been absolutely unable to contribute its share, or at least what the rest of the world confidently expected this country to produce, in the way of machinery for the winning of the war—the word machinery being used in the broader sense, as it applies to every cog and link and buttress in the war structure—were it not for the facilities immediately at hand which the public utilities were able to offer.

Granted the ability to erect buildings, factories of every description, shipyards and cantonments, etc., all of which was done in record time and at huge expense, all these structures would have been worthless—these built-over-night industries futile—without power supply. The manufacturers of generating apparatus and prime movers could not have supplied sufficient isolated-plant equipment, capable of supplying power capacity for all these war industries, under two or three years' time.

The public utilities were called upon to supply the demand. That this demand immediately became a very serious one was due to the fact that certain localities, because of their transportation facilities—water and rail—were natural centers where the government could not only develop existing plants but build new ones with the prospect of maximum and immediate production. Because of this situation the Philadelphia district, with its many natural advantages, immediately became one of the most important war industrial centers, if not the most important. In speaking of the Philadelphia district is meant, roughly, the territory contiguous to the Delaware River, from Bristol, Pa., on the north, to Wilmington, Del., on the south.

In this district are new and old shipbuilding plants whose production will be not less than 50 per cent of the entire shipbuilding output in the United States. If ships will win the war, it is obvious that the Philadelphia district is going to have a tremendous share in this eventuality. In addition to the shipbuilding industry, there is hardly a branch of war work which is not represented by one or more factories in the district, from the manufacture of large and small caliber field guns and howitzers, rifles and shells of all calibers and heavy armament—all the way up and down the scale—to storage batteries, chemicals and textiles.

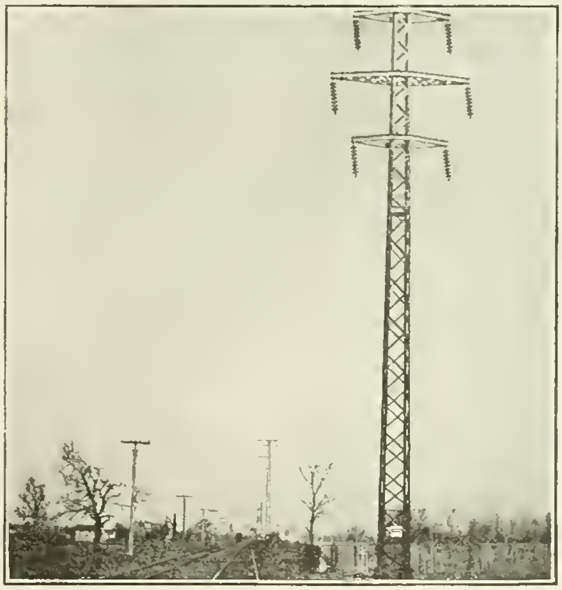


FIG. 1—TIE-LINE RELEASING RESERVE EQUIPMENT FOR SERVICE

The expansion of old industries and the building up of new ones naturally introduced a civic problem of great difficulty. The shifting of labor became tremendous, and the influx of additional workmen with their families and the housing and transportation of this new army presented numerous difficulties.

In the final analysis, the central station became the main source of supply. All lines seemed to lead to it —power for the factories, light for the dwellings, power for the transportation companies to take the laborers to and from their daily toil, etc.

This condition immediately developed into a serious problem for the central station. Where was the capacity to come from, and, not less serious, how was it to be financed? For it must be borne in mind that the central station, in spite of tremendously increased operating expenses, furnishes power to the government not at a cost plus basis but according to the regular scheduled rates and tariffs.

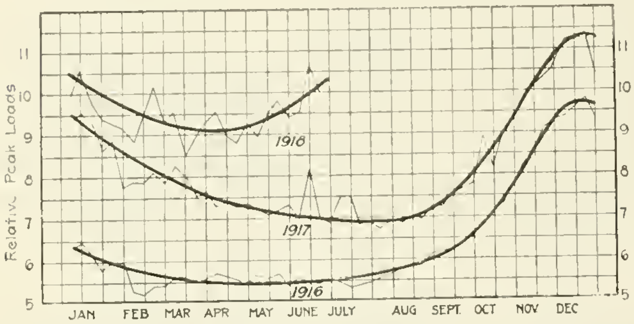


FIG. 2—HOW MONTHLY PEAK LOADS HAVE INCREASED SINCE WAR BEGAN

Fortunately the Philadelphia Electric Company had laid its plans, prior to this country's entering the war, for the erection of a 120,000-kw. plant on the Delaware River at Chester. This plant will have two 30,000-kw. turbines operating within a few weeks. A 66,000-volt tie line has been constructed and is in operation, connecting the old Chester plant and the new plant with the main generating station in Philadelphia. The additional capacity afforded in this way is not sufficient, however. Plans were made for another 180,000-kw. plant on the Delaware River, but, unfortunately, about the first of the year all work on this new plant had to be discontinued because of the impossibility, prior to the passing of pending legislation at Washington, of financing the operation.

The situation, naturally, is a very serious one as the company approaches the period of fall and winter demand. Many thousands of kilowatts have been connected to the lines on an off-peak basis, while some 30,000 kw. to 50,000 kw. of new business, practically all war business, cannot be connected at all, pending an increase in station, substation and transmission capacity.

The generating, substation and transmission system which furnishes central-station power to Philadelphia, the adjacent district and Delaware County covers a semi-circular area whose base is on the Delaware River, between Tacony on the northeast and Chester on the southwest, which territory covers an area of two or three hundred square miles.

The bulk of the power delivered to this district is supplied from four main generating plants. Stations A-1 and A-2, which are, for all practical purposes, operated as one station and known as the Schuylkill Waterside Station, are at Twenty-eighth and Christian Streets, approximately the center of this district. The northern section is supplied by a generating station at Tacony, Pa., and the southern section of the district is supplied by a generating station at Chester, Pa.

In addition to these generating stations there are five smaller plants distributed throughout this area. With the exception of one furnishing power to the old Edison underground system, these are used mainly for the generation of power for municipal lighting.

To supply the increased demands for power due to the recently built munition plants and shipyards in this district a new station of 120,000 kw. is now nearing completion in the southern district. Two units of 60,000 kw. rating will be placed in service in a short time.

The transmission system serving commercial lighting and industrial power loads carries 13,200-volt, 50-cycle, three-phase energy. The Pennsylvania Railroad electrification and the street railways in the central part of the city are supplied from the 13,200-volt, 25-cycle system. In order to obtain greater flexibility of operation the 25-cycle and 60-cycle systems are tied together through a frequency-changer station with a normal rating of 18,000 kva.

The main generating stations are tied together by heavy trunk lines approximately paralleling the Delaware River. These lines, operating at 13,200 volts, are used in the transfer of considerable amounts of energy between stations or in supplying the substations from either of the generating stations. In addition to the 13,200-volt trunks there is now in operation a 66,000-volt transmission line, approximately 12½ miles (20 km.) in length, capable of carrying 30,000 kva. between the Twenty-eighth and Christian Street stations and those in the southern section. This line is used not only to transfer energy between these two generating centers but also to feed a considerable amount of power to the munition and shipbuilding plants along the Delaware River.

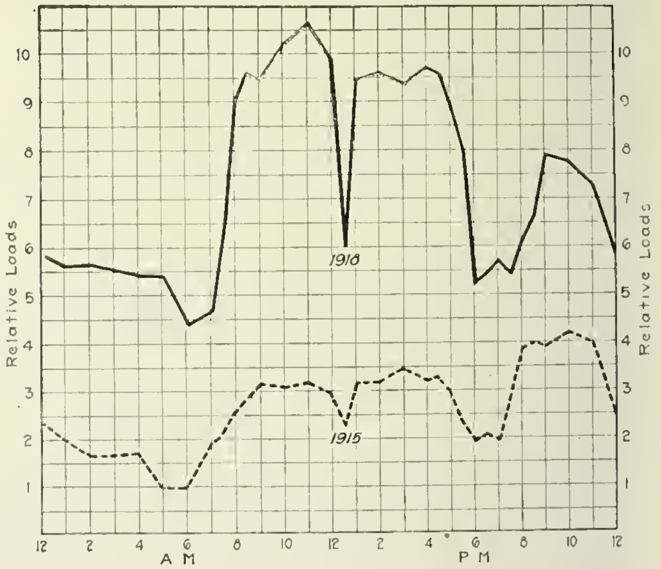


FIG. 3—TYPICAL SUMMER LOAD CURVES NOW AND DURING EARLY DAYS OF WAR

The distribution system is supplied by approximately fifty industrial and company substations. Power is delivered to the industrial substations at 13,200 volts, three-phase, while the company substations transform the energy either to 2400 volts, 60-cycle, for distribution over its lines in the central district, or to 110 220-volt direct current for distribution to the Edison district.

The entry of the United States into the war and the subsequent tremendous demand for all sorts of war equipment have totally changed the character of the manufacturing industry in Philadelphia. From being the "workshop of the world" and leading in the manufacture of articles of such widely diversified nature as locomotives, textiles, chemicals, carpets, street-railway cars, felt hats and saws, Philadelphia was transformed almost overnight into a city of war industries.

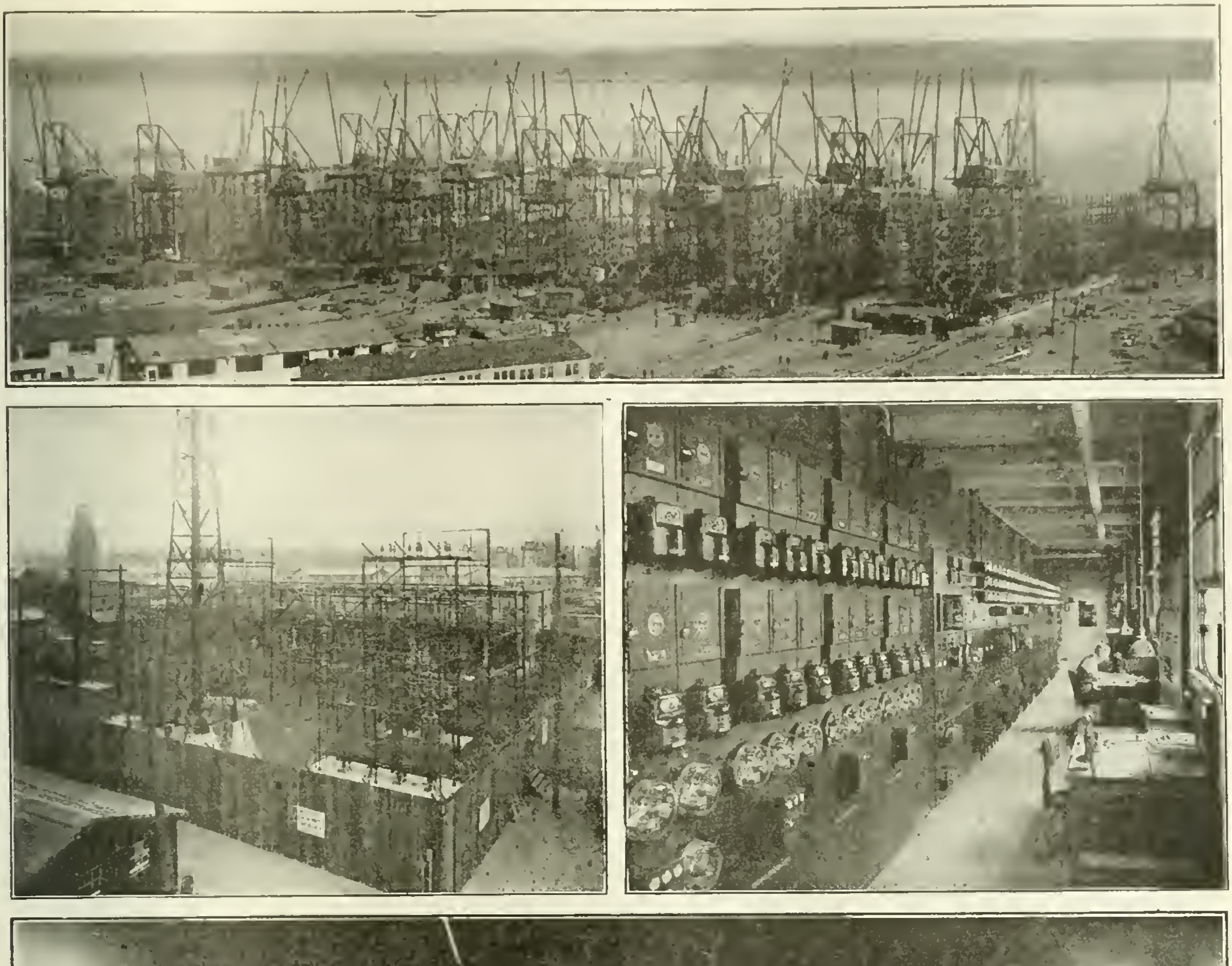


FIG. 4—GENERAL VIEWS AT LARGE SHIPBUILDING YARD SERVED BY PHILADELPHIA ELECTRIC COMPANY

The most important war industries served by the Philadelphia Electric Company and its subsidiary, the Delaware County Electric Company, in point of size and energy consumption, are the munition factories, arsenals and shipbuilding companies. Under the classification of munitions are included shells of all sizes and types as well as bombs—trench-mortar bombs, depth bombs and aerial bombs. The supplying of energy to the arsenals has an added interest because of the fact that Philadelphia Electric energy is used in every operation possible in the manufacture of the guns from the time the ingot is delivered until the gun is completed. This includes the gun carriage as well.

The shipbuilding industry on the Delaware River in Philadelphia and vicinity has always been a considerable factor in the shipbuilding trade of the country, but since the entry of the United States in the war and the consequent backing of the industry by the government it has, of course, greatly increased production. It is estimated that as soon as all the added facilities are completed a ship a day will be launched on the Delaware. They will be of many types—from the steel freighter of 11,000 tons deadweight down through all the grades and sizes to the 1000-ton wooden ships. With one or two exceptions, these plants are all served by the Philadelphia Electric Company.

The demand for power by the war industries has been little short of overwhelming in Philadelphia, as shown by the curves in Figs. 2 and 3, which indicate relative loads only. Part of the demand has been due to increased manufacturing facilities in the shape of extensions to existing plants. All hitherto idle machinery has been thrown into service, and the manufacturers are driving to the utmost every bit of existing equipment in order to speed up production. Where possible they are operating on a twenty-four-hours-a-day basis, but owing to the scarcity of both skilled and unskilled labor the best they can do in most cases is to operate in two shifts.

The war is revealing more and more sharply to the public at large the importance of the public utility—particularly the central station—in the conduct of the world's business. The Fuel Administrator's priority decision regarding fuel shipments to public utilities has opened the eyes of the "man on the street" to what he has been taking more or less for granted—the absolute dependence of the community on its public utilities.

The overnight establishment of war industries has also revealed very clearly the fallacy of the isolated-plant principle. Many manufacturers using central-station service found it was a simple matter to expand their facilities to take care of war business. On the other hand, many of those who were burdened with their own generating plants found that they had not the extra capacity for the new business, nor for that matter could they have secured additional labor and fuel without a great deal of difficulty. So they turned to the central station. Where new factories were built or additions made to existing plants, it was quickly found that central-station service was the only answer to the power problem. It was first of all impossible or unwise to divert the necessary capital into the purchase of a generating plant. Deliveries of prime movers and other necessary electrical equipment were on a one, two and three year basis. Labor and coal were high in price and exceedingly difficult to secure. All these factors would have made the cost per useful kilowatt to the war products manufacturer disproportionately high even had he been successful in building and equipping his generating plant.

But the final and determining factor in most cases was the central station's ability to deliver energy immediately. While central-station executives and engineers have been harassed to the breaking point almost by the same difficulties as experienced by individual manufacturers—except that these difficulties have been on a much larger scale—they have nevertheless made available large blocks of power to the war industries, and their superior resources along this line have naturally enabled them to expand with comparative speed.

PARTIAL LIST OF PRODUCTS FOR WAR PURPOSES NOW MANUFACTURED IN PHILADELPHIA AND VICINITY WITH CENTRAL-STATION POWER

Ships
Explosives
Railway supplies
Machine and trench tools
Hosiery
Submarine batteries
Submarine engines
Parts for U-boat chasers
Shipyard cranes
Truck parts
Cloth for uniforms, blankets
Fertilizer and chemicals
Drugs
Bayonets
Steel forgings
Food for U. S. Army
Soap and lye
Auto parts and floats for submarine nets
Balls and ball bearings for Liberty motors
Parts for range finders
Gas masks
Water jackets for machine guns
Fabricated iron and steel for ships
Chemicals for explosives
Cameras for aeroplanes

While it may be assumed that these conditions hold true in any territory devoted to the manufacture of war industries, they have been particularly applicable to the Philadelphia district. As an instance, a huge shipbuilding plant in the process of building had an immediate requirement of 600 kw. As soon as it was ready to begin operations, arrangements were complete to supply it according to its requirements. This initial requirement was only an insignificant part of the final total connected load. In another case a famous old concern was building a huge new plant for the manufacture of munitions. Here it was a question again of time—it would have been impossible for this firm to provide its own electricity even if it had desired to do so. Its immediate requirement was 1000 kw., and by the time the new plant was partly ready to operate the energy was available.

> This is much more than a war to alter the balance of power in Europe. It is a war to make the nations and peoples of the world secure against every such power as the German autocracy represents. It is war of emancipation. Not until it is won can men anywhere live free from constant fear or breathe freely while they go about their daily tasks and know that governments are their servants, not their masters.—*Woodrow Wilson.*

Woman Substation Operators a Notable Success

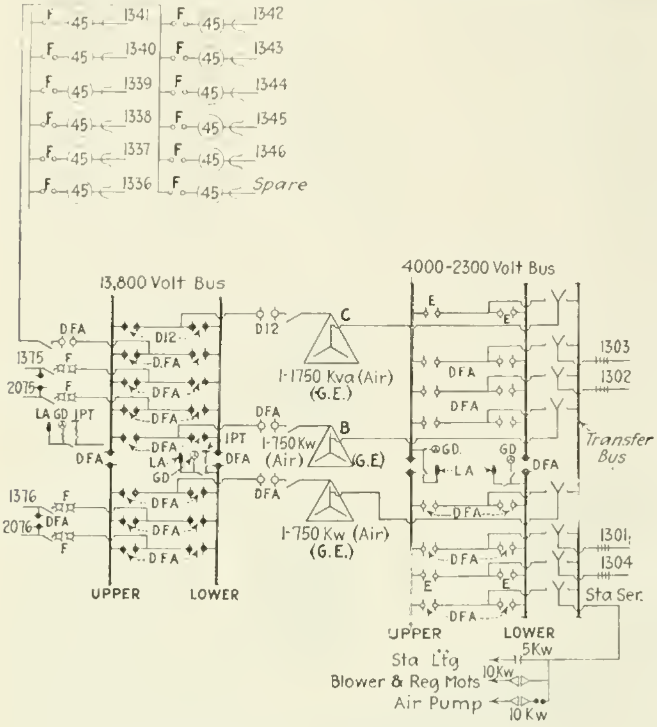
In a Month a Girl Who Never Heard of an Oil Switch Is Now Taught to Be an Assistant Operator—Pioneer Work by Boston Edison Company in Training Women for Electrical Service Yields Admirable Results

THE war has brought many changes in central-station practice, but few of these are more significant than the use of women as substation operators on the system of the Edison Electric Illuminating Company of Boston, Mass. While as yet only about thirty women are engaged in this work, there is every prospect that the number will be extended, in view of the entrance of station operators into the army, the navy or munitions plants and the difficulty of procuring men capable of being "broken in" for this service. The Roslindale and Dorchester substations are now operated exclusively by women, and the results appear to be admirable in every way. The service appears to be fully as reliable as though men were in charge of these substations. Emergencies have been skillfully met, and the effect upon the health of the operators has been uniformly good.

Last spring C. H. Parker, superintendent of the generating department of the Boston company, foresaw that continued war demands would make it more and more difficult to retain and to replace male operators in the substations. The company distributes energy over an area of about 700 square miles, and for this reason the substation service is of great importance. Steps were therefore taken to secure applicants through the various suburban stores of the company, no advertising being required. To R. E. Dillon, assistant superintendent of the generating department, was given the task of interviewing the women who applied for substation work and passing upon their qualifications.

In general, fitness depends upon character, size, physique and kind of work previously performed. Electrical knowledge or experience is not an essential. It has been found that where a girl has been doing heavy machine work or farm tasks she is usually better fitted to take up operating duties than is one whose experience has been purely clerical. A good grade of intelligence is requisite, although it is not essential that the applicant shall have completed even a full grammar-school education.

Upon accepting eighteen applicants, the company organized a course of training for them at the laboratory in the Massachusetts Avenue Service Buildings, and here the class was instructed in the fundamental principles of electricity. The initial course included textbook study, practical demonstrations, equipment set-ups, visits to the main generating plant of the company at South Boston, trips to substations, lectures, blackboard talks, examinations and reviews. The course was completed in a classroom partitioned off from the operating room at the Roslindale substation, the first installation to be operated exclusively by women in America. From the start of the work at the substation two students were detailed from the class daily to act as assistants to the male operators on shift. This gave them an insight into the routine work. Thorough instruction was given in the care and operation of rectifiers, transformers, regulators, oil switches and other equipment. Special study was given to the "general orders" of the company and to methods of meeting emergencies. On May 29 nine students went on watch at the Roslindale substation, the male assistant operators being transferred to other stations, leaving only the operators, who were kept at Roslindale for the purpose of giving instruction in handling the substation routine. They were also given orders to act in a supervisory capacity and not to interfere except to prevent a serious error. On July 5 the remaining male operators were removed from the substation, leaving the women in entire charge. One of the former operators was retained to make repairs on apparatus and to act as an emergency operator, but the substation has been in the hands of women since the foregoing date. The original course has been shortened to about thirty days since the first class completed its work, and this is now the standard time for instruction.



ARRANGEMENT OF ROSLINDALE SUBSTATION

The provision of separate lavatory facilities is the only change of importance required in the transfer of a substation from men to women operators, with the exception of extension handles for more easily setting oil switches. The latter are illustrated herewith. This extension piece consists of a treated wooden handle about 18 in. (45.72 cm.) long and 1½ in. (38 mm.) square, fitted at one end and near the middle with two iron straps to engage the head and shank of the ordinary switch handle. The strap at the lower end is of ¼-in. (6.3-mm.) stock, 1 in. (25 mm.) wide and 3⅜ in. (84.9 mm.) long, and is bored with two 5/16-in. (7.9-mm.) holes through which a pin 3 in. (75.4 mm.) long is carried when the extension piece is attached to the main handle. For some types of switch handles a wooden filler block is required at the lower end of the extension piece.

On July 17 the Dorchester substation was taken over by women operators. At this substation two members of a second class of applicants undergoing instruction were detailed to be "broken in" by the women operators. This work had previously been done by male operators, but was most satisfactorily accomplished under the new conditions.

The general arrangement of the Roslindale substation from the electrical point of view is shown in the accompanying single-line wiring diagram. The substation supplies energy for power, commercial and street lighting and has a rating of about 3790 kw. There are three banks of air-cooled transformers, two sets of 13,800 volt buses and a set of upper, lower and transfer buses for 4000/2300-volt service, besides an installation of 540 kw. in street-lighting transformer and rectifier equipment. The women operators are, of course, required to understand the detailed arrangement of all equipment in the substation, its handling and relations to the outside lines. The diagram symbolizes the daily work of the operators and is, of course, as familiar to them as to the men whom they succeeded.

The first class began its studies on March 25, and the first substation was completely taken over by women a little more than three months later. The revised course, as given by Mr. Wellington of the generating department, covers about a month. The women operators are paid the same wages as were the men and are also under compensation while studying. It is customary to take each class over to the South Boston station two or three times during the course in order that the general principles of electrical production may be set forth more effectively, the work of the load dispatcher seen, etc. The course is arranged to occupy six days per week, and a part of the work consists in meter reading by the entire class at substation switchboards, as well as circuit tests required in routine operation.

ROSLINDALE SUBSTATION, BOSTON EDISON COMPANY

The schedule of instruction is followed as closely as possible, but if occasions arise which necessitate a departure from the program, this is carefully noted for use in future courses. It is not the plan to hold the class to the exact minute in its curriculum, although the schedule has been planned on such a basis, to serve as a guide. Subjects in hand are carried out until completed. Every sixth day a review of previous work is held during the morning periods, and a written examination is held during the afternoon periods. The results of the examination then serve as a guide in the work of the following five days.

In general, the instruction starts each morning at 9 o'clock and a half-hour of meter reading follows. From 9:30 until 10:45 the class is then given either a talk or a demonstration, lasting until 10:45, upon the principles or practical application of equipment. A fifteen-minute recess is then followed by further in-

SYNOPSIS OF COURSE OF INSTRUCTION IN SCHOOL FOR FEMALE OPERATORS

Course to consist of three parts, as follows:

Part I—Preliminary, progressive.
Part II—Theoretical, progressive.
Part III—Practical, non-progressive.

Either two parts or all three parts of the course are combined as it progresses.

PART I—PRELIMINARY

1—Electric Power.
- (a) Definition.
- (b) Journey of a pound of coal from coal mine to lamp socket.
- (c) What is to be found in a power plant.
- (d) What is to be found in a substation.

2—The Edison Company—*Generating Department.*
- (a) Some statistics on number of stations, yearly output, daily output, daily maximum demand, classes of power generated and distributed, etc.
- (b) Kinds of stations: (1) Steam-engine stations, (2) steam-turbine stations, (3) motor-generator substations, (4) transformer substations.
- (c) The generating department: (1) Personnel of department, (2) personnel of operating force, (3) duties of operating force.
- (d) Outline of work in substations: (1) Watches, (2) changes and days off, (3) vacations, sick benefits, etc., (4) notifications in case of absence for any cause.
- (e) Visits to stations: (1) Fourth station, (2) thirty-eighth station, (3) ninth station, (4) forty-third station.

3—Electrical Apparatus.
- (a) Visit to stock room—nomenclature of apparatus.
- (b) Electrical terms — synonymous terms, definitions of various expressions in use.

PART II—THEORETICAL

1—Electricity.
- (a) Nature and analogy.
- (b) Static and current electricity.
- (c) Methods of producing electricity: (1) Mechanical, (2) chemical, (3) thermal.
- (d) Conditions necessary for current flow.
- (e) Properties of conductors and insulators—wire sizes, etc.
- (f) Effects of current flow: (1) Magnetic, (2) thermal, (3) electrolytic.
- (g) Ohm's law—units, ampere, volt and ohm.
- (h) Resistance in series and parallel.
- (i) Characteristics of series and parallel connections.
- (j) Power: (1) Watt and kilowatt, (2) relation between electrical and mechanical power.
- (k) Electrical diagrams: (1) Symbols, (2) one-line diagrams and others.

2—Practice.
- (a) Methods of connecting apparatus: (1) Series, (2) parallel.
- (b) Methods of making: (1) Splices, (2) taps, (3) different types of connections to apparatus.

3—Electrical Apparatus in General.
- (a) All types of circuit breakers, switches, etc.
- (b) Incandescent lamps and accessories.
- (c) Fuses.
- (d) Bells and signals.
- (e) Wiring principles and practice: (1) Conduits, cleat work, etc.; (2) line wiring, overhead and underground; (3) high-tension wires and cables.

4—Magnetism.
- (a) Relation to electricity.
- (b) Laws of magnetism.
- (c) Electromagnets.

5—Batteries.
- (a) Types: (1) Dry cell, (2) wet cell.
- (b) Characteristics.
- (c) Uses and methods of connecting.
- (d) Storage batteries, elementary: (1) Characteristics, (2) application.
- (e) Why batteries are not used instead of generators.

6—Meters and Instruments, Direct-Current.
- (a) Types.
- (b) Description of: (1) Ammeter, (2) voltmeter, (3) wattmeter, recording.
- (c) Applications and connections.

7—Principles of Induction.
- Lenz's law.

8—Direct-Current Apparatus.
- (a) Dynamos, elementary: (1) Principles, (2) types—characteristics.
- (b) Motors, elementary: (1) Principles, (2) types—characteristics.
- (c) Operation of dynamos and motors.

9—Alternating-Current Elements.
- (a) Description and analogy.
- (b) Sine wave, elementary.
- (c) Lead and lag.
- (d) Impedance.
- (e) Phase.
- (f) Power factor.
- (g) Alternating-current circuits: (1) Single-phase, (2) polyphase, (3) transmission lines, (4) feeders.
- (h) Alternating-current power.
- (i) Alternating-current connections: (1) Delta, (2) "Y"—characteristics of each.

10—Alternating-Current Apparatus.
- (a) Alternators, elementary—theory and characteristics.
- (b) Motors, elementary—theory and characteristics.
- (c) Meters: (1) Ammeter, (2) voltmeter, (3) indicating wattmeter, (4) recording wattmeter.
- (d) Transformers: (1) Theory; (2) applications; (3) Characteristics of power transformers, instrument transformers, and constant-current transformers; (4) Connections—delta and "Y."

PART III—PRACTICAL

1—Apparatus in Stations.
- (a) Location.
- (b) Diagrams.

2—Oil-Break Switches.
- (a) Theory.
- (b) Types: (1) Hand-operated, (2) remote-control.
- (c) Manipulation.

3—Disconnecting Switches.
- (a) Purpose.
- (b) Manipulation.

4—Rectifiers.
- (a) Theory.
- (b) Theory of tubes.
- (c) Constant-current transformers.
- (d) Connections.
- (e) Operation.
- (f) Series circuit characteristics.
- (g) Arc lamps, etc.

5—Lightning Arresters.
- (a) Theory.
- (b) Operation.

6—Regulators.
- (a) Theory.
- (b) Operation.
- (c) Auxiliary apparatus: (1) Contact-making voltmeters, (2) line-drop compensators.

7—Protective Systems.
- (a) Methods of protecting apparatus.
- (b) Methods of protecting lines and circuits: (1) Overload and time-limit protection, (2) balanced protection.

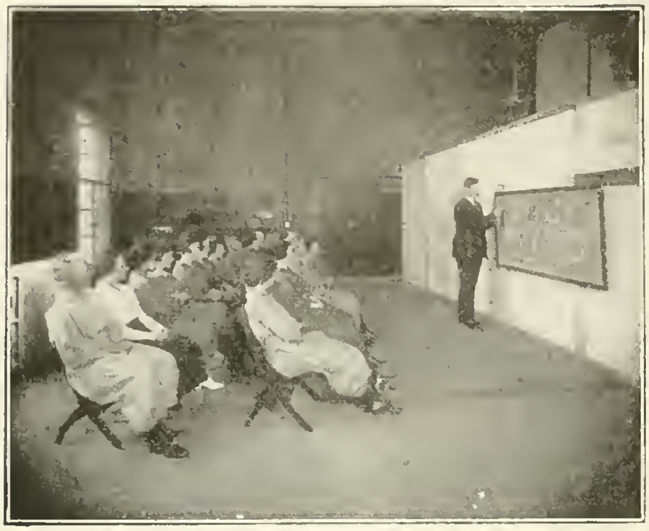
8—Operating, Elementary.
- (a) Principles of operating—precautions, red tags, etc.
- (b) Layout of buses.
- (c) Transformers: (1) Starting up and shutting down, (2) air-cooling system in use.
- (d) Station service panel.
- (e) Arc-circuit test.
- (f) Low-tension phase test and check.
- (g) Testing of potential transformer fuses.

9—Operating, Advanced.
- (a) Switching operations, 4000-volt board: (1) Changing over buses, (2) grounds, (3) short circuits, (4) live crosses, etc., (5) use of transfer bus.
- (b) Switching operations, 13,800-volt board: (1) Loss of commercial line, (2) general switching operations on order from load dispatcher

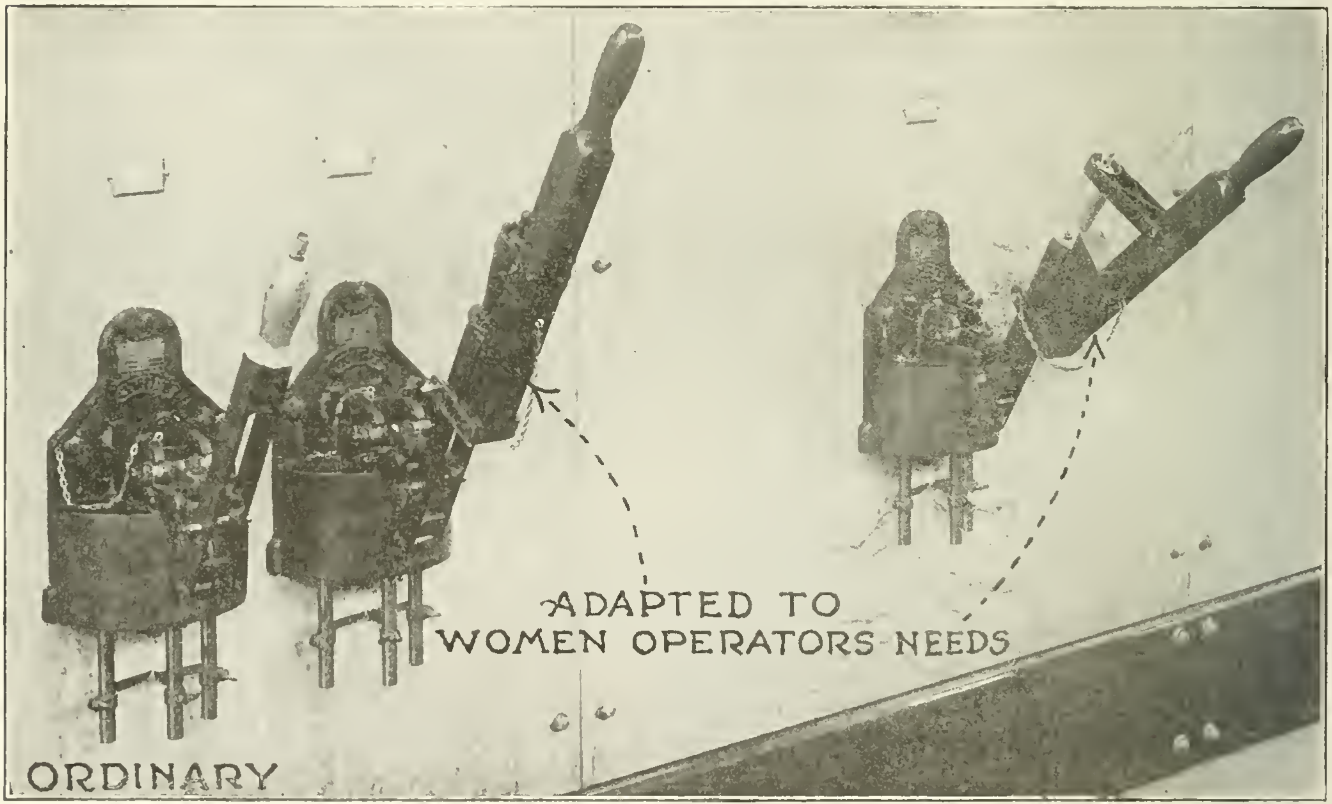
10—Maintenance.
- (a) Minor repairs.
- (b) Station routine.
- (c) Battery-charging, forty-third station.
- (d) "General orders."
- (e) Reading of meters.

struction or by observation and participation in substation test or switchboard handling until noon. Usually the half-hour from 1 p.m. on, after lunch, is given to informal discussion of matters arising in the course or noted in substation visits. From 2 to 5 p.m. intensive instruction continues, with a fifteen-minute recess beginning at 2:45 o'clock. In this period there may be a visit to another plant, perhaps accompanied by an hour of drawing by the class of wiring layouts, etc. From six and one-half to seven hours a day are given to instruction work. At the close of the course an allowance of about a week is made for necessary review work and final practice in switching operations, depending upon the fitness of the class members. The "general orders" of the company are given an increasing amount of study as the course progresses. A detailed schedule of the topics covered in the course is printed on the preceding page.

The operators wear a so-called "farmerette" uniform, selected by them at a Boston department store in response to the company's prohibition of skirts while on duty. This uniform fulfills the "safety first" requirement without completely sacrificing feminine taste.


INSTRUCTING WOMEN IN SUBSTATION OPERATION

INTERIOR OF ROSLINDALE SUBSTATION



EXTENSION HANDLES USED ON OIL SWITCHES AT ROSLINDALE SUBSTATION

The course of instruction occupies about 160 hours, divided as follows:

	Hours
Lectures and demonstrations	108
Visits to stations	15
Reading indicating and recording instruments	12
Visit to Edison company's stock room	1
Manipulation of oil switches (principle)	1
Arc circuit test	3
Drawing diagrams of station apparatus and wiring layouts	11
Reviews and general discussions	6

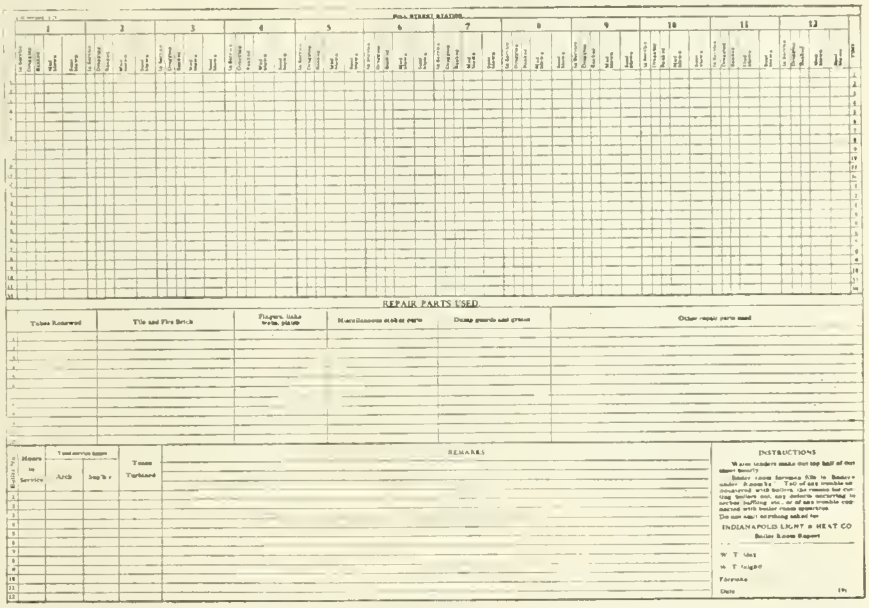
Boiler-Room Management Plan

Between $50,000 and $100,000 Is Saved Annually by Indianapolis Company by the Investment in Trained Boiler-Room Men and in Adequate Boiler-Room Instruments

BY T. N. WYNNE*
Vice-President and Chief Engineer Indianapolis Light & Heat Company

THE best practice for making a fireman is to select a young man and teach him the job. This course of instruction should last at least two years, and his time should be divided between operating and repairing. By repairing grates and stokers and cleaning and repairing boilers the student fireman familiarizes himself with the apparatus he is to operate and hence can fire with much greater intelligence. Too much time or pains cannot be taken with a man who is to handle the company's coal.

The fireman must be intelligent and honest—intelligent so that he can understand his instruments, and honest so that he will not make these instruments lie. In the average plant the fireman is turned loose on the coal pile and his job is to keep up steam. Usually there is no reference made as to how he is to do this, since he is supposed to have completed his education in the dim past and to require no further instruction. Our experience has shown that the average fireman must be watched very closely or he will do extremely wasteful things. As a general rule, especially in inclined-stoker or hand-fired plants, the fireman will fire and sit down, fire and sit down, and follow this plan throughout the watch. He will try to make his periods of sitting down last as long as possible by firing heavy and then letting the steam drop as far as he dares. He then starts a new cycle. The remedy for this is not to allow the fireman to sit down at all. This is made possible by having the fireman stand eight-hour watches and allowing no chairs or benches in the boiler room. This is not a hardship to the fireman. When he knows he is not supposed to sit down, he interests himself in his work and forgets about quitting time. This results in better and steadier fires and high economy.


REPAIR PARTS USED

Tubes Renewed | Tile and Fire Brick | Fingers, links, wear plates | Miscellaneous stoker parts | Dump guards and grates | Other repair parts used

Hours in Service | Arch | Supp'g | Tubes Turbined

REMARKS

INSTRUCTIONS

INDIANAPOLIS LIGHT & HEAT CO
Boiler Room Report

Date 19

FIG. 1—COMPLETE BOILER-PLANT RECORD

A fireman should not be allowed or required to do any other work than attend to his fires. It is the practice in some plants to require the fireman to look after pumps, heaters, etc. This of course is practical in a very small plant, but in larger plants it is decidedly not so. It gives the fireman an excuse for poor fire regulation. He cannot be blamed for having a wasteful fire if he is at that moment packing a pump.

A certain number of instruments are absolutely necessary in order to determine the degree of economy being obtained by the boiler and grate. A boiler and grate has a maximum efficiency at a certain rating. This rating should be found by an actual boiler test. This point of greatest economy is usually around 160 per cent of boiler rating. This rating should be maintained continuously, except of course in cases where it is necessary to crowd the boiler, as at peak load. This is where the underfeed stoker has the advantage over the other types. It can be operated during off-peak hours at the point of highest efficiency and crowded, as has been demonstrated, to 400 per cent of rating during peak hours. Operating at 400 per cent is decidedly uneconomical, but it is no more so than carrying banked boilers. The instrument to give this information regarding rating is the steam-flow meter. This instrument is the most essential of all the appliances of the boiler room.

The B.t.u., ash, sulphur and moisture must be determined for the coal being burned. Increase in ash and moisture decreases the B.t.u. and consequently increases the freight bill and maintenance cost per thousand B.t.u. In these days of coal shortage it is next to impossible to get the desired quality of coal, but no let-up should be made in the demand for the best coal available. Sulphur affects the rating which can be obtained from grates, especially of the inclined type, but it is not an appreciable factor on chain grates or certain kinds of underfeed equipment. At the present time with No. 4 coal not available it is useless to enter into a discussion on the effects of sulphur. From the foregoing it will seem that a calorimeter and some sort of coal-weighing apparatus should be used. A sample of coal should be taken from each car so that the entire car will be represented in the sample. A car sample should weigh about 1000 lb. (453 kg.). This sample should be handled in the manner laid out by the American Society of Mechanical Engineers. The weighing of the coal and ash can be done on scales suited to the purpose of the particular plant.

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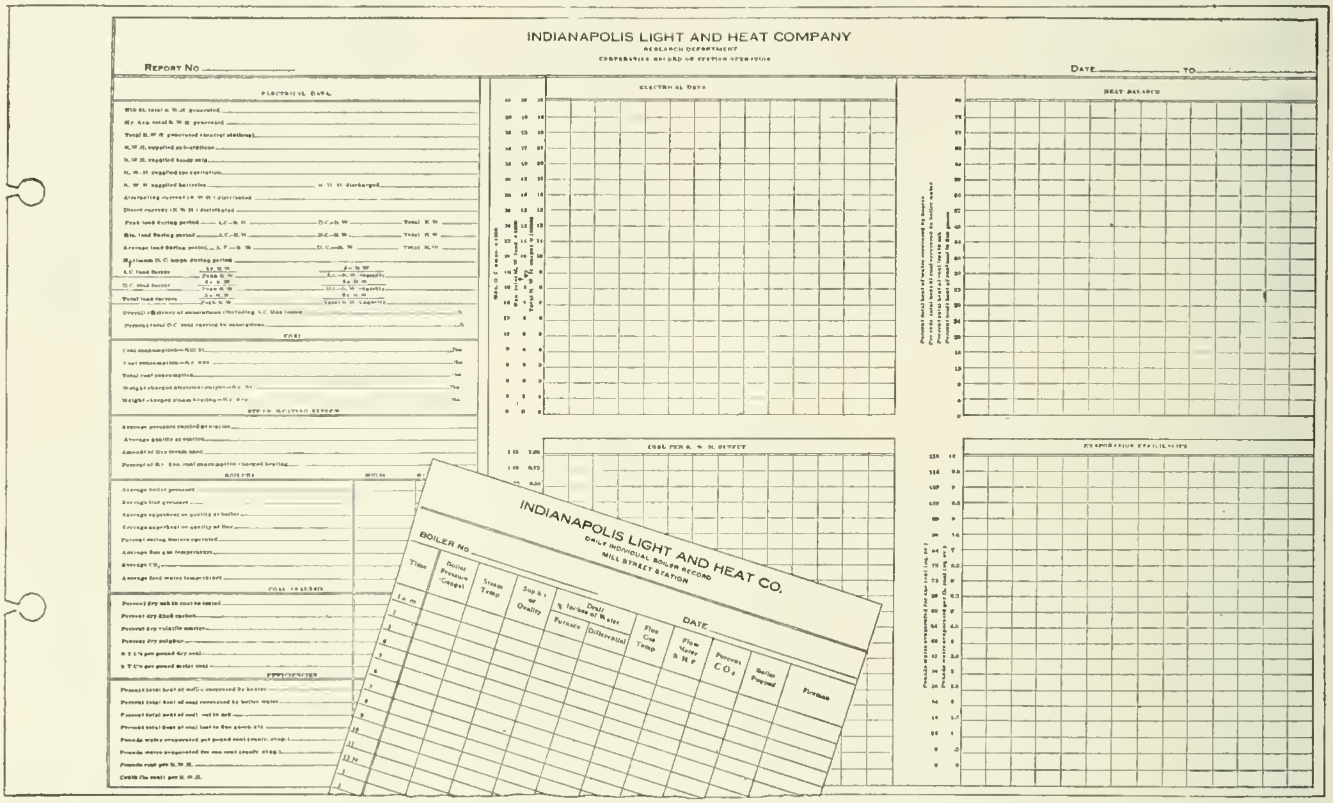
*From a paper read before the Indiana Electric Light Association, Aug. 7, 1918.

Special pains must be taken at all times with the fire. At normal loads a thin, fast fire is probably the best. With a thin fire holes are more apt to occur than in a thicker one. Hence the thin fire needs more attention, and this may account for the fact that the thicker fire predominates. A draft gage will tell the condition of the fire better than anything else and eliminates opening the inspection door so often to look at the fire. Opening the inspection door means a momentary cooling of the gases. When the first boiler test is made the draft over the fire necessary for different thicknesses of fire and boiler ratings can be determined. These values can be plotted so that for any rating the thickness of fire is known, as well as the draft necessary and, in the case of stokers, the stoker speed.


INDIANAPOLIS LIGHT AND HEAT COMPANY

REPORT NO

DATE TO

INDIANAPOLIS LIGHT AND HEAT CO.

DAILY INDIVIDUAL BOILER RECORD

MILL STREET STATION

BOILER NO

DATE

Time	Boiler Pressure (Gauge)	Steam Temp	Sup. h. t. or Quality	Draft Inches of Water: Furnace	Draft Inches of Water: Differential	Flue Gas Temp	Flow Meter B. H. P.	Percent CO₂	Boiler Popped	Fireman

FIGS. 2 AND 3—COMPARATIVE RECORD OF STATION OPERATION AND DAILY INDIVIDUAL BOILER RECORD

Two draft-gage connections should be made—one over the fire and another at the damper or base of the stack. The latter shows the amount of draft available at all times. Other connections can and should be made in case a thorough watch is to be kept on the boilers. These connections should be in the ash pit and ahead of each baffle opening. These will keep a check on the places of greatest resistance within the boiler setting and will show if any of the openings are becoming stopped up.

The temperature of the outlet gases from the boiler setting to the stack is a good indication of whether or not the boiler is clean. If the tubes are covered with soot and scale, the water will not absorb so much heat as otherwise. Soot is a good insulator and scale is not very far behind it. Soot can and should be removed at least every twelve hours by means of mechanical soot blowers, supplemented by a hand steam lance, for the soot blowers may not remove all the soot, and as a rule they do not, especially on superheater tubes. If soot is allowed to remain, it will soon become a very high insulator.

The flue-gas temperature should be as near the final heat of the steam as possible. As long as the temperature of the flue-gas remains constant the boiler is clean, but as soon as the temperature begins to rise one of three things or all can be looked for—soot, scale or leaky baffles. Pyrometers are made so that one instrument may be used on any number of boilers, up to and including twelve, each boiler having its own thermocouple and leads back to the instrument.

Carbon dioxide, or CO_2, indicates the condition of the fire and the combustion of the gases. In a sense it is the ratio of the air used to the air that has not been used. If, in a test for CO_2, CO, or carbon monoxide, is obtained, it will be on account of one of the following reasons: insufficient air supply, improper furnace design, improper method of firing, too low a furnace temperature so that the gases are too cold to ignite, poor mixing of air and combustible gases, or poor selection of fuel. For the average Indiana coal and the amount of air required to burn it, 12 per cent CO_2 is a good figure. Low CO_2 is caused by an excess of air, insufficient air (which would cause high CO) or improper mixture of air and gases. However, the most common fault is excess air, and in many cases this is caused by a leaky setting. All settings should be plastered with one of the boiler-coating preparations on the market.

Measurement of CO_2 is important. A drop from 16 per cent to 10 per cent CO_2 means a waste of fuel of 5 per cent, while a drop from 10 per cent to 6 per cent CO_2 means 12 per cent loss of fuel, and a drop from 6 per cent to 2 per cent means 57 per cent loss of fuel. So there should be added to our list of instruments a CO_2 recorder. If it can be a continuous chart recorder, so much the better, but if it is a hand apparatus, let the sample of gas be taken when the fireman is not looking.

The instruments mentioned constitute those which are necessary for good economy in a boiler room. They should be bought and used honestly. Whenever they give the information that there is any improper condition inside the boiler setting, this condition should be remedied as soon as possible. The instruments should be calibrated and taken care of so that they will perform efficient service. If they are not taken care of, they are worse than useless, for they will lie. This list may be supplemented by others which are important but not absolutely necessary, such as the furnace temperature pyrometer, a coal sample grinder, apparatus for determining sulphur content, CO recorder, etc. It would be poor business to obtain certain results from day to day from these instruments without properly recording these results for future reference.

A form should be provided for daily boiler operation, and this form should include all readings of any value. The readings for each boiler should be taken simultaneously as often as conditions dictate. Care should be taken that the fireman does not allow his fire to drop down between readings.

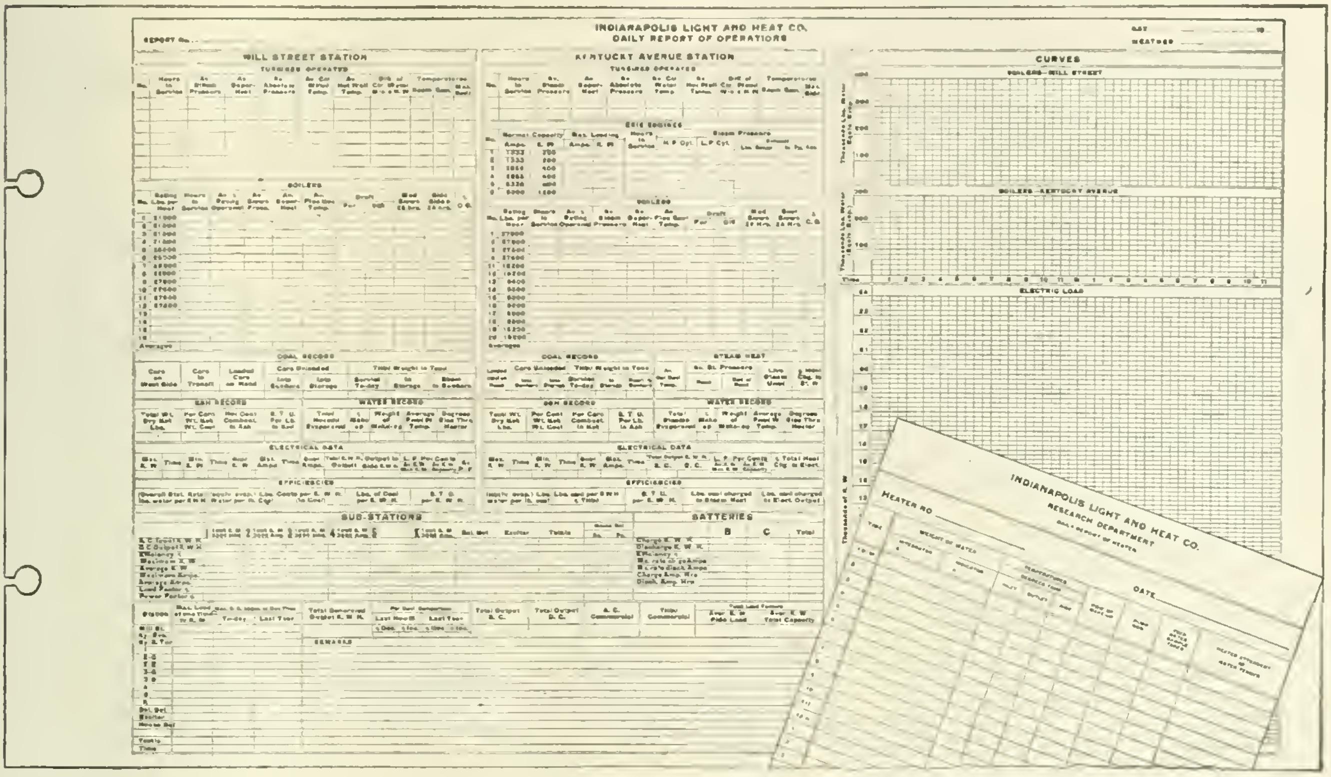
Another form should be used for the heater and still another for the coal and ash. The heater form should show the inlet and outlet water temperature and the amount of water used. The coal and ash forms should show the weight of coal used and the weight of ash for a twenty-four-hour run. It should also show the kind of coal, where it is from, and how much is on the way. The amount of storage coal should be shown on the same sheet.

Another form to use is the maintenance form—one that includes the repairs made on boilers, stoker, brickwork and auxiliaries. This information will not only apprise the chief engineer of the repairs being made but will also give boiler hours on the equipment. It is a good thing to know how long a stoker can operate without entire replacement or which grade of firebrick lasted the longest under the same conditions. These results should, by all means, be consulted by the purchasing agent, since they not only give absolute data on the life of material but also allow him to anticipate his needs.

All these reports, together with those from other parts of the station, are collected at a certain time and consolidated into one station daily report. The best time for collecting these reports is midnight. From then until morning a clerk can consolidate the information and have the daily report ready for whoever desires it in the morning.

Thus the manager or chief engineer may look over this report for an hour in the morning and tell exactly how the station was operated for the previous twenty-four hours. He can tell what mistakes were made in operating, what apparatus needs attention, or the effect of changes made a day or two before.

A monthly report and a yearly report should be compiled. The monthly report gives the average re-


INDIANAPOLIS LIGHT AND HEAT CO.
DAILY REPORT OF OPERATIONS

WILL STREET STATION

KENTUCKY AVENUE STATION

CURVES

BOILERS

COAL RECORD

ASH RECORD

WATER RECORD

ELECTRICAL DATA

EFFICIENCIES

SUB-STATIONS

BATTERIES

ELECTRIC LOAD

REMARKS

INDIANAPOLIS LIGHT AND HEAT CO.
RESEARCH DEPARTMENT

HEATER NO.

DATE

FIGS. 4 AND 5—DAILY REPORT OF OPERATIONS AND HEATER REPORT sults for a month and compares the month in question with the eleven preceding months. Such information as pounds of coal per kilowatt-hour, B.t.u. per kilowatt-hour load, pounds of water evaporated per pound of coal, etc., is contained in the report. These comparisons should be made in curves. The same outline applies for the yearly report.

Reports should not include useless information or too much detail. Be sure what readings or computations are desired, that these readings be taken and the computations made for every report. Also see that the final reports are looked over every day by the chief engineer and that he follows out whatever suggestions he receives from them. If this system is not followed out, it is obvious that the whole thing is useless, but if it is followed out, big dividends may be expected.

It may seem at first as if all this equipment will cost a prohibitive amount of money. There is no question that it will cost some money, but the investment is gilt-edged. The Indianapolis (Ind.) Light & Heat Company realized $50,000 saving the first year this system was put into force, and with coal and material prices as they are now the income from this investment this year will run over $100,000.

Selection of Lighting Units

Industries Wishing Maximum Production Should Observe Principles Outlined—Simple Method of Analyzing Distribution Curves Explained—Efficiency of Reflectors

BY DAVIS H. TUCK
Electrical Engineer Holophane Glass Company

Photometric distribution curves have a much more important meaning than is usually attached to them. To one familiar with their characteristics they give a good idea of the performance of the reflectors they represent. Therefore, in view of the close relation between industrial production and the illumination employed, an analysis of some of the common types of distribution curves may be of interest.

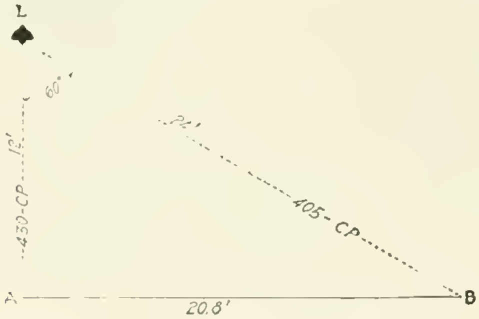


FIG. 1—FOR EQUAL ILLUMINATION AT POINTS *A* AND *B* THE CANDLEPOWER IN THE DIRECTION *LB* SHOULD BE GREATER THAN THE CANDLEPOWER IN THE DIRECTION *LA*

One of the first questions which arises is what form of distribution curve is desired for different classes of service. This can be answered for a specific case by referring to the law of inverse squares.* For example, if the reflector shown in Fig. 1 is hung 12 ft. (3.6 m.) above the floor, the illumination at point *A* directly under it would be $E = 430/12^2 = 3$ foot-candles. The illumination at a point *B*, 20.8 ft. (6.29 m.) away from point *A*, would be $E = 405/24^2 = 0.7$ foot-candle. However, the illumination of 0.7 foot-candle at point *B* (see Fig. 1) is the normal illumination or the illumination on a surface perpendicular to the line *LB*. In order to obtain the value of the illumination on a horizontal surface at point *B*, the normal value must be multiplied by the cosine of the angle of incidence (in this case 60 deg.), giving 0.35 foot-candle.

From the foregoing it may be seen that to obtain a uniform illumination over a horizontal surface the candlepower values represented in the distribution curve must increase at angles from the vertical to compensate for the decrease in illumination at these angles following the inverse-square law and the cosine law.

Another factor has to be taken into account in designing reflectors and adapting them to different light sources, and that factor is glare. It has been shown as a result of experiment and practice, and has been made the basis of the various state illumination laws, that high candlepower values at angles between 60 deg. and 90 deg. from the vertical produce glare, since it is light between these angles that enters the eye directly from the light source when looking at the work.

By considering this limitation, however, and applying the inverse-square and cosine laws it is possible to construct an ideal photometric distribution curve designed to give uniform illumination on a horizontal surface.

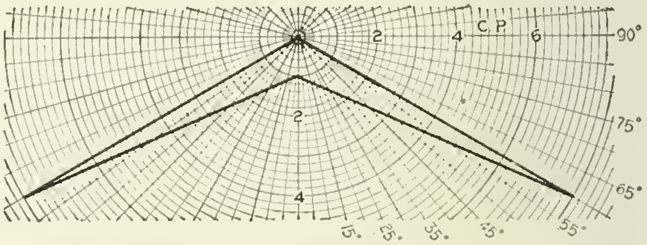


FIG. 2—THEORETICALLY IDEAL DISTRIBUTION CURVE TO PRODUCE UNIFORM ILLUMINATION

The sharp light cut off at 60 deg. eliminates glare. The candlepower values shown are relative and should be increased by a factor for the desired illumination intensity.

Referring to Fig. 1, the horizontal illumination at any point along the line *AB* is expressed by the formula $E = \text{cp.} \cos^3 x/h^2$, where *E* is the illumination on a horizontal surface at the point in question, cp. is the candlepower at the angle *x*, *h* is the height of the light source above the point where the illumination is ob-

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*Expressed by the formula $E = I/d^2$, where *E* is the illumination intensity, *I* is the candlepower and *d* is the distance from the light source having a candlepower *I* to the point at which the illumination is *E*.

tained, and cos x is the cosine of the angle between the vertical and a line drawn from the light source to the point where the illumination is measured. The candlepower required to produce this illumination is cp. $= Eh^2/\cos^3 x$. Eh^2 is a constant. Therefore, if a distribution curve be drawn (see Fig. 2) having the candlepower values proportional to $1/\cos^3 x$ for the various values of x, such a curve will represent an ideal photometric distribution curve for giving uniform horizontal illumination. At angles between 60 deg. and 90 deg. the candlepower should be zero so as to eliminate glare. Such a curve is shown in Fig. 2.

Commercial Types of Reflectors

Commercial types of reflectors are made of porcelain enameled steel, silvered glass and prismatic glass. In Fig. 3 is shown a porcelain-enameled steel reflector of the shallow-bowl type, together with its distribution curve. To analyze the performance of this reflector from its distribution curve it is first of interest to note that the comparatively high candlepower values at angles greater than 30 deg. insure a high vertical component of illumination. The light cut off occurs at 75 deg. from the vertical instead of at 60 deg. as shown in the ideal curve (see Fig. 2). Some glare is therefore to be expected.

TABLE I—COMPARISON OF ACTUAL DISTRIBUTION WITH IDEAL FOR REFLECTOR IN FIG. 3

Angle, Degrees	Candlepower I	$\cos^3 x$	h^2	Illumination d†	Illumination E
0	430	1.0	144	0	3.0
5	440	0.988	144	1.0	3.0
15	460	0.901	144	3.2	2.9
25	460	0.744	144	5.6	2.4
35	460	0.549	144	8.4	1.75
45	470	0.353	144	12.0	1.15
55	420	0.188	144	17.1	0.55
65	390	0.075	144	25.2	0.20
75	285	0.017	144	44.8	0.03

† d is the horizontal distance from the light source to the point at which the illumination is taken (line AB; see Fig. 1).

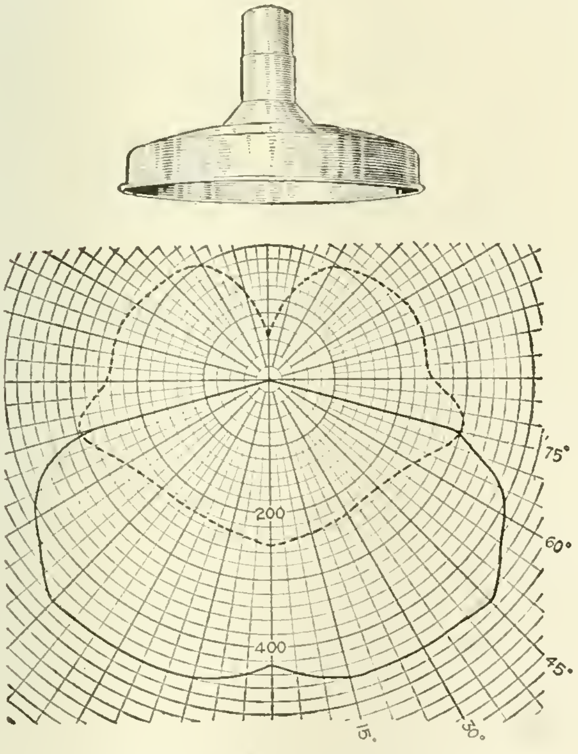


FIG. 3—A PORCELAIN-ENAMELED SHALLOW-BOWL-TYPE STEEL REFLECTOR WITH DISTRIBUTION CURVES

The dotted curve refers to a 200-watt type C lamp alone, and the full-line curve is for the lamp and reflector.

The next point of interest is to ascertain how nearly this distribution curve approaches the ideal as regards uniform illumination. Applying the formula $E = I \cos^3 x/h^2$, the mounting height being taken as 12 for this instance, a table should be constructed as in Table I herewith. From such a table it may be seen that the distribution curve of this reflector falls far short of fulfilling the ideal of uniform horizontal illumination (the ratio of maximum to minimum illumination being 100 to 1), although it may be suitable where this requirement does not obtain.

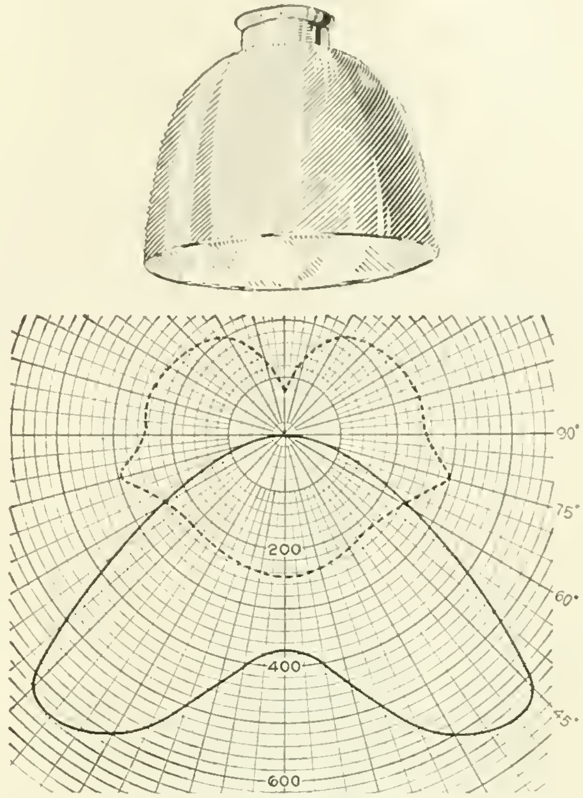


FIG. 4—A MIRRORED-GLASS DEEP-BOWL-TYPE REFLECTOR WITH DISTRIBUTION CURVES

The dotted curve is for a 200-watt type C lamp alone, and the full-line curve is for the lamp and reflector.

The next point of interest is to determine the efficiency of the reflector from its distribution curve. By the efficiency of a reflector is generally meant the percentage of the total lumens of the bare lamp that is contained in the 60 deg. zone, as this is the light that is useful for direct illumination. To obtain the number of lumens contained in any zone the average candlepower of that zone must be multiplied by the solid angle content of that zone. Table II gives values for comput-

TABLE II—EFFICIENCY OF REFLECTOR SHOWN IN FIG. 3

Zone	Average Cp.	Solid Angle Content of Zone	Lumens
0–10	440	0.0954	42
10–20	460	0.2834	130
20–30	460	0.4630	213
30–40	460	0.6280	290
40–50	470	0.7740	360
50–60	420	0.8970	380
Total			1415

Total lumens of bare lamp, 2800.
Per cent efficiency, (1415 ÷ 2800) × 100 = 53 per cent.

ing the efficiency of the reflector shown in Fig. 3 from its distribution curve.

From a study of the distribution curve of the reflector shown in Fig. 3, the following points of interest have been determined:

1. The reflector will give good illumination on vertical surfaces.
2. The reflector produces glare.
3. It does not give uniform illumination, the ratio of maximum to minimum being 100 to 1.
4. It has an efficiency of 53 per cent.

A silvered-glass reflector of the deep-bowl type, together with its distribution curve, is shown in Fig. 4. From an analysis of this distribution curve it may be seen that the illumination on vertical surfaces will not be so high as for the reflector shown in Fig. 3. From the standpoint of glare, however, the reflector shown in Fig. 4 will be better than the reflector in Fig. 3, as the candlepower values are not so high at angles between 60 and 90 deg.

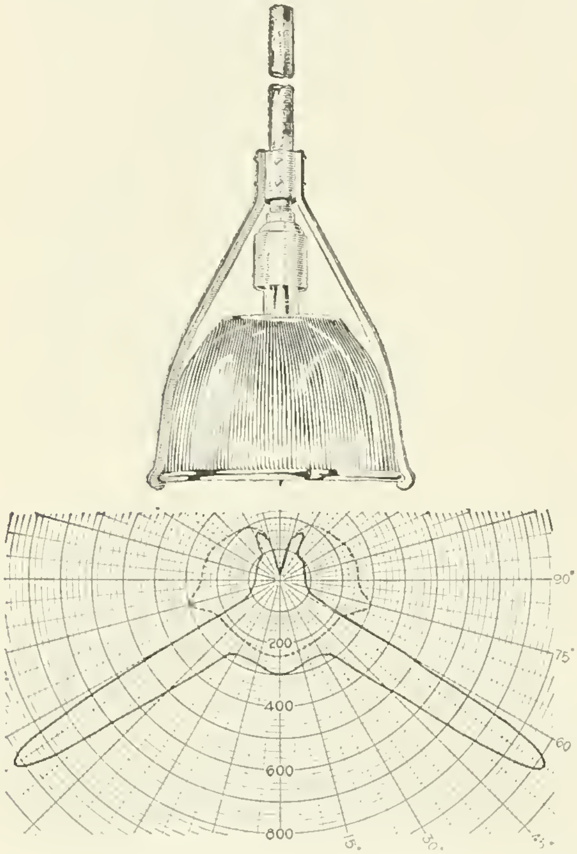


FIG. 5—A PRISMATIC-GLASS BOWL-TYPE REFLECTOR WITH DISTRIBUTION CURVES

The dotted curve is for a bare 200-watt type C lamp, and the full-line curve is for the lamp and reflector.

From the standpoint of uniform illumination Table III, similar to the first one presented, shows that the spread of light is limited to 45 deg. and that between 0 and 45 deg. the illumination is uniform. As indicated, the ratio of maximum to minimum is 1.7 to 1. The efficiency of this reflector computed according to Table IV is 58 per cent.

A prismatic-glass reflector of the deep-bowl type, together with its distribution curve, is shown in Fig. 5. From a study of this distribution curve it may be seen that owing to the high candlepower values at angles greater than 30 deg. the illumination on vertical surfaces will be high. The sharp light cut off at 60 deg. insures practical prevention from glare.

From the standpoint of uniform illumination, Table V shows that the illumination obtained with the distribution curve in Fig. 5 is uniform between angles of 0 and 60 deg., the ratio of maximum to minimum being 1.7 to 1.

The efficiency of this reflector, computed in Table VI, is 61 per cent. It is to be noted, however, that the zone 90-180 deg. contains 587 lumens (or 21 per cent of the bare lamp lumens), which when reflected from the ceiling adds to the direct component of illumination in the form of indirect illumination. Thus from this reflector 82 per cent of the bare lamp lumens is useful. provided that the indirect illumination produced is kept at a high degree by proper maintenance of the ceiling.

When lighting units are selected for industrial use facts, not personal opinions, tinged as the latter may be with prejudice, should be considered. The distribution curves of competitive equipment should be studied as outlined and the selection based on the result of this study, together with other practical considerations, such as cost, mechanical strength, flexibility and maintenance.

TABLE III—COMPARISON OF ACTUAL WITH IDEAL DISTRIBUTION FOR REFLECTOR IN FIG. 4

x	I	$\cos^3 x$	h^2	d	E
0	375	1.0	144	0	2.6
5	380	0.988	144	1.0	2.6
15	444	0.901	144	3.2	2.8
25	560	0.744	144	5.6	2.9
35	626	0.549	144	8.4	2.4
45	626	0.353	144	12.0	1.5
55	351	0.188	144	17.1	0.4
65	181	0.075	144	25.2	0.09

TABLE IV—CALCULATION OF EFFICIENCY OF REFLECTOR IN FIG. 4

Zone, Degree	Average Cp.	Solid Angle Content of Zone	Lumens
0–10	380	0.0954	36
10–20	444	0.2834	126
20–30	560	0.4630	260
30–40	626	0.6280	394
40–50	626	0.7740	485
50–60	351	0.8970	314
Total			1615

Total lumens of bare lamp, 2793.

Per cent. efficiency, (1615 ÷ 2793) × 100 = 58 per cent.

TABLE V—SHOWING UNIFORMITY OF ILLUMINATION WITH DISTRIBUTION SHOWN IN FIG. 5

x	I	$\cos^3 x$	h^2	d	E
0	298	1.0	144	0	2.1
5	298	0.988	144	1.0	2.0
15	274	0.901	144	3.2	1.7
25	272	0.744	144	5.6	1.4
35	381	0.549	144	8.4	1.4
45	475	0.353	144	12.0	1.2
55	1026	0.188	144	17.1	1.3

TABLE VI—EFFICIENCY OF REFLECTOR SHOWN IN FIG. 5

Degree Zone	Average Cp.	Solid Angle Content of Zone	Lumens
0–10	298	0.0954	28.0
10–20	274	0.2834	178.0
20–30	272	0.4630	126.0
30–40	281	0.6280	176.0
40–50	475	0.7740	368.0
50–60	1026	0.8970	921.0
Total			1697.0

Total lumens of bare lamp, 2791.

Per cent efficiency, (1697 ÷ 2791) × 100 = 61 per cent.

Record of Electrical Men in Selling Bonds

How the Industry Has Organized and Applied Its "Power for Selling" in the Three Former Liberty Loan Campaigns

WITH the launching of the fourth Liberty loan now only one week off, the knowledge that in this campaign twice as many bonds as in the case of former loans must be sold and in three-quarters of the time comes home to every man. Plans for the active participation of every member of the electrical industry can be delayed no longer. It may assist these plans for greater individual selling in this fourth loan, therefore, to review the methods and experience which preceding bond campaigns have developed among electrical men.

The record of this industry in war service up to this time is a brilliant one. The best available statistics show total subscriptions to the first Liberty loan of $100,000,000, to the second loan of between $100,000,000 and $150,000,000, and to the third issue of probably between $150,000,000 and $200,000,000—an aggregate of $400,000,000. Add the total contribution to the Red Cross drives, the total sales so far of thrift and war savings stamps, and the total breaks probably near $500,000,000 which in a year and a half of war has been tendered to the government by electrical men as their share in financing the great world war.

The plan adopted at the Schenectady works of the General Electric Company shows to what length the work can be carried when such large bodies of employees are accessible. This organization was perfected for the second loan and has been made a permanent staff for the period of the war.

Here, to begin with, seven prominent men connected with the works were appointed as a Liberty loan committee, and they in turn established 100 sub-committees, each to have charge of the canvass in one or more of the departments of the works and general offices. The total number of members thus enlisted was about 1000, so that the entire staff was known as the "committee of one thousand." These committee men and women began immediately the canvass of their departments, working toward a Liberty Loan Day, when a special drive was scheduled. This day was posted and advertised. A large recording clock was placed at the main entrance to the works, to indicate progress, with smaller indicators for each department. This immediately inspired strong interdepartment rivalry.

During the week preceding Liberty Loan Day mass meetings were held each day during the noon recess, and on one occasion at midnight for the benefit of the night force. These gatherings were addressed by "G. E." speakers and prominent men of the city and reached audiences varying from 3000 to 6000 in number. On Liberty Loan Day the committee of one thousand gathered at the works restaurant, where luncheon was served at the expense of the company, and great enthusiasm was aroused by special speakers.

Then at 2 o'clock the members were sent into the shops to rake every nook and corner and gather in every possible signature. The total showed 92 per cent of all the employees subscribing.

Tremendous as the success of this campaign was, it is only typical of the effective effort which the electrical manufacturers have made. In the great works of the Westinghouse and Western Electric companies similar scenes were enacted with similar results. Smaller manufacturers applied the same keen selling methods to the limit of their opportunity. Shops were placarded, mass meetings held, pay envelopes carried strong advertising, and bonds were financed by the company so that employees could spread their payments over ten months or a year. Prizes were also offered for high records.

The jobbers have been no less active in their effort. In addition to helping and stimulating their own employees to buy bonds, they have found a field for usefulness in the utilization of their selling men both in canvassing their regular trade for bonds and as a team in the local city campaign. Much good work was done this way, and in more than one city we find electrical jobbers, as "generals" and "colonels," directing a large number of selling teams as a unit or in charge of districts of the city.

Central-station activity has followed this same direction, but naturally with an even closer contact in the local selling. Central-station salesmen have a wide acquaintance among the people and are wise in arguments to make the householder invest. How skillfully and eagerly they went into the canvass is well illustrated in the case of Brooklyn, N. Y. In the last campaign there the drive was inaugurated with a special meeting of the sales force in which their campaign was planned, and every member present, including office boys, subscribed on the spot. Definite instructions were then issued. Salesmen were not only to sell bonds but to work for the war in the broadest possible way.

Advertisements were featured in the newspapers, special window displays and billboard signs were installed, and a systematic canvass was made of every user of electric service, particularly in the industrial field. In addition, two Edison company crews were formed for night work, and these men, equipped with electric trucks and supported by brass bands and a detail of soldiers and sailors, addressed the evening crowds in theaters, restaurants and other public places and on prominent corners. Daily reports on the work of every man were posted in each company's office every day, and the work went on persistently until at the close of the drive $1,460,550 in Liberty bonds had been sold by this one central station.

Smaller companies followed out this same general plan in degree as their spirit, organization and opportunity permitted. They have taken the initiative in countless cities in forming teams of electrical men for house-to-house selling and for the sale of bonds within the industry. They have been most liberal in the financing of bond sales to their employees and invested heavily out of the company treasuries.

The electrical industry, therefore, has won an honorable distinction in its contributions to the first three Liberty loans. It is a measure and a precedent that will not be allowed to falter in the coming fourth Liberty loan campaign. Electrical men will be behind the government in this great drive.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

SOME PRACTICABLE METHODS TO HELP IN SAVING COAL

Reminder of the Responsibility of Boiler-Room Operators in the War Economics--Practical Rules for Burning Coal

Just at this time, when the conservation of coal is an absolute necessity and every practicable suggestion for such conservation is a shot at our enemy, every one realizes that smoke issuing from boiler stacks represents unused heat units; but every one does not realize that certain simple rules, if observed in the fire room, will materially decrease this loss. The suggestions outlined below are based on many years' experience of the Westinghouse Electric & Manufacturing Company's combustion engineers:

1. Give your fireman an opportunity to acquire the fundamental principles of fuel burning.
2. If you have a difficult fuel problem, consult a combustion engineer.
3. Prevent smoke by proper firing methods.
4. Use gages to indicate exactly the condition of fire bed at all times. As a minimum these gages should consist of a draft gage indicating draft in furnace above fuel bed, a draft gage indicating draft at boiler side of flue damper, and a steam-flow meter for individual boilers.
5. CO_2 is the principal product of complete combustion of coal. From 10 to 12 per cent CO_2 should be obtained in flue gases to insure minimum fuel loss.
6. Avoid loss due to unburned coal in the ash.
7. If you are wasting exhaust steam, you are wasting coal.
8. Do not permit grates to clog. A systematic method of keeping the air spaces clean must be followed.
9. Inspect the baffles in boilers, as broken or leaky baffles raise the flue-gas temperature and waste coal.
10. Avoid leaking in of cold air around boiler setting.
11. Install stokers. Hand firing is rapidly being recognized as an obsolete and wasteful method of firing.
12. Clean scale from tubes, as every particle of scale wastes coal.
13. Avoid soot formation. All boiler tubes should be blown externally once every eight hours when in continuous service.
14. All smoke flues should be as short and straight as possible. Flues should also be made air-tight, and all joints and connections should be well fitted, calked and riveted. Use asbestos gaskets on clean-out doors.
15. Place flue dampers in front of boiler so that firemen will adjust them as required. Dampers placed in rear of boilers are seldom disturbed, regardless of their condition.
16. The size of coal has much to do with the capacity and efficiency of boilers. In general the air pressure penetrates the fuel bed formed by coarse coal more easily than that formed by finer coal, resulting in disturbance of best furnace conditions.

In addition to the above suggestions, the following "don't fail to do" list should be followed. Don't fail to:

Keep the heating surfaces of the boilers free from soot, scale or oil.

Keep the fires level and free from holes.

Do not carry the fires so thin as to draw a lot of excess air through.

Do not carry the fires so thick as to have incomplete combustion of the coal.

Do not soak the coal with water before firing.

Be sure the blow-off valves do not leak.

Do not have the safety valve popping off continually.

Cover steam pipes.

Do not waste steam through leaky valves or traps.

Never use live steam if exhaust steam is available and can be used as well.

An observance of the foregoing simple rules and suggestions should materially reduce the coal consumption of the average plant.

Buy Liberty Bonds Early

OPERATORS GIVE OPINIONS ON DEMAND METER PERFORMANCE

Different Types Discussed in a Critical Report Embodying the Experience of Meter-Men of Many Ohio Companies

Ten printed pages in the 1918 annual report of the meter committee of the Ohio Electric Light Association were devoted to demand meter performance. Troubles occurring in different types and remedies for these troubles were set forth in detail. Concerning those instruments operated by a solenoid or electromagnet which is controlled by a series of contacts with a moving member of the watt-hour meter the report had this to say:

"There are two parts to be considered in this type of measuring devices—the contacts and the indicating gears. The original contacts gave not a little trouble, for the material used in the manufacture of the cams would oftentimes carbonize, thereby closing the contacts at improper times, thus directly overmeasuring the demand. Moreover, rough spots could be found on them that would cause the contacts to chatter, this resulting in the same trouble. Both these difficulties were very objectionable. On the three-way contacts, such as are used in the graphometer and the type P, they sometimes get out of adjustment and weld together, this trouble generally resulting in the burning out of a potential coil.

"The later type of contacts now being manufactured are considerably more satisfactory. However, as long as contacts exist in connection with demand meters, there will always be some trouble. Therefore, they should be given occasional inspections, for it is always possible that dirt and dust will collect on them, or that they will otherwise get out of adjustment owing to inexperienced people meddling with them.

"Contact trouble is generally detected at the time of reading by suspicious-looking demands as compared with the normal registration of kilowatt-hours, or by an off-scale indication. Occasional inspection on this type of instrument is important, for at the time any suspicions arise the inspector can make an investigation of the contacts by examining them under a magnifying glass and checking their operation through complete revolution of the cam wheel. A thorough study of contacts should be made by men coming in connection with demand instruments, for there are a number of little details that can be watched and caught in time to save considerable annoyance to the company. Some companies report they are having all instruments and contacts removed and sent through the shop twice a year."

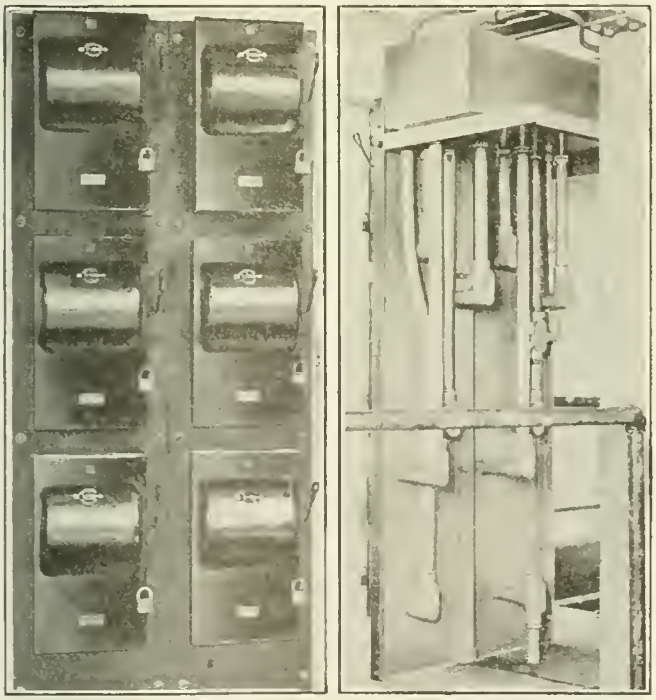
This discussion is typical of that found throughout the report, a complete copy of which may be secured from D. L. Gaskill, Greenville, Ohio. The committee in concluding its report states that while demand meters must still be regarded as being in the development stage they can be successfully operated under the vigilant care of trained inspectors who are always assigned to the same group of instruments.

Back Up Pershing's Crusaders

ACTUAL INSTALLATION COST OF INEXPENSIVE SWITCHBOARD

Industrial Plant Switchboard Controlling 150-Hp. Motors Built for 90 Cents per Horsepower Rating of Motors

Panelboards made entirely of angle iron and sheet metal and without slate are being installed at low cost by a number of electrical concerns on the Pacific Coast as outlined in the ELECTRICAL WORLD for Aug. 31, 1918, page 400. Cost data on a type designed and recommended by F. L. Leurey of San Francisco have been compiled to show the inexpensiveness of these boards. They measure 18-in. (45.7 cm.) by 84 in. (203 cm.), and the average group consists of two or three panels. On the panels are mounted three triple-pole, single-throw, fused, 100-amp., 500-volt switches manufactured by the Square D Company, Detroit, Mich.



FRONT AND REAR VIEWS OF SWITCHBOARDS THAT DO NOT REQUIRE SLATE

Each switch controls an average of 50 hp. in motors, and the total cost of erection with labor at $7 per day was $140 per panel. Therefore the average cost per horsepower of motors controlled would be $140 divided by 150 hp., or 90 cents. This cost includes the panelboard completely erected with all pipe connections made and wire installed. It does not include, however, the necessary sheet steel, condulets and angle iron used in the panel. These items are not estimated because they vary considerably in the different parts of the country and they represent only a minor part of the total expense.

TEACHING CABLE DUCT SPLICING TO NEW MEN

Each Man Before Being Permitted to Work in Manholes Must Successfully Make Splices in Imitation Manhole in Superintendent's Office

In order to be assured that new men are efficient and prepared to make good splices, the Duquesne Light Company of Pittsburgh, Pa., has arranged an imitation manhole in the underground department laboratory to allow the man to show his ability. This arrangement consists of half of a six-side manhole painted to appear like red brick and giving the man exactly the same amount of space as he would have if working under actual conditions. The work is watched by the superintendent or foreman of the underground department, and a man is not allowed to work in a manhole until he is fully qualified to make a neat splice and wipe the joint.

ASSURING CONSTANT VOLTAGE IN METER TEST DEPARTMENT

Use of Alternating-Current Synchronous Motor-Generator Set as a Means of Facilitating Testing Instruments

The maintenance of an absolutely constant alternating-current voltage is an important matter in the central-station meter department, if accurate tests are to be expected. Precision instruments show that in many cases the voltage variations on the alternating-current supply lines are so great as to require important test work to be done at night. By the installation of a 15-kva. synchronous motor-generator set the Hartford (Conn.) Electric Light Company has solved this problem so satisfactorily that tests can now be made on the assumption of constant alternating-current voltage even during the daytime and around such hours of load variations as 7 a.m. and 5 p.m. The unit, which is separately excited from the department's storage battery, was designed to provide for the future addition of a second generator when needed.

In case the frequency should vary during the test it can readily be adjusted by hand control at the field rheostat of the generator. Normally the frequency remains so nearly constant that even the sharp variations in system and feeder loads occurring at the hours above mentioned can barely be detected on a precision instrument.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

MAP WITH THE LOCATIONS OF PHYSICIANS POSTED

New York State Utility Has Prepared Against Emergency Map of City Showing Doctors' Residences and Telephone Numbers

In case of an accident calling for the immediate services of a physician there is likely to be confusion in summoning medical aid, and serious delay may result. If printed lists of physicians are posted in the plants or offices, as is the usual practice, the tendency is to call the first on the list. If such a list is not available, the person calling will summon the doctor whose name first comes to mind, and in either case little thought is given to the distance from the doctor's residence to the scene of the accident.

To eliminate this difficulty the Empire Gas & Electric Company of Auburn, N. Y., has prepared a map of the city drawn to a large scale and in a small white circle indicating the location of his residence or office has placed the name and telephone number of each physician, so that in an emergency a glance at the map enables the person calling to select physicians who can reach the scene of the accident quickly. In the margin of the map is a list of the company's officials who should be notified, together with their telephone numbers, and a list of the telephone calls for the hospital, fire and police departments. This method, while improving the efficiency of medical aid, also tends to distribute the calls more evenly.

Fire Liberty Bonds at Metz

SERVING THE COUNTRY CUSTOMER IN WAR TIMES

What One Middle Western Company Is Doing in Making Extensions to Farms and How It Justifies the Work

Running north from Berrien Springs, Mich., through a rather thickly settled farming community, is a newly built 9-mile (14-km.) extension to the system of the Indiana & Michigan Electric Company of South Bend, Ind. The line serves farmers only. It operates at 4400 volts, single-phase, and is constructed of 30-ft. (9-m.) wooden poles spaced on 150-ft. (45.7-m.) centers and carrying No. 6 copper wire. The line cost $11,800 and reaches 120 customers. To finance the line each farmer gave the company his promissory note for $102 before construction was started, with the understanding that the entire amount should be refunded in electrical energy at the rate of $1.50 per month. In all the company collected from the farmers $12,240, which it will have returned at this rate in about five and one-half years.

The average customer on this line has a ten-room house, each room of which is wired for electric light. The average cost of wiring and fixtures complete, ready to turn on the energy, was $70 for a ten-room house. The average connected load in a ten-room house on this line is 600 watts. In connection with this lighting load there will be more than fifty motors of 1 hp. or less, which will be used for pumping purposes. In such cases where the motor rating does not exceed 1 hp. in capacity it is attached to the regular lighting meter and adds nothing to the monthly minimum charge. There will also be a number of motor connections for units of larger capacity than 1 hp., and in such cases the motor will be put on 220 volts and a service charge of $1 per horsepower per month will be added to the energy charge. Practically every farmer along the line has signified his intention of wiring his barn and garage, so the total lighting load will soon amount to about 700 watts per customer exclusive of the motors. The 120 customers will be served from thirty-five transformers, in some instances as many as five customers being served from one transformer. It is interesting in this connection to know that where a farmer has a tenant house on his farm he can make connection to this building without extra cost to him except the cost of wiring the building.

The lighting rates charged on this installation are 11 cents per kilowatt-hour, with 1 cent discount, making 10 cents net with a $1.50 minimum charge per month. The average income for rural lines for residential lighting is approximately $150 per month, making an income on this line of approximately $2,160. When all appliances and stoves are on, as they will be within one year, the gross income will be approximately $3,500, which is approximately 30 per cent of the cost of the line. This, it is figured, will give the company the income it requires on the line. These rates and this financing plan do not include any provision for the long drop necessary to reach some farmhouses far back from the road. In the construction of the line the company allowed 300 ft. (91 m.) for each service connection. In case the customer's house was more than 300 ft. from the line, he was required to pay for all additional construction at the rate of $25 per 150-ft. span. The amount paid for this additional construction is considered as payment for a private line which is owned by the customer but maintained by the company.

The company's viewpoint on the situation, as explained by M. F. Caldwell, manager of the new-business department, is given in the following paragraphs:

"In serving the farmer life is made more pleasant for him, since electricity lessens his desire to go to the city in order that he may enjoy the city's luxuries. If the central station can meet these demands of the farmer, more food will be raised, and it takes food as well as bullets to win the war. Moreover, after the war there is likely to be a period of readjustment in some of the country's industries that will cause a reduction in demand by some of the central station's power customers. With the farmer it is hardly expected that there will be such a period. The line which is built now will be paid for while the farmer is receiving top price for his goods and while is is easy to sell him electric service. Therefore, why not meet his demands now while he has the money and is willing to spend it? If he does not spend it for these improvements, he will spend it for something else which will perhaps do him less good, and the central station will lose an opportunity to get his business and to keep him satisfied on his farm raising food for the nation.

"In cases where a careful survey shows that the line would give insufficient revenue to pay a reasonable profit on the investment, the company believes that sufficient of the farmer's deposit should be retained to reduce the investment to a figure which the revenue from the line will justify."

He Also Fights Who Buys Liberty Bonds

APPLIANCE REPAIRS CAN BE HANDLED BY WOMEN

In Four Weeks Boston Company's Maintenance Department Effected 447 Repairs with Excellent Results

Repairs on lamp cords, electric irons and other appliances are being made by a young woman maintainer with excellent results at the Head Place offices of the Boston (Mass.) Edison company. This work was formerly done exclusively by men, but the inroads of the war led the company to try the experiment of utilizing feminine hands and eyes in getting such equipment into shape for use as quickly as possible.

GIRL REPAIRER HANDLING ELECTRICAL EQUIPMENT

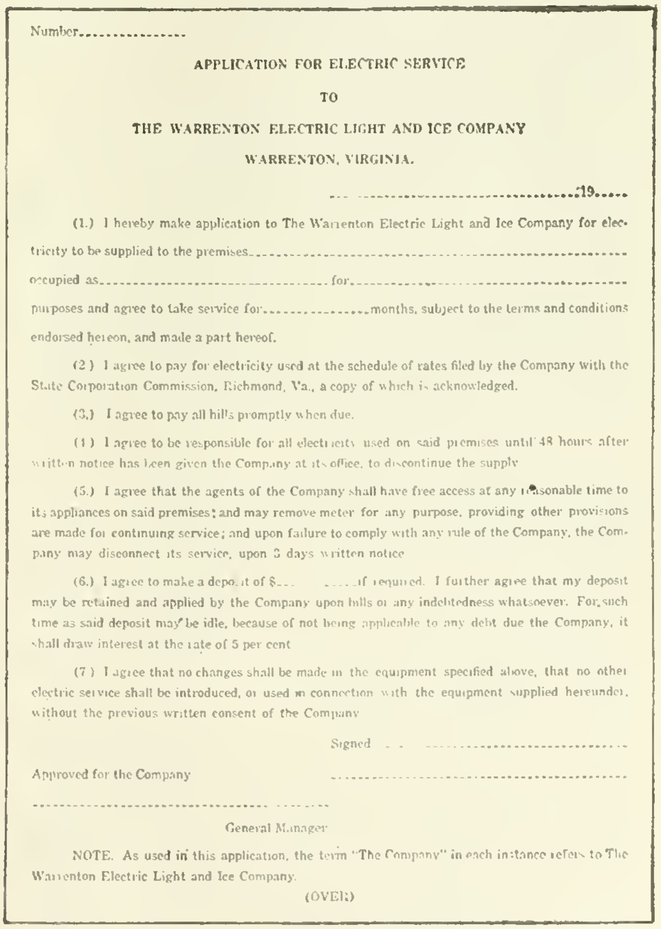
The accompanying illustration shows the maintainer in the act of removing the heating element of a General Electric iron from the terminals prior to inserting a new element. This young woman had never had any previous mechanical or electrical experience prior to joining the staff of the Edison company last spring. She was employed for three weeks in filing requisitions in the company stock room at the General Service Buildings and was then given about a week's instruction in appliance repairing at the Head Place office. From Aug. 1 to Aug. 27 she effected 447 repairs on appliances, the maximum number per day being thirty-four. The hours are from 8:30 a.m. to 5 p.m., except on Saturdays, when the repair department closes at 1 p.m.

SMALL-TOWN APPLICATION FORM FOR ELECTRIC SERVICE

Simply and Directly Stated with the Terms and Conditions of the Service Printed on the Reverse Side

The Warrenton (Va.) Electric Light & Ice Company has drafted a form for application for electric service which M. J. O'Connell, manager of the company, submits as appropriate for small communities. In drawing up the form the company found it very difficult to obtain such forms except from companies operating in large cities. Warrenton has a population of 2500 people.

The front of the application, which is 11 in. by 8½ in., is here shown and, as will be noticed, is worded in simple, direct language. On the reverse side are the terms and conditions.



Number................

APPLICATION FOR ELECTRIC SERVICE

TO

THE WARRENTON ELECTRIC LIGHT AND ICE COMPANY

WARRENTON, VIRGINIA.

....19.....

(1.) I hereby make application to The Warrenton Electric Light and Ice Company for electricity to be supplied to the premises.. occupied as.............................. for.............................. purposes and agree to take service for................months, subject to the terms and conditions endorsed hereon, and made a part hereof.

(2.) I agree to pay for electricity used at the schedule of rates filed by the Company with the State Corporation Commission, Richmond, Va., a copy of which is acknowledged.

(3.) I agree to pay all bills promptly when due.

(4.) I agree to be responsible for all electricity used on said premises until 48 hours after written notice has been given the Company at its office, to discontinue the supply.

(5.) I agree that the agents of the Company shall have free access at any reasonable time to its appliances on said premises; and may remove meter for any purpose, providing other provisions are made for continuing service; and upon failure to comply with any rule of the Company, the Company may disconnect its service, upon 3 days written notice.

(6.) I agree to make a deposit of $............if required. I further agree that my deposit may be retained and applied by the Company upon bills or any indebtedness whatsoever. For such time as said deposit may be idle, because of not being applicable to any debt due the Company, it shall draw interest at the rate of 5 per cent.

(7.) I agree that no changes shall be made in the equipment specified above, that no other electric service shall be introduced, or used in connection with the equipment supplied hereunder, without the previous written consent of the Company.

Signed ....

Approved for the Company ....

....
General Manager

NOTE. As used in this application, the term "The Company" in each instance refers to The Warrenton Electric Light and Ice Company.

(OVER)

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Installing Electric Motors.—A. CURCHOD.—The author examines all the types of direct-current and alternating-current motors that are in practical use and explains the starting apparatus in detail, showing how to make connections both to the motor and to the lines.—*Revue Générale de l'Electricité*. Aug. 3, 1918.

Lamps and Lighting

Improved Lighting of Automobile Manufacturing Plants.—F. H. BERNHARD.—High production and high efficiency of manufacture have required adequate and correct lighting schemes in the automobile industry. It is pointed out in this article how good lighting pays for itself, and attention also is called to some features that need special improvements.—*Electrical Review*, Aug. 10, 1918.

Project for Standardizing the Threading of the Bottoms and Supports of Edison Lamps.—CH. ZETTER.—A very elaborate article on efforts made in this direction in France, embodying the report made by the author in collaboration with M. Chalicarne, engineer, and M. Saquet, designer, to the Union des Syndicats de l'Electricité.—*Revue Générale de l'Electricité*, July 6, 13, 20 and 27, 1918.

Generation, Transmission and Distribution

Creation of an Artificial Neutral Point in a Monophase or Three-Phase Network.—L. DUBAR.—In some installations it is convenient to have two separate voltages—one for motor service, the other for lighting. With alternating current, monophase with two circuits and three-phase with four wires are often used; but it may happen that the transformers have no neutral point accessible, or, in the case of three-phase distribution, that they have their secondaries delta-connected. In such cases it is necessary to make an artificial neutral point with the aid of balancers. The author studies these apparatuses and their performance when charged with electricity and when not so charged. He propounds a theory applicable to all polyphase distributions, but particularly to the monophase and three-phase which are the most employed. Some observations upon six-phase balancers are also included.—*Revue Générale de l'Electricité*, Aug. 3, 1918.

Calculations of High-Tension Cables.—The complex method of calculating high-tension cables has the defect of not being easily capable of physical interpretations. The results are now put into a form in which the superposition of the no-load and short-circuit conditions can be clearly seen.—*Science Abstracts, Section B*, June 29, 1918. (Abstracted from *Elekt. Zeits.*, Feb. 28, 1918.)

Predetermination of Generating Costs.—The economic problem of central stations is to secure maximum surplus of receipts over expenses, this surplus being a complex function of the selling price per unit. Reducing the selling price results in increased sales, and this in turn reduces generating costs. The difficulty is to predetermine the reduced generating costs so that the lowest selling price which will yield a sound return may be ascertained with reasonable accuracy. There are too many variables to permit of an exact mathematical solution to the problem, and in particular the increase in connections resulting from decreased price per unit is indefinite. By making various assumptions it is possible to obtain linear relations between certain variables and to express others by rectangular hyperbolic functions. Klingenberg has evolved a means of predetermining working costs, assuming equal generating units, but the author's method covers the perfectly general case (with unequal sizes of generating units) and permits costs to be evaluated for a number of years ahead. A tariff suited to the desired or anticipated development can thus be framed with considerable accuracy.—*Science Abstracts, Section B*, June 29, 1918. (Abstracted from *Elekt. Zeits.*, March 28, 1918.)

Installations, Systems and Appliances

Electric-Winding Engines and Mine Hoists.—H. H. BROUGHTON.—The author deals with the technology of the electric winding engine or mine hoist. In this article, which is the first of the series, the scope of the work is defined, and notes of general interest are given on the question of power supply.—London *Electrician*, July 5, 1918.

Briquetting of Lignites.—R. A. ROSS.—This paper contains an outline of the fuel situation in Canada, with specific recommendations concerning the procedure to be followed in briquetting lignites.—*Journal of Engineering Institute of Canada*, August, 1918.

Electric Heating; Some Practical Experience.—E. R. SHIRLEY.—The author puts down the principal advantages of electric heating. He then discusses the results of electric heating in a house of certain definite description for which test data had been gathered. From the results of considerable data of this sort be also discusses the possibility of using electrical energy for heating in a city with a population of 22,000.—Toronto *Electrical News*, May 15, 1918.

Lift Controllers and Controlling Gear for Direct-Current Lifts.—In this article, which is one of a series, the writer discusses the car-switch control by means of which the attendant controls the elevator by having three switch positions—up, down and off. This method may be applied for high-speed elevators by having, in addition to the above, two extra steps, slow-up and slow-down. In another method, by means of push-button control, the attendant may be dispensed with and the elevator becomes automatic in operation.—London *Electrician*, July 19, 1918.

Reconstruction in Germany and Austria.—Proposals for the centralization and development of electric power supply in Germany have received a great deal of attention, and various schemes have been put forward. Reform of the present system has been urged on four grounds: (1) Economy in coal and its transportation; (2) the possibility of using a state monopoly of electricity and of coal as a source of revenue; (3) the importance of plentiful and cheap power in industrial reconstruction, especially in the development of the electrochemical and electrometallurgical industries; (4) the necessity of exploiting all the water-power resources of the country.—London *Electrical Review*, July 26, 1918.

A New Method for Separating Slate from Coal.—H. M. Chance.—The author presents the subject in the following order: (1) Various devices used for separation of slate from coal; (2) difficulties arising under these methods; (3) imperfect separation, loss of product, high unit costs; (4) new method of effecting separation by use of an agitated mixture of sand and water constituting a fluid mass of relatively high specific gravity, in which the coal floats and the slate sinks; (5) application of this principle to other ore-dressing problems.—*Journal of Engineers' Club of Philadelphia*, August, 1918.

Electrophysics and Magnetism

Characteristic Curves and the Conditions of Operating Stability.—J. Bethenod.—A supplementary note to an article by the same author on the spontaneous occurrence of oscillatory phenomena in electrical circuits, with particular reference to the singing arc of Duddell (*La Lumière Electrique*, Oct. 14, 1916). The short article under present notice takes up the case of a particular arrangement and studies the resulting phenomena.—*Revue Générale de l'Electricité*, July 13, 1918.

Proposed Revisions in Tests for Magnetic Properties of Iron and Steel.—According to a paper presented recently before the American Society for Testing Materials, the standard data for material intended for permanent magnets should consist of the normal induction (B), the normal residual induction (B'), and the normal coercive force (H_c) corresponding to a magnetizing force of 200 gausses. Standard magnetic data shall be determined by the Burrows compensated double-yoke method on test specimens prepared as indicated below. Each mill heat or lot shall be marked separately. The test sample shall consist of one test specimen from each of six different bars. The test specimen shall be 25 cm. (9.84 in.) or more long and shall be of such cross-section that it will pass through a rectangular tube whose cross-section is 2 cm. by 5 cm. (0.79 in. by 1.97 in.). The heat treatment prescribed follows: Heat the specimen to 825 deg. C. (1517 deg. Fahr.) and quench in water at 20 deg. C. (68 deg. Fahr.) for steels of the following approximate chemical composition: Carbon, 0.50-0.70 per cent; manganese, 0.50-0.51 per cent; phosphorus, 0.05 per cent; sulphur, 0.03 per cent, and silicon, 0.10 per cent. For tungsten steel heat specimen to 845 deg. C. (1550 deg. Fahr.) and quench in water at 20 deg. C. For other alloy steels the heat treatment is to be determined by practical tests on the test specimen. The furnace shall be of such size that the specimen is heated to the required temperature in not more than thirty minutes. The furnace temperatures given above shall not vary by more than 10 deg. C. On quenching, the test specimen shall be removed quickly from the furnace. The test specimen shall not be allowed to cool over 10 deg. C. (50 deg. Fahr.) after leaving the furnace and before immersion. Immerse end-on or edgewise. The quantity of water shall be such that after quenching it is not over 50 deg. C. (122 deg. Fahr.)—Extracted from paper presented before American Society for Testing Materials.

Units, Measurements and Instruments

Hysteretic Losses in Iron.—Marius Latour.—Supplement to an article printed in the *Revue Générale de l'Electricité* for April 13, 1918, upon hysteretic losses in sheet iron at high frequencies. The author determines the relation that exists between the hysteretic angle τ and the coefficient η of Steinmetz, showing that the exponent n, habitually valued at 1.6 in formulas giving hysteretic losses, is necessarily equal to or greater than 2 for inductions of more than 1000. In cases where the induction oscillates between two values of the same sign the coefficient η must be multiplied by a certain factor.—*Revue Générale de l'Electricité*, July 13, 1918.

Miscellaneous

Tungsten.—Désiré Pector.—A continued article on the production and characteristics of tungsten, with comprehensive details of its employment in the electrical industry.—*Revue Générale de l'Electricité*, July 20 and 27, 1918.

New Materials in the Electrical Industry in Germany.—S. Frid.—Although copper remains indispensable for many applications, the Germans have made much progress with substitutes. For copper conductors three substitutes have been tried with fair success—iron, a compound of iron and zinc, and a compound of iron and aluminum. Manganin and iron, as well as liquid rheostats, have been substituted for copper ones. Busbars have been made of iron, zinc, electron and magnesium. Paper has been used for insulation and for belting, steel bands have also been used for belts, oil of graphite and a potassic solution for lubrication, and many other replacements have been tried. A comparative estimate of metallic values is given, according to the following table:

	Conductance	Density	Point of Fusion in Deg. C.	Coefficient of Expansion per Deg. C.
Copper	57,0	8,9	1084	$1{,}7 \times 10^{-6}$
Aluminum	32,7	2,7	657	$2{,}2 \times 10^{-6}$
Maguesium	22,0	1,7	650	$2{,}2 \times 10^{-6}$
Zinc	16,0	7,2	430	$3{,}0 \times 10^{-6}$
Electron, cast	16,0	1,8	620	
Electron, compressed	16,0	1,8	620	
Iron	7,0	7,8	1400	$1{,}2 \times 10^{-6}$
Steel	5,8	7,7	1350	$1{,}2 \times 10^{-6}$

—*L'Industrie Electrique*, June 25, 1918.

Distribution of Copper Ores.—This circular, which is now ready for distribution, describes the distribution of copper ores in the earth's crust, the different kinds of copper ores, the metallurgical process of extracting metallic copper, the effect of impurities in copper, the electrical and mechanical properties, the physical characteristics, and the welding and hardening of copper.—*Circular No. 73*, Bureau of Standards.

Scientific and Industrial Research

(Printed in the Third Issue of Each Month)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Coöperative Work.

Conducted by Prof. Vladimir Karapetoff
Cornell University, Ithaca, N. Y.

Research in Progress or Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Technical Theory and Practice" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

CABLES, INSULATION TEST.
Additional information is being obtained on the characteristics of insulating compounds. It has been found that cable insulated with mineral-base compound will not withstand a high insulation test when cold, as the insulation resistance is much reduced under such conditions. All this complicates the problem of preparing standard specifications.—*A. I. E. E. Committee on Transmission and Distribution.*

CEMENT INDUSTRY, ELECTRICITY IN.
A sub-committee on the cement industry has tabulated all the processes involved from the point when the raw product is brought to the cement plant up to the point when the finished product is delivered, barreled and ready for shipment. Each process may be considered a movement of some kind. Where electric power is applied to this movement the preferred type of motor control and accessories and alternates are indicated.—*A. I. E. E. Committee on Industrial and Domestic Power.*

CONDUCTORS, SKIN EFFECT.
Skin effects in massed bars, such as are used in electric furnaces involving very large current, are being determined. Dr. Kennelly has published some very interesting experimental work along this line, and it would be interesting if others who have been experimenting with low frequency would publish the results of their measurements.—*Dr. Ernst J. Berg, Union College, Schenectady, N. Y.*

INDUCTANCE COILS, HIGH-FREQUENCY RESISTANCE OF.
The writer has compiled information on the usual methods of measuring this quantity, in which he calls attention to the weak points, if any exist, and develops equations for relations that exist where the distributed capacity may be ignored. The error which may attend this assumption of no distributed capacity in some cases is emphasized.—*C. S. Ballantine, Philadelphia.*

INSULATORS, EFFECT OF TEMPERATURE CHANGES.
Extensive tests are being conducted on the aging effect on insulators carried through a large number of temperature cycles corresponding to the daily and seasonal variations experienced in practice.—*Harris J. Ryan, Stanford University, California.*

INSULATION, LIQUID.
The sub-committee on tests of liquid insulation reported that an elaborate series of tests had been prepared and were being worked out in four different laboratories but were not yet in form for presentation.—*Committee on Electrical Insulating Materials of the American Society for Testing Materials.*

INSULATING VARNISHES.
Tentative specifications have been worked out for the testing of insulating varnishes, and will be given as thorough a trial this year as possible by the members of the committee and others who may be interested.—*Committee on Electrical Insulating Materials of the American Society for Testing Materials.*

SKIN EFFECT IN TUBULAR AND FLAT CONDUCTORS.
An extension of the previous work by various authors. Theoretical formulas have been deduced for the increase in resistance due to a non-uniform distribution of alternating-current density. The formulas check quite closely with a few available experimental results. A complete account of this investigation is published in the August *Proceedings* of the A. I. E. E.—*H. B. Dwight, Hamilton, Ontario.*

THERMO-ELECTRICITY, POSSIBILITY OF REFRIGERATION.
A theroretical investigation is being made into the efficiency of a refrigeration process based on the Peltier effect. It is well known that when a current passes through the junction of two metals a reversible heat phenomenon takes place. For example, when the current flows from antimony to bismuth heat is produced at the surface of contact, while heat is absorbed when the current flows in the opposite direction. Thus such a junction may be made to act as a refrigerator and in a familiar experiment ice is actually formed around the junction by placing it in cold water. The purpose of the present investigation is to deduce the most favorable conditions of operation and to determine the highest attainable efficiency on the basis of some late research into the Peltier effect.—*A. W. H. Griepe, New York City.*

Suggestions for Research

AIR WASHERS FOR LARGE TURBO-GENERATORS.
In many cases the distance between spray particles is equal to hundreds of diameters of each dust particle, even with extremely fine sprays in the densest spray washers now built. A thorough realization of this condition will make it apparent that with density of spray alone, no matter how great, one cannot hope to produce an efficient washer, although it will help. On the other hand, the method of directing the spray with respect to the path of the air is of first importance, and the future successful washer will probably be built with this consideration in view.—*C. B. Hunphrey, American Spray Company, New York.*

ALTERNATING CURRENTS, HARMONIC ANALYSIS OF.
The Braun-Ryan cathode tube, which has been used as a wattmeter (see articles in the A. I. E. E. *Transactions* by Minton and others) may be set up to measure harmonics by selective resonance. With known variable frequency and a constant-frequency alternating current which one wishes to analyze, it may be possible to get readings from which the amplitude of any harmonic may be determined.—*R. E. Bitner, Cornell University, Ithaca, N. Y.*

CORE LOSS, REDUCTION BY HIGH-FREQUENCY MAGNETIZATION.
It has been demonstrated by various investigators that the hysteresis loop of a specimen of steel may be made considerably narrower—that is, the loss reduced—by subjecting the specimen to a high-frequency magnetization at the same time that it undergoes a low-frequency hysteresis cycle. The effect seems to be the same as if the molecules were rapidly shaken and made less sluggish. In a piece of apparatus like a large transformer the core loss may be the limiting factor in determining the size of the core. If by means of high-frequency currents the loss could be considerably reduced, higher flux densities might be used. As a result the core would be smaller and the mean length of turn also reduced, bringing an added economy in the weight of copper. An investigation is desired of the possibility of such a method for practical use.

INSULATION TESTS ON APPARATUS IN SERVICE.
The following questions were recently asked of operating companies in the N. E. L. A. Question Box: (1) What companies apply potential tests to the insulation of their generators and other similar apparatus? (2) How frequently is such a potential test applied? (3) What test voltage is applied (measured in terms of normal operating voltage)? About eighty replies were received, but only five large companies reported periodical potential tests. For details of these replies see *N. E. L. A. Bulletin,* March, 1918, p. 185. In this connection, S. C. Lindsay, of the Puget Sound Traction, Light & Power Company of Seattle, suggests that each time it becomes necessary to rewind any generating or transforming apparatus tests to destruction be made in order to determine the strength of the insulation before the winding is removed for the purpose of putting on new. If this could be done every time a machine is rewound, it would result eventually in the collection of a valuable amount of data.

TEMPERATURE RISE.
Resistance thermometers and thermocouples are available for measuring temperature rise in the stationary parts of electrical machinery. It would be very desirable to develop a device to indicate the temperature rise in a revolving part of a machine in actual operation. There should be no slip rings for carrying the indicator current to the switchboard or to an alarm. For example, the current generator in a thermocouple may be used to excite small electromagnets attached to the revolving part. The magnetic fluxes so created may be used to induce currents in a stationary armature, and these currents, amplified if necessary, may be made to actuate an indicating or recording instrument or an alarm.—*Editorial Suggestion.*

THESIS SUGGESTIONS.
Many items suggested by various contributors in the Research Section are particularly well suited for thesis work of students in colleges of engineering. Some professors state that these suggestions would be much more valuable if the writers would not only indicate the results desired but also outline in detail the method of procedure. Actual experience shows that a general statement of a problem is not sufficient for a beginner and he is liable to lose considerable time in finding out exactly what is desired.

[Persons who are equipped to take up such research should communicate with the person suggesting it for details since space in these columns does not permit our giving them.—*Editor* Electrical World.]

TRANSFORMER, OPERATION AT TEMPERATURE OF LIQUID AIR.
It is desired to investigate economies that would result from the operation of a large power transformer at the temperature of liquid air or thereabouts. Such an arrangement is by no means impracticable, since liquid air could be circulated in pipes or even perhaps used as insulation. At such a temperature the resistance of copper is but a fraction of its value at ordinary operating temperatures, so that much higher copper densities could be used, thus reducing the weight of copper and the length of the mean turn. The size of the core would consequently be reduced, and, moreover, higher flux densities could be safely used.—*Editorial Suggestion.*

TRANSMISSION LINES, CHARGING CURRENT.
In the operation of a high-voltage, 60-cycle rural transmission line fed from comparatively small generators, the charging current has often been found to constitute quite a large percentage of the full-load current of the generators. This condition makes a constant-voltage operation rather difficult and the regulation is very poor. Some of the smaller companies have bridged across the generator busbars reactances taking exciting currents comparable with the charging current drawn by the transmission line. This practically reduced the demand upon the generators to the actual load current and should improve the operation materially. An investigation of this method of operation would be of considerable interest to the transmission-line companies operating in sections of the country, like the Middle West, where the population is comparatively scattered though prosperous.—*V. L. Hollister, University of Nebraska, Lincoln.*

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

BALTIMORE WARNING OF "POWERLESS DAYS"

President Herbert A. Wagner Tells Consumers of the Consolidated Company to Prepare for Probable Contingencies

"Powerless days" are possible in Baltimore, and notice to this effect has been sent to large power consumers by president Herbert A. Wagner of the Consolidated Gas, Electric Light & Power Company. The notice was issued for the purpose of preparing customers for probable contingencies. At present the company has enough power to supply all needs.

Mr. Wagner expresses himself as sure of the coöperation of consumers. He says in his notice to the consumers:

> We are very sorry to have to inform you that we are threatened with a shortage of electric power as we approach the time of year when the amount of power obtainable from the Susquehanna River is small on account of low water flow.
>
> It has been our fixed policy to make every effort to anticipate the power demands of the community long enough in advance to assure the delivery and installation of sufficient machinery to supply all requirements without any aid whatever from the Susquehanna River. In line with this policy we ordered in October, 1916, two 20,000-kw. (52,000-hp.) steam turbines and generators as an addition to our power plant. These were scheduled for delivery in February and March of this year. Owing to war needs and government control of steam-turbine production, and in spite of the highest priority, giving us preference over all other public utilities, the delivery of these machines has been delayed and cannot be made before October next. We are therefore doing our utmost to supply the service needed by our customers with more than 50,000 hp. less generating capacity than we expected to have at this time.
>
> It is possible that we may be able to pull through without curtailing our service to you, but if we find the demand becomes greater than we have ability to supply, we must count on your coöperation to reduce your consumption of electrical energy to the amount which we find necessary upon twenty-four hours' notice. It is our intention to distribute this reduction among all our industrial customers on the basis of a percentage of the demand of each, but if we find our requests for such reduction are ignored, we shall have only one alternative, and that is to supply power to consumers only in rotation on a schedule which will deprive each consumer of all power whatsoever for one or more days in each week. In anticipation of this we have divided our power consumers into groups and have placed you in the group which will, in the event of a shortage of power, have the power supply cut off entirely from 6 a. m. until 6 p. m. on —— of each week, as long as the deficiency shall continue.
>
> We wish to accomplish the utmost conservation of power with the least inconvenience to our customers and, in the event of shortage, we will notify you what reduction is required and will only resort to the "powerless day" schedule in the event that our requests are not complied with, in which case power will be cut off on the weekday specified without further notification.
>
> We cannot tell you at this time when the call for power reduction may be necessary, but when or if it comes you will receive at least twenty-four hours' notice. We are writing you now merely to advise you of the conditions which are threatening us.

Ring the Liberty Bell—Buy Bonds

HITCH IN CONGRESS ON THE WATER-POWER BILL

Legislative Complication in the Senate Endangers the Prospect of Early Action on the Much-Needed Law

The prospect that there might be action in the near future on the water-power bill in Congress has apparently been lessened, according to the Washington representative of the ELECTRICAL WORLD.

A legislative situation has arisen in connection with the measure which at the same time involves the prospect of early action by Congress on the emergency power act under which $200,000,000 would be appropriated as a war measure for the creation of additional power facilities. Before this is published it is possible that some action will have been taken by the Senate on the water-power bill. The measure will in all likelihood be committed to conferees for the Senate and the House.

But a new element has entered into the legislative situation concerning both the water-power bill and the emergency power act. Senator Thomas of Colorado, who has been endeavoring for some time to have passed by Congress certain legislation which would encourage and promote in his opinion the mining of coal, phosphate, oil, gas and sodium, and who has been unable to obtain the legislation he has desired in the form in which he advocates it, has given notice in the Senate that he intends to offer his legislation as an amendment to the water-power bill. This proposal will still further complicate the legislation proposed in the water-power bill because all Senators who where originally opposed to Senator Thomas' legislation would be opposed to the water-power bill if it came before them with Senator Thomas' legislation attached to it.

The fate of the emergency power act is involved in this situation, because Senator Shields, to whose committee the emergency power act will come from the House of Representatives, has informed the Washington correspondent of the ELECTRICAL WORLD that he doubts if his committee will be able to take up the emergency power act until the water-power bill is out of the way. The prospect, therefore, is for a long parliamentary delay on both bills on the Senate side.

In the meanwhile the House committee on interstate and foreign commerce has been whipping the emergency power act into shape to report it to the House as soon as the revenue bill is passed by the House.

Dr. H. A. Garfield for $200,000,000 Power Law

United States Fuel Administrator Urges Upon Congressional Committee the Importance of Passing the Emergency War Plant Act to Provide Adequate Power Supply for Coal Production

ANOTHER reason for the passage of the two-hundred-million-dollar emergency power act has been advanced before the committee on interstate and foreign commerce of the House of Representatives by Dr. H. A. Garfield, United States Fuel Administrator, who sees in the measure the promise of a more adequate supply of power for coal mining and, furthermore, economy through the substitution of central stations for isolated plants in coal mining.

Why Dr. Garfield Supports the Bill

Dr. Garfield, in testifying before the committee this week, said that the bill appeals to him as one which ought to be enacted into law for several reasons. An adequate supply of power is essential to maintain the full and reliable production of coal. There are several sections of the country where the coal supply is of particular importance, those sections being especially the regions furnishing the by-product coal which is essential to steel making and without which the whole war program must halt. In all of the regions where the central power plant has been introduced a difficulty has arisen because of the fact that the overloading of the central plant by reason of the large increase in requirements due to the war has resulted sometimes in a breakdown of the plant, at other times in a failure to furnish power for continuous operation.

Dr. Garfield said that the chief reason why the companies involved do not increase their plants is, he is informed, that the financing of the war by the government made it virtually impossible to raise the necessary amount of capital at the present time.

The regions where there is the greatest need are in general these, said Dr. Garfield: First, western and central Pennsylvania; second, the eastern Ohio coal fields; third, the central Illinois fields; fourth, the western Virginia fields; fifth, the eastern Kentucky fields.

Adequate power systems are essential for the use of coal for power service to industrial undertakings.

"In a general way," said Dr. Garfield, "there is a saving in the cost of operation of something like two and a half times by the installation of these central plants, but I take it that your committee is not particularly interested in that, inasmuch as that saving comes primarily to the mining companies that utilize the central power instead of making their own power. You are interested particularly—at least we are—in the amount of coal saved, and it is from two to four times in quantity. Indeed, in the anthracite regions where the situation is somewhat peculiar we have figures that enable us to speak, not as from an estimate, but with much more accuracy than that. There is a saving of nine times the quantity of coal. Now at a time like this, when we are so pressed upon for additional coal, that saving is of the utmost importance."

Chairman Sims—You mean utilizing the coal in these large stations would result in a large economy of coal, amounting to the figures you have just mentioned?

Dr. Garfield—Yes. Speaking of this anthracite illustration, to mine 90,000,000 tons of anthracite coal requires in the isolated plant 9,000,000 tons of coal, which must be burned up at the mines; and I say it is better than an estimate, because it is in part based upon their experience, that if they were able to utilize power from a central plant for their mines, only 1,000,000 tons of coal would be used in producing 90,000,000 tons.

Chairman Sims—By the use of one power plant instead of a power plant at each mine?

Dr. Garfield, answering in the affirmative, gave particulars of one plant in which only one-fourth of the amount of coal is consumed in supplying the energy that was formerly used when the mine ran its own plant and generated its own energy. Continuing, Dr. Garfield said:

"The difficulty at the present time is that these central plants which are established here and there, because the movement was well under way before the war began—the economy of it being obvious to everybody interested in the industry—the difficulty is that with the overload now on these plants there are breakdowns that lay up the coal production."

"There are two ways of economizing, looked at from the fuel standpoint," added Dr. Garfield: "One is to build your plant, or where, as in some instances, it is already built, to enlarge your plant at the point of production, namely, at the mine or at a point remote from the mines but in the center of a manufacturing district. In a place like eastern Ohio, or in the Pennsylvania fields, the central plants can be most economically set up in the midst of the coal-mining region, so that there is the shortest haul on coal, because the manufacturing district lies right around near at hand and can be economically reached by the energy. On the other hand, where no coal is produced the coal should be brought to a central point—central that is to the manufacturing interests—and a plant there established or enlarged, as the case may be, to furnish the energy. The location of such a plant would be of importance. It should be so located that it could receive its coal by transportation through the less congested districts; perhaps by barge would be the best way out of the New York ports, so as to avoid the open sea haul."

Necessity of Financial Aid from Government

Chairman Sims, summarizing the points as emphasized by Dr. Garfield, said that, as he understood, it would be very difficult to finance the construction of the large central stations without government help. The cost of construction at this time would be so great that there would have to be a loss to the owner of the plant after the war.

Dr. Garfield said that the whole question of amortization cannot be carried on successfully except under some government regulation.

Chairman Sims—And government assistance in building the plant? Dr. Garfield—Yes.

Representative Esch asked questions bearing on the use of culm-bank coal by electric central stations in the anthracite region.

Dr. Garfield said that he had the notion some months ago that there ought to be a different price for the culm-bank coal. Engineers of the Fuel Administration and accountants at the Federal Trade Commission advised him that it would be unwise to try to make a different price, because the cost of providing for the special process of washing and the extra incidental expense would really absorb the difference due to the fact that the coal could be got out of the culm banks at less expense than the cost of mining fresh coal.

Advantages of Large Central Plants

Representative Esch asked whether a central plant would give more continuous service to many different consumers than individual plants.

Dr. Garfield—That is one of the chief arguments for putting in the central plant, yes, from the standpoint of the operators.

Representative Esch—Is that due to the fact that the individual plants are usually small and have no duplicate equipment of boilers or generators?

Dr. Garfield—Yes.

Representative Esch—While your central heating plant would be built with a view to meeting contingencies and thus always have a surplus of units?

Dr. Garfield—Yes. The difficulty just now is that they have been reduced to the place of the isolated plant because of the heavy load put on them due to the war, and that they have used up even their reserves, so they have got to build more; but your principle is right.

Representative Esch asked whether it would be possible to equalize the load of a central plant in a war industry by extending the period of use through the twenty-four-hour period.

Dr. Garfield—Yes, but not without difficulty, because of the prejudice of the miner in favor of working certain rather established hours; but by working two shifts of eight hours each there could be a distribution of the load.

Representative Stephens—Doctor, does your plan or this bill contemplate taking or uniting the existing plants in an industrial center? For example, suppose in a certain industrial center there would be fifty or sixty plants now in operation. Some of those plants use all the power they have; others do not, and perhaps many only use their maximum capacity a few hours a day. Now is it contemplated that the power produced by all of these isolated plants will run into one line and furnish a reservoir of power that can be distributed where it is needed, and thereby use the maximum power of the district instead of as at the present moment only using a portion of it in certain plants and leaving others overloaded?

Dr. Garfield—I should like Mr. Stuart [Charles E. Stuart, chief of the power and light section, Bureau of Conservation, United States Fuel Administration—Eds.] at the proper time to answer that. I have heard that discussed as one of the ways. It lies in my mind that the engineers answer that differently in different places, depending upon conditions.

Representative Stephens asked if it was anticipated that the central plants could be constructed and put into operation in time to serve a real purpose before the war closes if it should close in another year.

Dr. Garfield—I should suppose that in a good many instances certainly plants could be enlarged. Whether new plants could be put into operation to accomplish the result before the close of the war, again I should like Mr. Stuart to state to you.

Representative Stephens—Well, even though they wouldn't be installed in that reasonable length of time, the use of it during the war wouldn't end in a year. These plants will still serve a great economic purpose, I should judge, without any regard to the war?

Dr. Garfield—Oh, yes, without any regard to the war.

Representative Montague expressed it as his understanding that Dr. Garfield thought that fundamentally it is cheaper to transport power than to transport coal out of which power is to be generated.

Dr. Garfield said he thought it was, within a limited region.

Representative Montague—Your statement is that that centralization can be accomplished by two methods —coördinating certain existing plants or establishing a government plant.

Dr. Garfield—It might either be built and directed by the government as a whole or it might be better to arrange for its direction.

Representative Montague—And the government would loan the money?

Dr. Garfield—Yes. The bill is left open as I understand it in that regard.

Representative Montague asked if Dr. Garfield was viewing this from the standpoint of a permanent economic policy, as related to government intervention and government supervision or operation, or as a policy to subserve the uses of this war.

Dr. Garfield in his reply said: "It is a permanent economic policy outside of that question, whether the government runs it or not. For a long time I have been convinced that there should be that kind of economy. In 1901 and 1902, when I was actively interested in the projection of a coal enterprise in southeastern Ohio, it was a thought with me then that we ought to consider the advisability of enlarging our enterprise and putting a plant in at the mine and using our own coal that way and selling power rather than coal, because I believe in the economic principle of it."

Representative Montague said that the point of view with himself and maybe some others of the committee had been that if this is to be a permanent business in which the government enters, then time is not the essence of its merits or necessities, but if it is to be for a military purpose alone, then the question of how long the government should engage in this policy after the war is over would be a question perhaps to be determined by legislation.

War Necessity or Permanent Policy?

Dr. Garfield—I may say that I have viewed this wholly outside of the question of war necessity. My thought is, what are the merits of it as a permanent economic policy?

Representative Montague—I don't mean as a permanent economic policy, if it is a wise thing, but the question with me is, has the government the right, the constitutional right, to engage in these private businesses and conduct them after this war is over as a peace policy?

Dr. Garfield—I shouldn't undertake to answer that without more careful attention to the question. I have brushed aside everything else and have said to myself, "That piece of proposed legislation appeals to me, because I believe it will accomplish what we are after." Of course, if the war comes to an end quickly, the plants may not yet be in operation, but I have proceeded on the assumption that we must get ready as if the war were to be long-continued.

Representative Hamilton—You are saying this now as a purely war emergency proposition?

Dr. Garfield—Yes.

Representative Hamilton asked just how the law would be applied in the briefest possible time.

Dr. Garfield explained what was done in the case of one central station furnishing say 90 or 95 per cent of the mines in its territory. That company sent to see if Dr. Garfield could help it to secure additional machinery which it must have. Part of the difficulty was financial. Part of it was lack of authority to get construction of the machinery hastened and the equipment delivered. Dr. Garfield had Mr. Stuart and his associates figure on the matter and turned it over to the counsel for the Fuel Administration and a contract was worked out. What they were going to do if it had seemed wise to do so was to use a fund, either what is included in the Lever act or else ask the President for the money, but it would in any event have been the government's money, $1,000,000 to be turned over to the plant for the purchase of this new machinery.

Mr. Hamilton—How would that be secured?

Dr. Garfield—That would be secured by the government having a lien on the machinery, virtually owning it until such time as the government would be settled with. In addition to that, we insisted that they must make some further provision in the way of securing it. My own notion was in the beginning that the bondholders should all consent to allow this lien of the government to be on lines very much like receiver's certificates.

Mr. Hamilton—Otherwise the government might have security on what might ultimately, or rather soon, become junk, if it was simply machinery?

Dr. Garfield—I thought that was likely to be the way. The practical difficulty was so great that the managers said they did not wish to do it, and eventually they solved it in another way, because they were able to arrange with the War Department for energy that gave the government a direct use that took the place, you might say, of a further lien.

There was then some further discussion following questions by Representative Hamilton to reveal what relief would be obtained during the war. Dr. Garfield made this statement:

"The less essential industries, being told that they could not have coal, at the outset gave up coal or some of them did. They gave up coal and went over to power where they could, which was an indirect use of coal; and without some arrangement by which we can also control power companies we were in danger of having our coal used indirectly, and not being able to curtail where we ought to curtail. The regulations which would be set up governing power companies, the government having control of them, would, of course, prevent any switching by less essential industries to power and thereby using not so much, but still, coal."

Dr. Garfield, replying to a question, said that with central-station energy coal could be mined at less expense and much greater speed.

Buy for Your Country's Sake

AUTHORITY GIVEN FOR ST. LAWRENCE RIVER DAM

New Construction Plan to Increase Output of Electricity at Massena, N. Y. Is Approved Despite Objections

Authority will be given to the St. Lawrence River Power Company to construct a submerged weir in the South Sault Channel of the St. Lawrence River near the entrance of the company's power canal leading to the power house at Massena, N. Y. This decision follows a meeting of the International Joint Commission at Montreal, at which the application of the company for authority to undertake this construction was strongly opposed by the Canadian government.

At the meeting of the commission the Dominion government insisted that building the weir would interfere with navigation in the channel, in contravention of the provision of the Webster-Ashburton treaty; also that it was against public interest to permit such work to be done by private corporations, inasmuch as the control of the water level of the river would pass from international territory to the power house at Massena.

It was pointed out by the United States War Department that the erection of the weir was necessary to increase the output of aluminum for war purposes, and A. B. Davis, president of the Aluminum Company of America, said that increased production of aluminum could not be secured at any other point. He wanted the dam for war purposes during the war and to prevent interference by ice with the ordinary production after the war. The State of New York maintained that title to any structures in the St. Lawrence River should remain in the State of New York, and that while there would be no objections to grant permits for the duration of the war, the state was opposed to a permanent hindrance to navigation of the South Sault Channel.

It was intimated by the Dominion government that if the commission granted the application, the Canadian government would at once request the United States government to guarantee that the weir will be removed upon request at any time after the war. Formal protest would also be made against the present diversion of water through the St. Lawrence River Power Company's power canal and against any possible future increased diversion.

Those representing interests in this country were Marshall McLean of the State of New York, Judge Koonce of the United States War Department, George Gordon, Pittsburgh, and Leighton McCarthy, Toronto, attorneys for the power company; Henry Holgate, Montreal, B. F. Groat, Pittsburgh, and James W. Rickey, engineers for the power company.

PRIORITY REGULATIONS FOR THE JOBBERS AND DEALERS

Text of the Circular Outlining Priority Position of Manufacturers and Distributers in the War Industries Board Program

Following is the complete text of Circular No. 23 of the Priorities Division of the War Industries Board, addressed to all electrical manufacturers and resale distributers of electrical equipment, apparatus, appliances and supplies and signed by Edwin B. Parker, Priorities Commissioner, under date of Sept. 17:

I. It is in the public interest that all jobbers, wholesalers and resale distributers of and dealers in electrical equipment, apparatus, appliances and supplies should be permitted to maintain reasonable stocks from which government agencies, war industries, contractors and the civilian population may draw to meet essential requirements. Such persons, however, should recognize the existing necessity for rigid economy in the use of all such products and their duty to see that such products shall be devoted to essential uses, and they should pledge their whole-hearted coöperation in a program to accomplish such results.

II. Jobbers, warehousers and resale distributers (all of whom will be herein referred to as jobbers) through their war service committee have already obligated themselves to assist in securing such results. They will be permitted to maintain reasonable stocks and distribute therefrom as follows:

1. Each such jobber will execute and file its pledge of coöperation addressed to the Priorities Division (mailing same to the electrical and power equipment section of the War Industries Board). Such pledge of coöperation will be as follows:

Pledge of Jobbers, Warehousers and Resale Distributers of Electrical Equipment, Apparatus, Appliances and Supplies

Priorities Division, War Industries Board,
Washington, D. C.

The undersigned hereby pledges itself:

(1) Not to use, nor so far as lies within its power permit to be used, any electrical equipment, apparatus, appliances or supplies which now are or may hereafter come into its possession or under its control except for essential uses as that term has been or may be defined or applied from time to time by the Priorities Division of the War Industries Board.

(2) Not to make any sales or deliveries from its stocks except (a) such small sales from shelf stocks as are necessary to meet minor needs of the community which it serves; (b) such sales as are warranted by priority certificates or by automatic priority ratings issued or authorized by the Priorities Division; (c) sales of appliances the manufacture of which has been approved by circular or express permit of the Priorities Division and for whose sale a pledge has been given by such jobber to the manufacturer thereof, or (d) sales to dealers, contractors, retailers, repairmen or others buying for resale who have filed with the undersigned a pledge in writing similar to this pledge.

(3) That, in ordering electrical equipment or apparatus, it will furnish the manufacturer in the manner prescribed by such manufacturer information regarding stocks of substantially similar ratings and types then on hand and the essential character of the sale or sales made justifying the order placed.

(4) That it will use its utmost endeavor to reduce all stocks to the minimum consistent with the essential requirements of the territory to be served, to prevent hoarding of stocks and to insure that they be distributed solely for essential purposes.

When the Priorities Division shall have approved such pledge, the electrical and power equipment section will issue to such jobber its certificate declaring such jobber to be entitled to avail itself of the benefits of this circular.

2. To the extent that its sales fall within the limits of the foregoing pledge, a certificated jobber shall be entitled to place with any manufacturers or jobbers constituting its sources of supply orders for stock, provided:

(a) That such orders for stock shall not be in substantial excess of the amounts actually sold from previous stocks.

(b) That due regard has been had for such jobber's obligation to reduce all stocks to the minimum consistent with the essential requirements of the territory which it serves.

(c) That each order for electrical equipment or apparatus is accompanied by a statement as indicated in item 3 of its pledge. The electrical and power equipment section will revoke its certificate issued to any jobber for any violation of the pledge given by such jobber and will certify such revocation to such jobber's suppliers, and the Priorities Division will withhold from such offender all priority assistance.

3. All orders for stock placed in accordance with the foregoing plan shall be and they are hereby rated as Class B-4 and entitled to priority and precedence accordingly, conditioned that any certificate holder, when placing any order with any supplier, must have on file with such supplier a copy of the certificate issued to holder by the electrical and power equipment section.

III. All dealers, contractors, retailers, repairmen and others buying for resale (all of whom will be herein referred to as dealers) not holding certificates issued by the electrical and power equipment section (except jobbers whose certificates have been revoked) will pledge their coöperation and will be permitted to purchase reasonable quantities of electrical goods for resale and to distribute same pursuant to the following plan:

1. Each such dealer will execute and file with each of its suppliers its pledge of coöperation. Such pledge will be signed by the person, firm or corporation owning such business or by an authorized executive thereof and will be in the following form:

Pledge of All Dealers, Contractors, Retailers, Repairmen and Others Buying Electrical Goods for Resale

To..............................
City of.......................
State of..................

The undersigned hereby pledges itself:

(1) Not to use, nor so far as lies within its power permit to be used, any electrical equipment, apparatus, appliances or supplies which are now or may hereafter come into its possession or control except for essential uses as that term has been or may be defined or applied from time to time by the Priorities Division of the War Industries Board.

(2) That, in ordering electrical equipment or apparatus, it will furnish its source of supply, in the manner prescribed by such supplier, information regarding stocks of substantially similar ratings and types and the essential character of the sale or sales made or to be made justifying the order placed.

(3) That it will use its utmost endeavor to reduce all stocks to the minimum consistent with the essential require-

ments of the trade served, to prevent hoarding of stocks and to insure that they be distributed solely for essential purposes.

2. All orders placed in accordance with this pledge shall be and they are hereby rated as Class C and entitled to priority and precedence accordingly, conditioned, however, that such dealer shall have on hand with its supplier its said pledge.

3. Any supplier of any dealer with whom any order is placed by such dealer in accordance with the plan prescribed by this circular shall scrutinize such order carefully in the light of the then relationship of supply and demand generally of the particular electrical goods and the needs of the trade served by the dealer placing such order.

4. Any violation by any dealer of its said pledge must be promptly reported to the electrical and power equipment section, and such section will certify such dealer to its suppliers to be no longer entitled to avail itself of the benefits of its priority classification under this circular, and the Priorities Division will withhold from such offender all priority assistance.

IV. The War Industries Board will rely upon such certificated jobbers and their war service committee and trade supplied by them to see that the policies mentioned herein are safeguarded as to all business done through such jobbers or which comes under their observation. It will rely upon the manufacturers of electrical goods and trade supplied by them to see that the policies mentioned herein are safeguarded as to all business done by such manufacturers or which comes under their observation.

The government is depending upon the experience and patriotism of all manufacturers, jobbers, dealers and consumers to assist it in securing an equitable distribution of all products and their application solely to essential uses.

Make the World Safe—Buy Bonds

WORK ON STANDARDIZATION FOR THE HOUSING PROJECTS

Manufacturers Form Committee on Electrical Materials Advisory to the Building Materials Section of the War Industries Board

Rapid progress has been made in the organization of the movement to assure standardization of the electrical materials required for the extensive housing projects planned by the government.

As stated in last week's issue of the ELECTRICAL WORLD, a conference was held on Sept. 13 in Washington between Richard L. Humphrey, chief of the building materials section of the War Industries Board, and representatives of the manufacturers producing the kinds of supplies needed for the government program. The manufacturers met again on Sept. 17 at the headquarters of the Associated Manufacturers of Electrical Supplies, New York.

The manufacturers have formed the "committee on electrical materials advisory to the building materials section of the War Industries Board" with the following members:

J. C. Dallam, chairman, representing seventy-seven manufacturers of wiring devices.

W. H. Thornley, representing nine manufacturers of nonmetallic flexible conduit.

F. W. Hall, representing ten manufacturers of metallic flexible conduit and armored conductor.

D. H. Murphy, representing eleven manufacturers of rigid conduit.

C. E. Corrigan, representing two manufacturers of metal molding.

H. D. Betts, representing twelve manufacturers of outlet boxes.

H. R. Holmes, representing forty manufacturers of electrical porcelain.

H. W. Bliven, representing twenty-one manufacturers of metal reflectors.

Mr. Dallam, as chairman, has advised Mr. Humphrey that other groups of the manufacturing industry are organized and that members can be called promptly to act on this committee if developments show the need of greater range of representation than now included.

Each branch of the industry represented has already well under way a very complete program of conservation, the reports of which will be made to the Conservation Division of the War Industries Board within a week. The work with the building materials section will follow along the line of recommending the standards included in this program.

Use Your Money Wisely—Buy Bonds

TENTATIVE PROGRAM FOR ILLUMINATING ENGINEERS

Outline of the Proceedings Scheduled for the Illuminating Engineering Society Convention in New York on Oct. 10

Following is the tentative program for the annual convention of the Illuminating Engineering Society, to be held in the Engineering Societies Building, New York, on Oct. 10:

Morning Session—9:30 A.M.

Presidential address, G. H. Stickney.

Report of committee on progress, F. E. Cady.

Report of committee on nomenclature and standards, A. E. Kennelly.

Statement on behalf of United States national committee of International Commission on Illumination, E. P. Hyde.

New York State automobile headlight law, F. M. Hugo.

Report of committee on automobile headlighting specifications, C. H. Sharp.

Report of committee on lighting legislation and statement concerning work of divisional lighting committee, L. B. Marks.

Statement concerning war committee of technical societies, D. W. Brunton.

Report of committee on war service, P. S. Millar.

Four-minute Liberty loan talk.

Afternoon Session—2:00 P.M.

"Lighting of Cantonments," Bassett Jones.

"War-Time Lighting Economies," committee on war service.

"Light as a Manufacturing Stimulant," W. A. Durgin.

"Protective Lighting," Edmund Leigh.

"Influence of Lighting Curtailment Upon Accident Hazards," R. E. Simpson.

"Plan for Insuring Quality of Industrial Reflectors," Ward Harrison.

In the evening at a dinner-meeting speakers of national note will discuss the war and illumination.

It Is Liberty for You—Buy Bonds

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

International Association of Municipal Electricians.—As previously announced in the ELECTRICAL WORLD, the annual meeting of the International Association of Municipal Electricians will be held in Atlanta, Ga., Sept. 24 to 27, inclusive.

Kansas Public Service Association.—It has been announced that the meeting date of the Kansas Public Service Association has been changed. The meeting, which is to be an informal conference, will be held at Hutchinson, Kan., on Oct. 4.

A. I. E. E., Cleveland Section.—A joint meeting of the Cleveland Section of the American Institute of Electrical Engineers and the Society of Automobile Engineers was held Sept. 19. C. F. Kettering, president of the Society of Automobile Engineers, addressed the meeting. The regular meetings of the Institute will begin in October, it has been announced.

Engineers' Society of Milwaukee.—The regular monthly meeting of the Engineers' Society of Milwaukee was held under the auspices of the Milwaukee Section of the American Institute of Electrical Engineers on Sept. 11, 1918. E. R. Shephard, associate electrical engineer of the United States Bureau of Standards, Washington, D. C., gave an illustrated talk on "The Work of the Bureau of Standards with Special Reference to Local Electrolysis Surveys."

N. E. L. A., Michigan Section.—W. M. Lewis, vice-president, and H. Silvester, secretary, of the Michigan Section, National Electric Light Association, have announced that the convention of the section, which was to have been held Sept. 17 and 18 at the Hotel Pantlind, Grand Rapids, Mich., has been postponed indefinitely. Developments have shown that it is inconvenient for many members to attend, and the prospect of a small attendance was the immediate cause of the postponement.

A. I. E. E., Pittsburgh Section.—The first meeting since summer adjournment of the Pittsburgh Section of the American Institute of Electrical Engineers was held Sept. 17. "Fundmental Principles and Application of Electric Arc-Welding Apparatus" was the subject of discussion by A. M. Gandy, general engineer of the Westinghouse Electric & Manufacturing Company. The paper was illustrated with lantern slides and embodied the advances made in arc welding in the last year.

Massachusetts State Association of Electrical Contractors and Dealers.—A short business meeting of this association will be held at the Hotel Kimball, Springfield, Mass., at 10 a. m. Saturday, Sept. 28. The contractors have been invited by the New England Section of the National Electric Light Association to attend the Saturday afternoon meeting, at which a paper will be read by John J. Gibson of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The meeting, which is one of the sessions of the annual convention of the latter association, will also be addressed by William L. Goodman.

American Society of Mechanical Engineers.—Marcel Knecht, member of the French High Commission in the United States, addressed a meeting of the American Society of Mechanical Engineers on Sept. 17 at the Engineering Societies Building, New York City. The subject of the address was "The Supreme Effort of the French War Industries—Franco-American Industrial Coöperation During and After the War." Brigadier-General L. B. Kenyon of the British War Mission, recently returned from a trip to the front, told of his experiences, including his observations of salvaging work and machine and repair shops. He discussed particularly the necessity, even yet not thoroughly appreciated, for precision work in manufacturing ordnance.

A. E. R. A., Manila Section.—At a meeting of the Manila Joint Company Section No. 5 held recently Miguel E. Borja, watch engineer of the power-plant department of the Manila Electric Light & Railroad Corporation, read a paper on the "Economical Production and Transmission of Electric Power." He enumerated the various pieces of power-plant apparatus essential for the conversion of the heat energy contained in coal into electrical energy and laid stress on the necessity of keeping all apparatus clean and in good repair. In this connection he pointed out that the improper maintenance and operation of steam boilers results in from 6 to 20 per cent decrease in efficiency and that the condition of the condensers as to cleanliness and vacuum has much to do with the overall efficiency of the steam turbine to which the condenser is connected. In the company's Morales power plant improved methods of operation in the boiler room have increased boiler efficiency by 10 per cent. Relative to the efficiency of transmission lines, Mr. Borja stated that while the power plant is much handicapped by machinery of which the operation and efficiency are largely beyond the control of the transmission line, the only limit to its efficiency is that of adjusted capital. The average loss on the lines of the company is about 15 per cent, although an additional 10 per cent is unaccounted for. This unaccounted-for loss is now being studied in order to eliminate it.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Rate of Return.—In discussing rate of return in a case affecting the Lockport Light, Heat & Power Company, the New York Public Service Commission, Second District, says in part: "We know that at the present time it is difficult, if not impossible, for such a company to sell its securities at any price, and the fact that the company might be able to pay its stockholders a return of 8 per cent on their investment would not make any substantial demand for them. Beyond this it is not known how long the present situation is to prevail. People who are versed in financial matters believe that rates for money will be high for several years after the present unusual conditions have become a thing of the past and the world has been restored to normal conditions. We believe that those who invest in the service of the public in a city the size of Lockport should receive a return of 8 per cent."

Amortization of Steam Plant When Stations Are Connected.—In upholding an advance in rates by the Southern Illinois Light & Power Company, the Illinois Public Utilities Commission says regarding a charge of $696 for amortization of the cost of the Coulterville steam plant: "The amount included by the petitioner for the amortization of the Coulterville steam plant is included upon the theory that the construction of the transmission line connecting these two communities enabled a saving to be effected, and that, in order to care properly for the company's investment, this investment should be amortized over a period of years. If sufficient showing were made as to the savings which will actually be effected by a combination of systems in this manner, the arguments advanced by the petitioner would be entitled to very serious consideration. Frequently the construction of transmission lines and the linking together of various generating stations is to be desired, since in many cases it insures a better grade of service than would be financially possible from small isolated stations and in many cases offers opportunity for a more economical generation and distribution of energy. However, the allowance of an amount such as here proposed in operating expenses must certainly be predicated upon a showing as to the saving which is really effected by such a method of operation, and such a showing is not made in the record herein, and under the circumstances scarcely could be made until some time had elapsed under the new scheme of operation."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Town Dark Because of Poor Coal.—In the municipal plant at Hamilton, Ohio, it was found impossible recently to get sufficient steam to operate the generators, and as a consequence street lamps were dark one entire night. Only sufficient energy could be generated to supply domestic patrons.

Women in Industry.—Dr. Francis D. Patterson, chief of the division of industrial hygiene and engineering, Department of Labor and Industry of Pennsylvania, Harrisburg, has sent questionnaires to 1500 industrial physicians asking for data. The questions deal with the employment of women in industry due to the war emergency. They cover the matters of physical examination, whether the pay is equal to that of men, hours of employment, uniform, wearing of jewelry, etc.

Further Sign Curtailment Likely in San Francisco.—Restrictions on street signs in San Francisco, which expire Sept. 30, may have to be extended to prohibit their use seven days a week instead of five, according to a recent announcement made by State Power Administrator Butler. The power situation has not improved, according to Mr. Butler, but on the contrary is reaching a more critical stage, and it will probably be necessary to extend rather than modify present restrictions on the use of power.

Bessemer Ferro-Silicon Made Electrically.—Chattanooga has added to its industrial activities the Chattanooga Electro-Metals Company. Although encouraged by the government, it is purely local, being Chattanooga-made to a great extent and financed with Chattanooga capital. It adjoins its sister plant, the Southern Ferro-Alloys Company, of which Mr. Kruesi is also president. The capital stock of the company is given at $200,000, and the personnel is as follows: Paul J. Kruesi, president and treasurer; N. Thayer Montague, first vice-president and secretary; G. L. Davison, second vice-president and manager; Arthur Raymo, general superintendent; D. H. Cowan, assistant superintendent; R. L. Patterson, chemist; H. H. Rushbridge, chief electrician; N. W. Westbrook, assistant secretary. The plant is already in operation. The three transformers have a total rating of 4000 hp. and weigh 21,000 lb. apiece as shipped. Chattanooga's original electric furnace plant, that of the Southern Ferro-Alloys Company, is by far the largest customer of the Chattanooga Railway & Light Company. The new plant is the second largest user of power in or around Chattanooga. Energy will be supplied at 6600 volts, the alloy plants doing their own transforming. The design of the plant was intrusted to the Fitzgerald Laboratories, Niagara Falls, N. Y. The product will be sold by the Fairbanks Morse interests, New York City.

Standardization of Telephone and Telegraph Rates.—Postmaster-General Burleson will order standardization of telephone and telegraph rate schedules throughout the country. David J. Lewis, member of the Postmaster-General's committee directing the government control of wires, will be in charge of both investigations. On the telegraph rate committee with him will be John C. Willever, vice-president of the Western Union Telegraph Company, and Edward Reynolds, general manager of the Postal Telegraph Company. H. B. Thayer, vice-president of the American Telephone & Telegraph Company, and Charles Y. McVey, president of the Ohio Telephone Company, are the committee for the telephone inquiry.

Fuel Administrator Expected to Limit Power Use in California.—Further restrictions in the use of power by industries in California not wholly engaged in the manufacture of war materials will probably be ordered soon, according to recent announcement made by Fuel Administrator Schwabacher. In order to determine the amount of power necessary for the lesser industries, all power companies are to forward to the Fuel Administrator the names and addresses of their customers, together with class of work performed, amount of power consumed by each and the percentages of war materials made. From these data a preferential list will be compiled, and a supply of power will be assured to those industries wholly engaged in war work. Lightless nights will be enforced throughout the state on Monday and Tuesday only, beginning Oct. 1

Securities Must Await Liberty Loan.—The Capital Issues Committee has passed a resolution providing that in view of the paramount importance of meeting the government's financial requirements for war purposes the committee will not pass any application respecting sale or offer for sale of shares or securities during the period from Sept. 15, 1918, until after the close of the fourth Liberty loan campaign, except applications which the committee may regard as urgently necessary. Investment houses, brokers, corporations and others offering the unsold portion of security issues heretofore passed by the Capital Issues Committee are asked to withdraw the same from public offering or solicitation during the period from Oct. 1 to the close of the Liberty loan campaign in order to give the government the right of way. This action is not intended to restrict counter sales or sales of listed securities made in the ordinary course of business on stock exchanges.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Power of Commission.—The Public Service Commission act, being highly remedial, must be liberally construed, the Supreme Court of Missouri held (204 S. W. 497). The ascertainment and establishment of reasonable rates for public service is within the police power of the state. The fixing of reasonable rates for public service may be delegated by the Legislature to the Public Service Commission, subject to court review of the question of reasonableness.

Liability for Injuries Caused by Plant Guard.—Where soldiers, not under the control of defendant, were placed on guard around his power plant in the interest of the general public by the United States military authorities during a warlike situation, to suppress a hostile invasion, which was imminent, and not at defendant's request, defendant was not liable to an employee shot through the negligence of a soldier, although if he were the employer of the soldier he would be liable, the Court of Civil Appeals of Texas held in Sweetman versus Laredo Electric & Railway Company (204 S. W. 701). In action against employer for injuries caused by a soldier guarding defendant's plant, where it clearly appeared that the soldier was not an employee, testimony relevant only to the question of whether the soldier was negligent, if improperly admitted, was not a reversible error.

Power to Fix Price.—The question whether the Public Service Commission has been endowed by statute with the power to adjudge unconstitutional a confiscatory statute fixing a maximum price for gas is not between the gas company and the state, but between the commission and the state, it was held by the Court of Appeals of New York (120 N. E. 132). The Legislature legally could empower the Public Service Commission to fix by order in any given case the maximum price to be charged for gas, not exceeding that fixed by statute. As between the Public Service Commission and the Legislature from which it derives its powers, the commission being empowered to fix a price for gas not in excess of the statutory maximum, it is immaterial that the legislative maximum price is confiscatory, even manifestly confiscatory, of a gas company's property. In view of the laws of 1907 fixing $1 per 1000 cu.ft. as the maximum price of gas in Albany, under the Public Service Commissions law the commission has not power to authorize gas company to charge in Albany a greater price, even if legal price is confiscatory.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

J. P. Powell of Valdosta, Ga., has become manager of the Selma (Ala.) Lighting Company.

Lieut. C. E. Norenberg, formerly of the engineering department of H. M. Byllesby & Company, Chicago, has been commissioned captain.

George Williams, manager of new business of the H. L. Doherty Organization, has been elected a director and vice-president of the Crew Levick Company.

Victor V. Starzenski, assistant general manager of the Schenectady (N. Y.) Illuminating Company, has been commissioned first lieutenant in the chemical warfare service of the army. He left recently for the Edgewood Arsenal, Baltimore. His work there will deal mostly with the manufacture of gases for use in France.

Leonard W. Egan, formerly special engineer with the Wellman-Seaver-Morgan Company, has severed his connection with that concern and has become associated with the Electric Furnace Company, Alliance, Ohio, in a similar capacity. Previous to Mr. Egan's connection with the Wellman-Seaver-Morgan Company, he was for five years electrical engineer of the Pittsburgh Crucible Steel Company, Midland, Pa.

W. B. Miser, manager of the Drumright division of the Oklahoma Gas & Electric Company, has received a commission as captain in the Engineer Corps of the United States Army and will leave shortly for one of the cantonments. Early this year he was appointed chairman for Drumright of the Military Training Camp Association. He went to Drumright about a year ago, having formerly been general superintendent for the Illinois Traction System at Jacksonville, Ill.

Frederick A. De Lay, who has been instructor in the Chicago Central Station Institute of the Commonwealth Edison Company, has resigned to accept a position as assistant superintendent of the Mechanical Appliance Company of Milwaukee. Mr. De Lay has been in the employ of the Insull interests of Chicago six years, having been connected at one time with the engineering department of the Public Service Company of Northern Illinois. He was recently elected as secretary of the Chicago Section of the Illuminating Engineering Society.

Charles B. Youts, who has been connected with the Illinois Northern Utilities Company since 1912, has resigned to become manager of the La Crosse (Wis.) properties of the Wisconsin-Minnesota Light & Power Company. Mr. Youts started with the Illinois Traction System in 1906 as sales manager at Danville, Ind. In 1910 he became new-business manager for the entire system. Two years later he resigned to become general contract agent with the Illinois Northern Utilities Company, Dixon, Ill., which position he has held since then.

G. E. Chapman, who for the last year has been superintendent of Division L of the Public Service Company of Northern Illinois, with headquarters at Lacon, has resigned.

Peter S. Klees, sales manager of the Franklin Electric Manufacturing Company, Hartford, Conn., has just been made vice-president of the company also. Mr. Klees was born in Lebanon, Pa., in January, 1879, and received his early education locally. He entered the electrical industry in the employment of the American Electric Lamp Company of Philadelphia, where he remained until about twelve years ago, when he became connected with the Franklin company as sales manager. He is a very active member of a number of important committees in the lamp industry, besides being a member of several national electric associations. During 1916-17 he was Jovian congressman for New England.

P. S. KLEES

Prof. James Theron Rood has resigned as professor of electrical engineering of Lafayette College, Easton, Pa., to take up the professorship of railway electrical engineering in the department of transportation at the University of Illinois, Urbana, Ill. Professor Rood was graduated from the Worcester (Mass.) Polytechnic Institute in 1898 with the degree of B. S. and received the degree of Ph. D. from Clark University in 1906. He was instructor in physics and mathematics at Ursinus College, 1906-07; instructor in physics and electrical engineering at the University of Alabama, 1907-09, and since 1909 professor of electrical engineering at Lafayette College.

J. A. Schabeck, formerly assistant superintendent of Division O of the Public Service Company of Northern Illinois, has been appointed superintendent of Division L, succeeding G. E. Chapman, resigned.

Edwin Jowett, for many years assistant chief engineer of the Fish and Quarry Street stations, Commonwealth Edison Company, Chicago, and for the past four years chief operating engineer for the Texas Power & Light, the Fort Worth Power & Light and the Dallas Power & Light Companies of Texas, which position he recently resigned, has been appointed superintendent of power plants of the Kansas City Light & Power Company, Kansas City, Mo.

Richard H. Wheeler, who was recently appointed traffic manager of the Hercules Powder Company at the Nitro plant, Nitro, W. Va., is well known in electrical engineering circles. Mr. Wheeler was assistant designing engineer of the electric locomotive department of the General Electric Company in 1911-12. From 1912 to 1915 he was assistant electrical engineer on the electrification of the Mount Royal tunnel and terminal project of the Canadian Northern Railway at Montreal, in charge of designing and building of the electric locomotives, multiple-unit cars, shops, signals, etc. From 1915 to 1917 he was assistant engineer of the Shawinigan Water & Power Company at Montreal. From 1917 to 1918 he was designing engineer with Ford, Bacon & Davis, New York, and from February, 1918, up to the time of his appointment in the Hercules Powder Company, he was assistant manager of the power apparatus department for the Thompson-Starrett Company, construction engineers, building the United States government explosive plant "C."

Charles F. Wallace has withdrawn from the Stone & Webster organization to enter the service of the government in the Emergency Fleet Corporation, with headquarters at Philadelphia. Mr. Wallace was graduated from the Massachusetts Institute of Technology in 1892 and immediately entered the service of Stone & Webster, being stationed in the Boston office. He soon became chief of the engineering department and later was transferred to the Stone & Webster Management Association, where he devoted himself to public utility development and administration, including important hydroelectric projects in the West and South and the supervision of properties in the Southeast and on the Pacific Coast slope. For several years he was a vice-president of the management association, and he has lately been making his headquarters at Dallas, Tex., in the interest of the Stone & Webster properties in that section. As an engineering executive Mr. Wallace attained a high reputation during the development period of the Stone & Webster organization, and in his later administrative work he has had great success.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

RECORD FISCAL YEAR IN ELECTRICAL EXPORTS

For the Twelve Months Ended June 30 Last Electrical Merchandise to the Value of $54,527,570 Was Exported

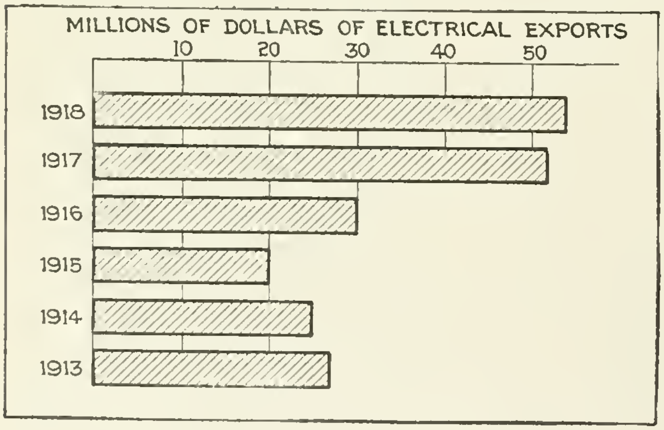
A new record in electrical exports has just been hung up. During the fiscal year of the Department of Commerce $54,527,570 worth of electrical merchandise manufactured in the United States was exported, the largest fiscal year in history. This was less than $1,000,000 under the record calendar year of 1917.

ELECTRICAL EXPORTS OF THE UNITED STATES FOR JUNE AND FOR FISCAL YEAR 1917-1918

Articles	June 1917	June 1918	Twelve Months Ended June 1913	1914	1915	1916	1917	1918
Batteries	$442,846	$272,316		$685,640	$967,146	$1,569,836	$3,009,676	$3,351,838
Carbons	......	117,995		...				1,525,128
Dynamos or generators	277,575	133,549	$2,773,407	2,634,385	2,013,130	1,468,961	2,554,504	2,688,169
Fans	79,580	164,486	358,781	432,656	258,309	356,729	482,652	818,338
Heating and cooking apparatus	....	49,185						533,988
Insulated wire and cables	633,235	340,138		1,992,304	1,911,850	3,157,239	7,192,204	5,716,275
Interior wiring supplies, including fixtures	102,731	138,805		721,069	753,351	818,985	1,123,664	1,532,309
Arc lamps	1,061	90	186,019	76,766	30,984	18,693	15,752	13,308
Carbon-filament lamps	20,949	3,985	228,288	172,064	101,923	144,872	157,413	144,761
Metal-filament lamps	357,275	475,768	394,692	219,439	473,149	1,282,039	2,143,802	3,183,021
Magnetos, spark plugs, etc		167,710						3,167,325
Meters and measuring instruments	84,072	208,294			440,916	776,381	1,039,149	1,592,195
Motors	643,862	521,442	3,797,917	4,541,541	2,819,743	4,218,974	5,889,770	6,598,664
Rheostats and controllers		24,170						212,059
Switches and accessories	...	188,408	....					2,229,023
Telegraph apparatus, including wireless	19,915	11,659	215,105	136,592	76,271	148,536	539,389	294,297
Telephones	283,152	274,809	1,371,546	1,552,951	1,149,361	1,329,346	1,953,504	2,566,929
Transformers	162,180	464,195	...	1,455,343	624,483	993,193	1,265,459	2,235,847
All other	2,472,009	1,462,515	17,447,061	10,440,114	8,152,141	13,972,994	24,536,885	16,123,996
Total	$5,580,442	$5,019,519	$26,772,816	$25,060,844	$19,771,757	$30,256.778	$51,903,823	$54,527,570

The five preceding fiscal years stood as follows: 1913, $26,772,816 (then the record); 1914, $25,060,844; 1915, $19,771,757; 1916, $30,256,778; 1917, $51,903,823.

The accompanying table compiled from reports by the Bureau of Foreign and Domestic Commerce shows to what extent and in what direction the foreign trade has grown. Attention is called to the figures for batteries, which have jumped from $685,640 in 1914, when they were first listed, to $3,351,838 in the last fiscal year. While a considerable part of this increase, of course, is a matter of price, still the demand for batteries by the warring nations, particularly dry cells, has required a large expansion in this trade.



GRAPHICAL REPRESENTATION OF COMPARATIVE ELECTRIC EXPORTS FOR FISCAL YEARS FROM 1813 TO 1918

The value of generator exports is about the same as before the war. It is therefore evident that the volume of business in this line has fallen off. Insulated wire and cable exports have grown greatly since the war began, but there was a perceptible falling off last year. The decrease in volume, however, was probably very slight, if any, owing to the drop in price of wire and the settlement of a government price which holds for allied-country purchases.

Metal-filament lamp exports have grown by leaps and bounds from $394,692, representing 1,363,493 lamps, in 1913 to $3,183,021, or 14,865,899 lamps, in the last fiscal year. Motor exports have about doubled in value in the last six years, but a large part of this of course represents increased prices. The item "all others" fell off apparently last year because certain items formerly included therein have been given a separate classification.

Figures for the month of June are also shown in the table. June last was the second largest electrical export month, December last being the largest by two or three hundred thousand dollars, around 5 per cent. Exports of batteries, insulated wire and cable and of motors were particularly large.

The illustration shows graphically the totals contained in the table.

VERY LITTLE DEMAND FOR POLE ERECTION TOOLS

Ash to Manufacture Handles Is Now More Difficult to Obtain than Steel—Prices Much Higher than Formerly

To determine the market condition of pole erection equipment in so far as demand is concerned is simply to answer the question, "How much new construction work is there going on?" This equipment is seldom purchased except for new construction, and when the construction is completed the equipment is adequate for several years for maintenance purposes. The present financial status of public utilities in general, plus the urgent requests of the government, prohibit any new construction that is not absolutely essential to industry and public welfare.

This answer to the foregoing question bears out the report of manufacturers that there is little demand for such articles as pikes, cant hooks, shovels, spoons, picks, digging bars and "jimmies." Because of the small demand and poor prospects for any immediate need very little stock is being carried. A small quantity of shovels and spoons is kept on hand, but few of the other tools. Although steel is a scarce commodity, it is reported that for the manufacture of pole erection equipment wood for handles is obtainable in still smaller quantities. Steel can be manufactured, but wood has to be grown. A few years ago certain manufacturers of these tools specified and would accept only second-growth ash with straight grain. Later they were requested to and did accept other than second growth, and still later ash with the grain at a slight angle to the axis of the handle had to be accepted. This was followed by the use of maple as well as ash, and at the present time little but maple can be obtained.

In fact, the supply of wood handles for replacement purposes has been particularly short this year. Prices are higher. Hardware jobbers in certain sections report the arrival recently of a fair supply of handles, but generally there is the complaint of insufficient stocks to meet the demand.

All tools are up in price, and those used in the erection of poles are no exception, as they have come in for an advance of from 50 to 75 per cent. Only last week prices advanced 10 to 15 per cent on this line. Delivery of orders in any considerable quantity may be somewhat delayed by the existing conditions.

No curtailment of types has as yet been reported. In other construction and digging lines, however, there has been a marked reduction in the number of types of tools that are being produced.

METAL MARKET SITUATION

Little Change in Prices—Tin Still Unsettled—Very Little Trade

There was little activity in the metal market during last week. Except for a falling off in antimony and a slight rise in spelter, prices have been unchanged. Even the old-metal market was very steady.

The tin situation is still as uncertain as ever. Very little trading is taking place and no trustworthy quotations are available.

The copper market has been greatly disturbed by the I. W. W. strike at the Butte mines. Latest reports, however, indicate that the strike is broken and that the men are mostly back at work again.

Iron and steel manufacturers meet the War Industries Board this week, when permission to charge higher prices for the last quarter of the year will be sought.

NEW YORK METAL MARKET PRICES

	Sept. 10	Sept. 17
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26 00
Casting	Govt. price 26 00	Govt. price 26 00
Wire base	29.25	29 25
Lead, trust price	8.05	8.05
Antimony	14.00	13 87½
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	15.00	15.00
Spelter, spot	9 50	9.85
Tin, Chinese *	No quotations	No quotations
Aluminum, 98 to 99 per cent	Govt. price †33 10	Govt. price †33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	23.50 to 24.50	23.50 to 24 50
Brass, heavy	14 50 to 15.00	14 50 to 15 00
Brass, light	11 50 to 12.25	11.50 to 12.25
Lead, heavy	7 50 to 7.75	7.50 to 7 75
Zinc, old scrap	6 50 to 6.75	6.50 to 6 75

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* No Straits offering. † In 50-ton lots or more; carload, 33 10 cents per lb.; 1-ton to 14-ton lots, 33 20 cents per lb

THE WEEK
IN TRADE

THE announcement by the War Industries Board of its plan for the conservation of building materials has brought such a flood of telegrams regarding buildings under way that it is now announced that all such buildings may be completed and materials may be supplied. On all new buildings, however, where the cost exceeds $2,500 and excepting government projects permits must be procured. Investigation and reports on such new projects will be made by the State Councils of National Defense under arrangements made by Bernard M. Baruch, chairman of the War Industries Board.

Total business continues as large as ever, but distributers are finding it increasingly difficult to obtain supplies of a number of staple wiring products. Prices are again advancing.

Labor conditions are still very unsatisfactory and wages are advancing. The government made it very plain in the case of the Bridgeport strike that its decisions must be carried out. The striking employees have decided to return to work. This and Dr. Garfield's action regarding the coal miners are specially significant.

It is now definitely understood that development work on electrical supplies must wait until the end of the war. Little, of course, has been done in the past three years.

NEW YORK

Government business continues to dominate the local market. Commercial inquiries are becoming fewer as the inability to get material is recognized. Supplies of essential material depend largely on the foresight of the local house in placing orders. Incoming stocks of conduit are disappointingly small. The small-wire output has been greatly reduced by the government's outpost wire needs, which utilize the small-wire machinery.

Prices have advanced on a number of lines since the first of the month, particularly those using cotton to any extent.

All construction work in the state costing $2,500 or more must be referred to the county home defense committees. In this way only necessary construction will be permitted. School buildings were ruled to be unnecessary.

WIRE.—Double braid No. 14 has been advanced slightly in price owing to the high price of cotton. The tremendous order by the government for outpost wire is taking the small-machine capacity so that it is particularly difficult to get wire of No. 8 and smaller.

TAPES.—Cotton tapes are climbing in price almost daily because of the price of cotton. In the past year the advance has been over 50 per cent.

CONDUIT.—Rigid conduit is still becoming scarcer and more difficult to get. Non-metallic is in easy supply and deliveries have been very good. Two weeks ago one manufacturer of non-metallic made an advance of 20 per cent in his product.

ARMORED CABLE.—There was an advance last week by one manufacturer on No. 14 flexible-steel armored conductor.

POLE-LINE HARDWARE.—A 10 per cent advance was made last week in this line.

CONSTRUCTION TOOLS.—Pole-line construction tool prices went up last week from 10 to 15 per cent in the entire line.

INSULATING VARNISHES.—The manufacturers of insulating varnishes and compounds are somewhat disturbed over the failure of the War Industries Board to give their product a place on the new preference list. It is thought that these products were considered simply as varnishes. The producers, it is understood, are planning to present their case to the War Industries Board shortly.

MOTORS.—The demand for small motors has fallen away off in the local market for both new and used apparatus.

CHICAGO

The building situation has been definitely settled by the War Industries Board, and apparently the settlement was much to the liking of the electrical trade. Evidently an order of more drastic character was expected. As the situation now stands, all building under construction will be provided with material for completion. All new building projects will be reviewed by the State Council of Defense, which will report to the War Industries Board on whether or not the work is necessary. All projects reported as necessary will then receive the consideration of the non-war section of the War Industries Board, which will grant or withhold the permit and notify the State Council of Defense at once. If the State Council of Defense decides against the project, it will notify the person concerned. Through this system action on all projects should be prompt.

Building which is now contemplated in this section consists of large groups of industrial residences or factory buildings. Three hundred and fifty industrial houses are to be built at Rock Island, Ill., but there is a question as to whether the material will be bought locally or in Washington. The Wells Brothers Construction Company has been awarded a contract for the erection of 119 industrial houses at Hammond, Ind. George M. Moffett of New York has purchased 62½ acres of land from the Chicago Clearing Land Association at Archer Avenue and Sixty-third Street, Chicago, and will build fifty homes for industrial workers in this manufacturing district within a short time. Work has already been begun on a quarter-million-dollar shop building for the Panhandle division of the Pennsylvania Railroad by Charles B. Johnson & Son, contractors. These proposed jobs indicate the character of work which has come up during the week.

Announcement that Chicago's quota of the fourth Liberty loan is $250,000,000, or $100 per capita, indicates that during the coming month it will probably be necessary for a large section of the industry's man power to spend a considerable time in placing this loan.

Jobbers and manufacturers both report that orders are continuing to come in with less and less sales effort. One manufacturer voiced the belief that business is becoming more settled and that in the coming months "more business will be done with less conversation" than formerly. A few price changes which have been made indicate that the trend is still upward.

Everything that can be used for industrial building is moving out of jobbers' stocks. Wiring devices of all kinds are active. Pole-line material and other stock of this sort are slow.

WIRE.—The wire situation is becoming more difficult from day to day. The demand on smaller sizes is good.

LAMP CORD.—Word has been received that lamp cord has advanced slightly. It still remains on the 34-cent base, but the discount has been changed. Lamp cord is now sold on the same basis as copper, that is to say, it is supplied only for direct or indirect war industries.

CONDUIT.—It still remains a difficult problem to secure enough conduit to meet the industrial demand.

LAMPS.—Contrary to expectations, the announcement that the use of carbon in "gem" lamps would be discontinued has not increased the demand on jobbers' stocks. No effect has been felt. Jobbers report that they will simply refrain from ordering more stocks of these lamps, and this will automatically bring about the cessation of their use.

SCHEDULE MATERIAL.—The statement published in the ELECTRICAL WORLD of Sept. 7, page 469, to the effect that an advance in schedule material was to be expected has proved to be true. Schedule material has advanced between 7 and 8 per cent.

ELECTRIC FANS.—Best estimates place the number of fans which Chicago jobbers are carrying over at 4000. If it had been possible for the jobbers to get larger stocks early in the season, this number would no doubt be greater.

PORCELAIN.—Factories report that the labor situation is becoming more and more severe, and it is expected that the new draft laws will work a still further hardship on this business. The factories are largely working on orders which have come from the East, where interconnection is in progress, or on direct government orders.

BOSTON

Jobbers report a very active week. The tendency toward impoverishment of stocks increases, and deliveries do not show much improvement in general. Collections are fair. Prices show little sign of going lower, and the manufacturers are greatly handicapped for labor. Registration day necessarily interfered somewhat with business, but the patriotic response of the country's man power means so much to the war program in all its aspects that the effect on industry cannot but be beneficial from the standpoint of morale. New England industries are now chiefly concerned with war business and the buyer without a priority number is seriously handicapped. Contracts have been let during the past week for the construction of houses for shipyard workers at Quincy, Mass., and Bath, Me., but the market for schedule material is principally for munitions plant, factory and ship use.

CONDUIT.—Stocks are getting low and the outlook is unsatisfactory. Jobbers who have ordered carefully and with due regard to reporting the ultimate destination of their pipe seem to be in a better position than others. The "non-essential" buyer stands a poor chance of getting conduit at present at any price. Some shipments are coming through from the mills, but in general the supply is far from adequate.

FANS.—The season is practically over and a good many fans will be put away for next spring's business as summer weather was late in arriving and intermittent in duration. Some jobbers "guessed right" on the season and their stocks are nearly exhausted.

RADIATORS.—A fair business is anticipated this fall. Stocks are likely to run short, as things now look. Early deliveries are greatly needed, and the factories are almost certain to be oversold in view of the coal situation.

WASHING MACHINES.—Jobbers and dealers cannot get enough of these machines to fill orders in sight. It looks as though the jobbers would have to devote themselves to meeting the wants of their regular retail distributers, letting new business go for the present. One large Boston house is likely to be limited to a maximum allowance of twenty-five machines a month and is curtailing its sales campaigning.

STORAGE BATTERIES.—Inquiries are numerous, government orders predominating. Prices are firm and the automobile trade is still good, though dealers report a falling off in demand due to the curtailment of Sunday riding.

MOTORS.—Some orders can now be filled from stock. The volume of trade is still large, with firm prices. Deliveries are a little easier.

GENERATORS.—Deliveries are very long and prices high. Only essential orders have the right of way.

LAMPS.—Stocks of standard sizes are growing larger and the outlook is good. Miniature lamps are scarce, a large percentage of the output going into military and naval service. Prices are steady. It is reported that the supply of lamps for Ford cars is now adequate.

FIXTURES.—Stocks are large and jobbers and dealers are not buying from the manufacturers to any great extent. Though business is sub-normal, prices do not reflect it as might be expected.

FARM-LIGHTING SETS.—A price advance of $30 in the ¾-kw. sets and of $100 in the 3-kw. sets made by the Delco company is scheduled for Oct. 1. The farmers are prosperous and business is good. Government orders are also a feature of the market.

ATLANTA

Jobbers and dealers report business as being well sustained, with increases in some lines. The call for material for shipyards is growing more insistent. Miscellaneous supplies to lumber camps show a healthy growth. The demand for all classes of material for this purpose will be much greater as the year advances, owing to government activities requiring great quantities of timber. The Jonathan Starr Company, New York, is reported to have purchased 50,000 acres of timber in North and South Carolina and Georgia. Fifty mills will be established to work up approximately 1,000,000,000 ft. of heavy timber. A great portion of the output will go into railway ties.

The commandant of the Charleston (S. C.) Navy Yard proposes to build a large factory for naval clothing, also a shrinking plant and a storehouse. The type of power plant has not been decided upon as yet.

It was expected that the 150 retail power customers of the Georgia Railway & Power Company would be allowed to use service again beginning Sept. 16. The lack of sufficient rain, however, will not permit the company to supply service to its numerous hydroelectric customers.

The impression left from statements of the War Industries Board regional chairman would indicate that the government intends relaxing its embargo to some extent on building. As a result, the board has been swamped with applications. The Priority Commission rules, however, that buildings now under way may be completed. Repairs and extensions on operations where the materials purchased are less than $2,500 require no priority certificates.

STEAM-FLOW METERS.—The Fuel Administrator's activity to secure greater plant economy has stimulated the demand for flow meters, especially for feed-water measurement. Prices have advanced from 20 to 25 per cent. since Jan. 1. Shipments are very good and fairly prompt to essential industries.

SEATTLE—PORTLAND

Seattle jobbers and dealers report that sales during the past week were well sustained with no marked improvement over the previous week. The flow to shipyards and industrials continues steady, but government buying was a shade lighter. The fluctuation in prices for the past six months has been negligible, and no immediate increase is predicted by local jobbers. The freight situation is growing more serious, with no prospects of improvement, particularly during period of crop movement. Labor conditions are expected to become worse instead of showing improvement as a result of the new registration. However, it is understood that the lumber industry will not suffer as much as expected. Orders for ship timbers, railroad material and various other government and commercial requirements combined last week to set a new record for business accepted by Northwest lumbermen.

At present wire shipments are coming through fairly well, but the demand is heavy. The existing shortage in certain sizes is expected to increase. Stocks of rubber-covered and larger sizes are low. Household appliance demand is holding up well. The sale of washing machines, heavy vacuum cleaners, irons and all labor-saving devices is showing an increased demand as labor shortage becomes more pronounced. Demand for renewable fuses from shipyards and industrials is heavy. The supply is ample. Motor sales are well sustained and all kinds of power apparatus are in demand. No stocks are on hand, this equipment being delivered as ordered. Sales to shipyards are heavy.

Portland territory reports very little activity. During the past week the sales of motors were slow, and this also applies to generating equipment and larger sizes of transformers. Lamp stocks are improved materially with the arrival of heavy shipments, leaving practically no unfilled orders with the exception of miniature sizes. Jobbers report stocks on hand of practically all lines of electrical goods.

Portland jobbers have been requested by manufacturers to refrain from any sales campaign particularly in the line of electric ranges and washing machines and to sell these appliances only where actual need is shown. In other words, these appliances are not to be sold to replace any other type which is serviceable.

A number of substantial additions to present industrial plants in Portland are going on, most of them being extensions of shipyards, foundries and machine shops. Portland has guaranteed the director of transportation and housing, Emergency Fleet Corporation, that 2000 four-room and five-room cottages to be built for accommodation of shipyard workers will be well under way before the first of the year. Seattle's "more homes" campaign is daily gaining momentum, and it is believed that the original objective of 5000 homes will be easily exceeded. Other Puget Sound cities are taking similar steps to solve their own housing problem and are meeting with success.

SAN FRANCISCO

The outstanding feature of the past week has been a considerable rainfall, unexpected and unprecedented, that was eagerly welcomed by some and as earnestly deplored by others. The unfavorable effect has been the ruin of most of the grape and prune crops as well as of all other fruits that were out in trays drying at the time. Many of these firms were under contract with the government, which loaned them a thousand soldiers to assist in certain districts. The favorable effect has been the accumulation of water in depleted reservoirs and the drenching of certain districts where extensive electrical irrigation had been considered necessary, so that electricity may now be diverted to war enterprises. The federal Fuel Commissioner has warned manufacturing firms that present conservation orders must be continued and that the rain simply averted more drastic regulations.

The August building permits, with their approximate values for the three principal cities of this district, San Francisco, Oakland and Los Angeles, were respectively 324 permits with a value of $869,000, 276 valued at $901,000, and 569 of $763,000 value. New construction includes a huge shipyard to be erected by the Parr Terminal Company.

Oakland announces that it has selected a site for the settling of 4000 Mexican families that officials of the United States Shipping Board desire to bring here in connection with shipbuilding work. The United States government will construct a series of buildings to house 3500 students of the Army Training Corps at the University of California. New packing plants at Willows and Pomona and new shops for the Salt Lake Railroad terminal at Los Angeles are also announced.

STREET LIGHTING.—With five lightless nights in northern California and two such nights in southern California and such work as is now being done in Oakland for reducing the size of street lights, no further municipal action on such projects may be expected.

WASHING MACHINES.—For some time past dealers have been expecting increased sales of larger electrical appliances on account of high industrial wages, and evidences of this expectation are developing week by week. Representatives report their inability to get machines in salable sizes. The prices have so increased on account of new freight rates, raw materials and high manufacturing costs that the price on the average family machine is now $132.50 to the consumer.

MOTORS.—There are many inquiries for motors, but as each inquiry is subjected to severe scrutiny on the strength of essential requirements much business is being diverted to motor repair shops. Induction motors recently advanced 10 to 15 per cent. The recent rains that reached sterile districts will no doubt hold up many electrical irrigation projects which have been marked lately by inquiries for motors of from 25 hp. to 100 hp.

WIRE.—The municipality of San Francisco has placed a large order for trolley wire for its industrial municipal railway extension at $33\frac{3}{8}$ cents per pound delivered.

PORCELAIN INSULATORS.—The expected demand for insulators, tubes and cleats of standard house-wiring sizes has not materialized. Authorities predicted that scarcity of conduit would re-establish these items. Porcelain strain insulators have recently decreased in price 10 per cent.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List Per 1000 Ft.
No. 14 solid	$61 00
No. 12 solid	71 00
No. 10 solid	90 00
No. 8 solid	106.00
No. 6 solid	145 00
No. 10 stranded	95 00
No. 8 stranded	115 00
No. 6 stranded	160 00
No. 4 stranded	205 00
No. 2 stranded	266 00
No. 1 stranded	315 00

Twin-Conductor

No. 14 solid	104 00
No. 12 solid	135 00
No. 10 solid	185.00
No. 8 stranded	235 00
No. 6 stranded	370.00
No. 4 stranded	575 00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	12½%—57.25

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	12½%—66.75

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	12½%—97.75

	No. 12 Solid
Less than coil	List
Coil to 1000 ft.	12½%—126 80

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20% to List
Coil to 1000 ft	5% to 15%

	No. 12 Solid
Less than coil	+20% to List
Coil to 1000 ft	5% to 15%

Twin-Conductor

	No. 14 Solid
Less than coil	+5% to $80 00
Coil to 1000 ft	5% to 75.00

	No. 12 Solid
Less than coil	+20% to +5%
Coil to 1000 ft	5%

ATTACHMENT PLUGS

List ranges from $0. 22 to $0 30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	12%
1/5 to std. pkg.	20%
Std. pkg	44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to 12%
1/5 to std. pkg.	List to 20%
Std. pkg	25% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0. 40	$0. 40
12 to 50	.35—.36	.35—.36
50 to barrel	31—.32	32—.33
Barrel lots	.28— 289	29— 299

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 40	$0 40
12 to 50	.35	35
50 to barrel	.319 to .322	329 to 33
Barrel lots	.289 to 292	.299 to .302

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5 00
⅜	250	7 50
½	100	10 00
¾	50	13 00
1	50	21 00
1¼	50	26 00
1½	25–50	35 00
2	25–50	45 00
2½	25–50	52 00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75 00	$63.75— 69.75
⅜-in. double strip	75 00— 82.50	72 00— 75.00
½-in. single strip	100 00	85.00— 93 00
½-in. double strip	100.00—110 00	96 00—100 00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75 00	$63.75 to $64 25
⅜-in. double strip	78 25 to $78.75	71. 25
½-in. single strip	100.00	75.00 to 85.00
½-in. double strip	105 00	93.00 to 95 00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0 05½	1	$0.25
¼	.06	1¼	33
⅜	.09	1½	40
½	.12	1¾	.47
⅝	15	2	55
¾	18	2½	65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	35 00–55 00	24 45–32.00	21 50–29 00
¼-in.—	40 00–60 00	27 00–35.00	23 50–32 00

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$60 00	$30 00	$26.50
¼-in.—	65 00	33 50	29 00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
¼	$0 08½
⅜	.08½
½	08½
¾	11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0.05	$0.19
⅜	06	.19
½	.07	.19
¾	.10	25
1	13	.37
1¼	17	.45
1½	21	.50
2	28	1.10
2½	40	1.80
3	60	4 80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	7% to 12%	9% to 14%
2500 to 5000 lb.	10% to 15%	12% to 17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb.	1.5% to 6 8%	3.5% to 8 8%
2500 to 5000 lb.	4 5 to 10.7%	6.5% to 12.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5.00 to $6.00
Discount	30%

CHICAGO

List price	$6.00 to $7 00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0 25
35-amp to 60-amp.	100	.35
65-amp. to 100-amp	50	.90
110-amp. to 200-amp	25	2 00
225-amp. to 400-amp	25	3 60
450-amp. to 600-amp	10	5 50
600-Volt		
3-amp. to 30-amp	100	$0. 40
35-amp. to 60-amp	100	.60
65-amp. to 100-amp	50	1.50
110-amp. to 200-amp	25	2 50
225-amp. to 400-amp	25	5 50
450-amp. to 600-amp.	10	8 00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	30%
1/5 to std. pkg.	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	30% to 31%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$5.00 to $6.00
1/5 to std. pkg.	4 50 to 5.25

Standard packages, 500. List, each $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$7 00
1/5 to std. pkg.	5.75

Standard packages, 500. List, each, $0.07

LAMPS, MAZDA OR TUNGSTEN

105 *to* 125 *Volts*

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0 30
60-watt—B	100	35
100-watt—B	24	70
75-watt—C	50	70
100-watt—C	24	1 10
200-watt—C	24	2 20
300-watt—C	24	3 25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25	50	53
25-watt—G 25	50	.55
40-watt—G 25	50	55
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30	24	77
Round Bulbs, 4⅜-in., Frosted:		
100-watt—G 35	24	1 10

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$20 20—$35 90
Coil to 1000 ft	26 95— 27 18

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$35 00
Coil to 1000 ft	26 00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24 00

CHICAGO

Net per 100	$21 75 to $30 00

OUTLET BOXES

Nos.	List, Per 100
101—A, A1½, 4 S.C., 6200, 320	$30 00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30 00
103—C.A., 9, 4R, B 1½	25 00
106—F.A., 7, C.S., 1½, 3 R	20 00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10 00 list	25% to 33%	20% to 27%
$10 00 to $50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Glavanized
Less than $10.00 list	30% to 40%	20% to 35%
$10 00 to $50 00 list	40% to 50%	30% to 45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg	20%
Std. pkg	30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$21 00 to $38 00
1/5 to std. pkg.	17 85 to 19 00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$16 80
1/5 to std. pkg.	15 80

Standard package, 2200 List per 1000, $20 00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std Pkg 3500 5½ N C.	Std. Pkg. 4000 Solid Nail-it—N C.
Less than 1/5 std. pkg.	$16 00 to $20 20	$32 00
1/5 to std pkg	13 60 to 15 60	27 20

CHICAGO

Per 1000 Net.	Std Pkg. 3500. 5½ N C	Std Pkg 4000 Solid Nail-it N C.
Less than 1/5 std. pkg.	$11 70 to $24 00	$33 85
1/5 to std. pkg	10 15 to 20 00	26 60

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
¼-in. cap key and push sockets	500	$0 33
¼-in. cap keyless socket	500	30
¼-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std pkg.	+10% to 10%
1/5 to std. pkg.	5% to 8%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List
1/5 std. pkg.	16⅔%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0 80
60-amp. S. P. S. T.	1 20
100-amp. S. P. S. T.	2 25
200-amp. S. P. S. T.	3 48
300-amp. S. P. S. T.	5 34
30-amp. D P. S. T.	1 20
60-amp. D. P. S. T.	1 78
100-amp. D. P. S. T.	3 38
200-amp. D. P. S. T.	5 20
300-amp. D. P. S. T.	8 00
30-amp. 3 P. S. T.	1 80
60-amp. 3 P. S. T.	2 68
100-amp. 3 P. S. T.	5 08
200-amp. 3 P. S. T.	7 80
300-amp. 3 P. S. T.	12 00
Low Grade:	
30-amp. S. P. S. T.	$0 42
60-amp. S. P. S. T.	74
100-amp. S. P. S. T.	1 50
200-amp. S. P. S. T.	2 70
30-amp. D. P. S. T.	68
60-amp. D. P. S. T.	1 22
100-amp. D. P. S. T.	2 50
200-amp. D. P. S. T.	4 50
30-amp. 3 P. S. T.	1 02
60-amp. 3 P. S T.	1 84
100-amp. 3 P. S. T.	3 76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+5% to Net
$10 to $25 list	11% to 15%
$25 to $50 list	14% to 20%

	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16% to 25%
$15 to $50 list	24% to 28%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+15% to +5%
$10 to $25 list	List to 11%
$25 to $50 list	5% to 14%

	Low Grade
Less than $10 list	+5% to 5%
$10 to $25 list	8% to 16%
$25 to $50 list	16% to 24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0 28
5-amp. single-pole, ind	250	32
10-amp. single-pole	100	48
10-amp. single-pole, ind	100	54
5-amp. three-point	100	54
10-amp. three-point	50	76
10-amp., 250-volt, D. P.	100	66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	70
10-amp. double-pole	50	70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+10%
1/5 to std pkg	5% to 8%
Std pkg	23% to 25%

DISCOUNT—CHICAGO

Less than 1/5 std pkg	+20% to 10%
1/5 to std. pkg	List to 16⅔%
Std pkg	25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0 34
No. 160	60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 40%	Net to 30%
$2.00 to $10.00 list	10% to 50%	5% to 40%
$10.00 to $50 00 list	20% to 60%	10% to 52%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2 00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6 00
Discount	30%

CHICAGO

List price	$6 35 to $7 00
Discount	25% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0 434—$0 51
No. 18, full spools	384— 49

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0 65 to $0 69
No. 18, full spools	55 to 575

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15 00–$20.00	$13 00–$15 00	$11 25–$12 00
12	21 29– 27 10	19 35– 23 20	$17 05– 17 42
10	29 70– 37 80	27 00– 32 40	23 75– 24 30
8	41 91– 53 35	38 10– 45 70	33 35– 34 29
6	60 30– 84 40	54 27– 72 35	51 55– 53 05

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft	500 to 2500 Ft.	2500 to 5000 Ft.
14	$21 00–$22 00	$16 00–$22.00	$13 25–$16 50
12	28 70– 29 46	28 70– 29 46	24 50– 25.54
10	40.10– 41 10	40 10– 41 10	34 23– 34 62
8	56 50– 57 90	48 23– 57 90	41 34– 50 18
6	85 31– 91 18	77 84– 85 31	66 72– 72 27

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 *to* 3 *Inc.*

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$37 75 to $38 40
25 to 50 lb	36 40 to 37 75
50 to 100 lb.	32 40 to 36.75

CHICAGO

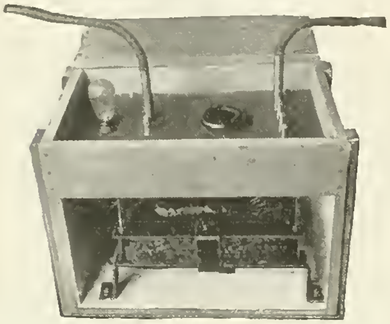
	Per 100 Lb. Net
Less than 25 lb	$37 00 to $39 72
25 to 50 lb	36 00 to 38 72
50 to 100 lb	35 00 to 37 72

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Alternating-Current Electric Welder and Cutter

Economy, efficiency and portability in cutting and welding are claimed for the use of an alternating-current electric arc welder manufactured by the Electric Arc Cutting & Welding Company, 222 Halsey Street, Newark, N. J. The machines manufactured by this company are designed for use with alternating current and consist of a special transformer with no moving parts. It is claimed that this machine will last indefinitely and that it will accomplish as much as, if not more than, the direct-current-type welder. The temperature and the amount of heat at the arc can be varied to suit the proper melting points of nearly all metals.

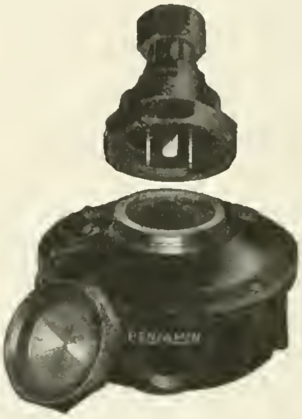


MACHINE MAY BE EASILY LOCATED IN ANY POSITION

The ideal condition for electric arc welding is the absolute control of heat conditions, which is accomplished with this machine, says the maker, automatically and unchangeably for any given setting through the use of an easily moved shunt in the magnetic circuit. This enables the operator to take care of conditions requiring various amounts of heat at varying temperatures. The efficiency of this type of electric arc machine is higher than that secured from any other type of electric cutting and welding machines, because the loss in power wasted is minimum. The weight of this machine complete with all accessories necessary for work is about 200 lb. (181.4 kg.), and two men can easily set it up in any desired location. The over-all dimensions are 2 ft. by 2 ft. by 2 ft. (61 m. by 61 m. by 61 m.). No moving parts are employed, which means there is no maintenance cost. It will operate in any position or location and is designed to meet any power supply. An expensive wiring system is not required because the ordinary power circuit is sufficient. This machine is especially recommended by the maker for use on boiler construction and repairs, ship construction and repairs, locomotive construction and repairs, tank manufacturing and repairs, pipe manufacturing, automobile construction, railroad line work and cutting of shell stock by nicking and kindred uses.

Marine Receptable for Three-Blade Plug

A watertight junction box for a three-blade plug with a screw cap for marine work has recently been placed upon the market by the Benjamin Electric Manufacturing Company, 806 West Washington Boulevard, Chicago, Ill. As shown in the accompanying illustration, the removal of this cap enables the use of a watertight attachment plug for a portable device of any kind on shipboard. The metal parts are all of cast brass and the interior portions are of molded insulating material. The whole apparatus is constructed especially for the stress of marine service.



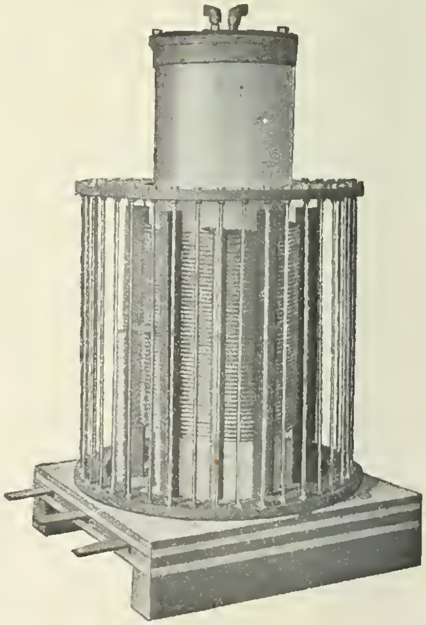
METAL PARTS ARE ALL OF CAST BRASS IN THIS DEVICE

High-Frequency Induction Furnace

A furnace which is a radical departure from the usual furnace design has been developed by Dr. E. F. Northrup, with the aid of facilities afforded by the Palmer physical laboratory of Princeton University for the Ajax Metal Company of Philadelphia. It is primarily intended for the heat treatment of materials where quantity production is contemplated, but as this furnace in small units is also adapted to laboratory and scientific purposes, arrangements have been effected with the Ajax Metal Company whereby furnaces of a rating of 20 kw. and under are manufactured and marketed by the Pyrolectric Instrument Company of Trenton, N. J.

The operation of the furnace depends upon utilizing the powerful inductive effects obtainable by the employment of high-frequency currents. In the furnace now being marketed the high-frequency current is obtainable by the oscillatory discharge of a bank of condensers. By reason of the highly effective induction possible, when using oscillatory currents, it becomes unnecessary, the designers think, to make use of an iron magnetic circuit such as is employed in all other types of induction furnaces. The currents which produce the heating are set up in the walls of the containing crucible or in the melt itself, if this has sufficient conductance to permit the flow of currents. A crucible containing the melt is surrounded by a coil of some fifty to seventy turns of copper wire, which constitutes the inductor winding.

This inductor winding, which carries current of a frequency of from 10,000 to 20,000 cycles, constitutes one of the main features of the furnace.



INDUCTOR COIL INCLOSED IN GROUNDED CAGE AFFORDS PROTECTION

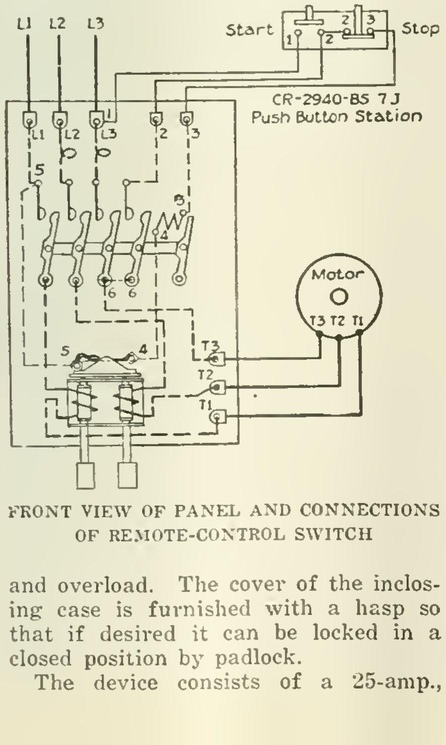
The electrical connections are as follows: A transformer steps the line voltage, which may be 110, 220 or 440 volts, 60 cycles, up to about 8000 volts. The condenser is charged at this high voltage and discharged through a double gap and through an inductor winding, which surrounds the crucible. There is a reactance in shunt with the primary of the transformer which serves the purpose of adjusting the power factor of the supply line to near unity, and there is an adjustable reactance in series with the supply line which regulates, without waste of energy, the input of power. The inductor winding is electrically insulated from the crucible, in the case of a non-vacuum metal melting furnace, by a cylinder of "micanite."

In the illustration there is shown a furnace of the vacuum type adapted to produce melts in a crucible of approximately 6 in. (15 cm.) diameter by 12 in. (30 cm.) high. In a furnace of this construction and these dimensions a temperature of not less than 1600 deg. C (2912 deg. Fahr.) may be obtained with an input of 10 kw. as measured at the switch terminals.

The furnace has been developed for operation on either single-phase or polyphase circuits, and a furnace absorbing as much as 60 kw. has been in successful operation for some time. The Pyrolectric Instrument Company, however, at the present time is marketing single-phase furnaces in the following sizes only: 6 kw., 8 kw., 12 kw., 16 kw., and 20 kw.

Remote-Control Starters For Squirrel-Cage Motors

In order to meet a demand for a device for starting small induction motors from remote points by throwing them directly across the line the General Electric Company, Schenectady, N. Y., has recently developed and placed upon the market such a starter, known as the CR-7006 remote-control switch, arranged for push-button control. This starter is applicable for use with motors up to and including 5 hp., 110 volts, and 7½ hp., 220, 440 and 550 volts. In addition to its starting function it provides protection against under-voltage and overload. The cover of the inclosing case is furnished with a hasp so that if desired it can be locked in a closed position by padlock.



FRONT VIEW OF PANEL AND CONNECTIONS OF REMOTE-CONTROL SWITCH

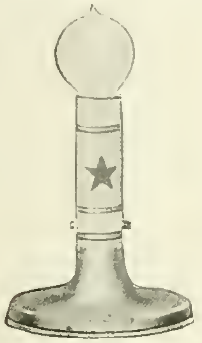
The device consists of a 25-amp., three-pole contactor with two inverse-time-limit gravity-reset overload relays mounted on a slate base totally inclosed in a strong sheet-iron case.

A small "start and stop" push-button station is used as a remote-control switch. Completion of the starting circuit by pressing the "start" button energizes the coil of the magnetically operated switch, which closes the contacts and throws the motor directly on the line. Interruption of the circuit or a radical decrease in voltage permits the contacts to reopen by gravity, thus stopping the motor, which cannot start again until the "start" button is pressed.

The overload relays can be adjusted for various values ranging from normal up to 50 per cent above normal. They can also be adjusted over a wide range of time values. The relay trips automatically and rests by gravity.

Candlesticks with Service Stars

Under the trade name "Service Sticks," the Beardslee Chandelier Manufacturing Company, 216 South Jefferson Street, Chicago, Ill., is now manufacturing four types of red, white, and blue candlesticks decorated with service stars. The different styles are all made of brass metal, four being finished with baked enamel and one with a rose gold finish. They range in height from 9 in. to 13½ in. (22.8 cm. to 34.2 cm.) over all. Linen or silk shades can be supplied with the units. They are sold wired with candles, sockets, plugs and 6 ft. (1.8 m.) of silk cord, but bulbs are not included. These units are designed for the mantel, dressing table, buffet or window of the home.



STEEL METAL CANDLESTICK WITH ROSE GOLD FINISH

Vertical-Arc-Type Electric Furnace

For melting down cold charges for steel-casting foundries, the Booth-Hall Company, 505 West Washington Boulevard, Chicago, Ill., has designed an electric steel furnace of the vertical-arc type with conducting hearth having two main and one auxiliary electrode. This furnace is adapted to give a balanced load on a three-phase circuit, but also built for two-phase or single-phase circuits. The furnace has a solid hearth which becomes conductive of electricity when hot, and the use of an auxiliary electrode which acts as a return for the electric current until the hearth becomes heated and conductive. Two sets of grids embedded in the hearth of the Booth-Hall two-phase electric furnace are electrically insulated from each other and are related to the main electrode so that the currents of the two phases cross in the bath, this giving a maximum of circulation of the molten metal.

With the two-phase electric furnace a minimum of electrode consumption is secured due to the fact that a minimum number of electrodes for a balanced polyphase load is used. This insures fewer electrodes to handle, less electrode breakage and less surface burning. The loss on the auxiliary electrode is small, because it is in operation for such a comparatively short time. The electrode jaws are made so that the electrodes can be gripped or released by turning a handwheel or lever at the side of the furnace, and therefore it is not necessary for the melter to climb on top of the furnace when changing the grip on the electrodes. These jaws are arranged in segments so as to adjust themselves to the inaccuracies in the surface of the electrodes.

The furnace tilts or rocks backward as well as forward, and slagging operations can be handled either from the rear or front. Air is prevented from getting into the furnace and excessive losses of heat are eliminated through the door because it comes flush against the door frame, thus sealing the opening and preventing it from swinging open of its own accord. The main electrodes are arranged for automatic regulation and can be regulated by hand in case the regulators or motors should require repair.

Weather-Proof Snap-Switch Fitting

The Appleton Electric Company of Chicago has designed the fitting shown herewith to meet the demand for absolute water-proof protection for snap switches. The bridge in the fitting permits of mounting any 5-amp. or 10-amp. switch. The fittings are complete with flanged hood, rubber gasket and all necessary fastening screws. Ample room is allowed around the switch handle for convenient use. When a lock switch is desired the switch handle may be removed and replaced with lock attachment. Extension stems are furnished for use with Perkins switches, but stems for the other makes can be furnished if the make is specified.

5-AMP. OR 10-AMP. SWITCH MAY BE MOUNTED ON THIS FITTING

Trade Notes

Government Contracts

The following contracts have been placed by government purchasing officials for electrical supplies and equipment:

HARDWARE AND METALS DIVISION, QUARTERMASTER'S DEPARTMENT.—Aug. 22, Westinghouse Electric & Manufacturing Company, Washington, D. C., motor.

QUARTERMASTER UNITED STATES MARINE CORPS.—Aug. 16, F. H. Stewart Electric Company, Philadelphia, Pa., electrical supplies; Aug. 21 and 22, Western Electric Company, Atlanta, Ga., copper wire, copper conductor, rigid conduit, switchboard.

NAVY DEPARTMENT, BUREAU OF SUPPLIES AND ACCOUNTS.—Aug. 19, Westinghouse Electric & Manufacturing Company, Washington, D. C., motors; R. P. Andrews Paper Company, Washington, D. C., binders; Manhattan Electric Supply Company, New York City, dry cells; Crouse-Hinds Company, New York City, electrical materials; Bailey Electric Supply Company, New York City, electrical materials; Hi Po Waterproof Battery Company, South Norwalk, Conn., dry cells; Bourn Rubber Company, Providence, R. I., electrical insulated wire; Essex Rubber Company, Trenton, N. J., rubber bushings; W. S. Electric Tool Company, Cincinnati, Ohio, electrical grinders. Aug. 20, Ward Leonard Electric Company, Mount Vernon, N. Y., rheostats; General Electric Company, Schenectady,, N. Y., radio materials; J. A. Roebling's Sons Company, Trenton, N. J., electric wire; Western Electric Company, New York City, cable ships' light; Westinghouse Electric & Manufacturing Company, Washington, D. C., powder hoists. Aug. 21, Machine Company of America, Big Rapids, Mich., radio material; General Electric Company, Washington, D. C., logs; Radio Telegraph & Telephone Company, New York City, radio sets; Electric Boat Company, Groton, Mass., batteries.

NEW SOUTH WALES BARS AMERICAN WIRE.—The Fire Underwriters' Association of New South Wales has made the following ruling with regard to American wire. "To enable local firms holding stocks of insulated wire manufactured in the United States of America to dispose of the same, the note to Rule 37, page 2, 1912 Rules, will be deemed in force until Oct. 1, 1918." This means that an embargo is virtually placed on American-made wire in this British colony.

ALL CABLEGRAMS AFTER OCT. 1 TO BE IN PLAIN LANGUAGE.—The Censorship Board has authorized the following announcement: "On and after Oct. 1, 1918, no confirmation of a cablegram shall be allowed to leave the United States, its territories or possessions unless it be in plain language. On and after Nov. 1, 1918, no confirmation of a cablegram shall be allowed to enter the United States, its territories, or possessions unless it be in plain language. It is to be noted that code confirmations will not be passed by postal censorship even when accompanied by what purports to be or actually is a translation thereof."

RULING AGAINST GIVING GRATUITIES.—The Federal Commission has ordered the Dearborn Chemical Company of Chicago to discontinue the practice admitted to have been employed by some of its salesmen of giving gratuities, such as liquor, cigars, meals, entertainments, souvenirs, etc., to employees of its customers and prospective customers with a view to influencing the purchase of supplies. The company, which manufactures boiler compounds, chemicals and preparations for the treatment and preservation of steam boilers, admitted further to have spent money for the entertainment of customers. The company accepted the issuance of the commission's order without presentation of testimony in support of the practice.

GERMAN ELECTRICAL WORKS TO HAVE SWEDISH FACTORY.—The Allgemeine Elektricitäts Gesellschaft, which is one of the largest industrial institutions of Germany, purchased in Malmo, in the south of Sweden, according to a recent report of Consul General Albert Halstead before the war, ground for the purpose of erecting a factory and manufacturing electrical products for the Swedish market, so as to avoid the Swedish tariff. The war necessitated the abandonment of the original plan. Now, according to the *Svensk Handelstidning* of July 28, 1918, a factory is to be erected at a cost of over $2,000,000. Under the Swedish law the company running the factory must be a Swedish concern and subjects of Sweden alone may be officers of the company. The capital will, however, be German.

PROHIBITED FRENCH EXPORTS.—Since the commencement of the war various orders have been issued by the French government imposing prohibitions on the exportation from the country of certain materials. The British Board of Trade *Journal* has just published a complete list of the prohibition orders at present in force in France, from which the following list of electrical goods is taken: "Electrical apparatus materials and parts adapted for use in war, dynamo-electric machines, magnet accumulators and accumulator plates, electric batteries and their elements, telegraphic apparatus, land, submarine, and wireless; carbons and other electrodes for electrical purposes, carbon brushes for dynamos, cables and insulated wire for electrical purposes, ebonite and vulcanized fiber."

CUTTING STANDARD ADVERTISED PRICES DECLARED A FRAUD.—An important decision which may have an effect on the price of electrical goods, and in particular those priced by the manufacturer for retail sale, has just been handed down by Vice-Chancellor Lane of the New Jersey Court in Chancery restraining the Hahne company, a Newark department store, from selling trademarked watches manufactured by Robert H. Ingersoll & Brothers at less than standard advertised prices. The decision is important in its possible bearing upon the interpretation of the Sherman and Clayton anti-trust acts. A practice of selling below the manufacturers' stipulated price was declared by the court to be in effect a fraud upon the public. This fraud the court defines as an intention by the defendant company to sell the watches under price in order to lead the public into believing that all the goods sold in its store were similarly low-priced.

IMPORTANT SWEDISH TELEPHONE AND WIRE MERGER.—*The Affarsvarlden*, a Swedish trade journal, for July 10, 1918, reports the consolidation of the Aktiebolaget L. M. Ericsson & Company and Stockholms Allmänna Telephone Company, stating, according to Consul-General Albert Halstead: "The two Swedish telephone companies have been combined in order to meet expected competition and possible business extensions after the war. The Aktiebolaget L. M. Ericsson & Company mainly manufactures telephone instruments and materials, while the Stockholms Allmänna Telephone Company installs and maintains the wires. The latter company also has concessions for wires in other countries." The Stockholms Allmänna Telephone A. B. recently sold its wires with certain properties to the government, but its factory will continue to manufacture materials for the government for the next five years. It has also recently established a factory for manufacture of cables. Aktiebolaget L. M. Ericsson & Company employs about 1500 men in Stockholm, 3000 in England, America and Austria-Hungary, and under normal conditions 3000 in Russia. Besides telephone materials, it makes electric meters, magnetic spark plugs, etc. Its branch in Russia used to be a great enterprise, that country absorbing the plant's entire output. Its main competitors in Russia are the Germans. The largest branch of the Ericsson company is in England, where it employs 1000 persons, with a market in England and its colonies. However, its export trade is almost closed on account of England's consuming all its output. The Ericsson company's branches in Vienna and Budapest manufacture mostly telephone instruments. Its branch in France is of recent origin and is much hampered on account of the shortage of labor.

THE WESTERN ELECTRIC COMPANY has leased the property at 400 West Fourteenth Street, New York City, having a floor area of 10,000 sq. ft., to provide for extensions.

THE CROUSE-HINDS COMPANY, Syracuse, N. Y., is said to have acquired property adjoining its plant on Wolf Street for the construction of an extension. An addition to the company's works has recently been completed.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., has commenced the erection at its works of a new four-story and basement office building, 34 ft. by 96 ft., to cost about $50,000.

THE AJAX ELECTRIC SPECIALTY COMPANY, St. Louis, recently incorporated, is planning for the early operation of a plant for the manufacture of electric flashlamps, plural plug sockets, and kindred specialties. The company will be located at 1408 Morgan Street.

THE ELECTRICAL SALES COMPANY, 176 Federal Street, Boston, has moved its Chicago office from room 536 to room 1946 in the People's Gas Building. Edward E. Williams is manager of the company's Chicago office. This concern is the sole distributer for Schwarze bells.

THE TORRINGTON COMPANY, National Sweeper Division, is adding Charles J. Blout to its sales department in charge of advertising on Torrington cleaners. Mr. Blout comes from Denver, Col., having previously been associated with sales work of the company in that territory.

THE CHARLES T. TOPPING MACHINERY COMPANY has merged its interest with the Pittsburgh office of the Lakewood Engineering Company, Cleveland, Ohio, manufacturer of "construction plant" and "industrial haulage." The address of this office is 411 Fulton Building.

THE HAYWARD COMPANY, 50 Church Street, New York City, will have in operation at the foundrymen's convention, to be held at Milwaukee in the week beginning Oct. 7, an electric motor bucket. The exhibit, which will include other working models, will be in charge of C. F. Hutchings and H. M. Davison, sales engineers.

THE LIVE WIRE SUPPLY COMPANY, Macomb, Ill., has been awarded a contract to build a transmission line from Dallas City to Blandinsville and Stronghurst, Ill., for the Western Illinois Utilities Company of La Harpe, Ill. The Utilities company will furnish the material for the line, which is 44 miles long. W. I. Savidge is president of the Live Wire Supply Company.

THE NATIONAL MACHINERY & WRECKING COMPANY, 1914-18 Scranton Road, Cleveland, Ohio, which has been in business for the past fifteen years, has been incorporated under the name of the National Power Machinery Company. The company will continue to handle new and used power machinery. A contract has just been let for a new warehouse in addition to the three now in use.

THE BATES EXPANDED STEEL TRUSS COMPANY, 208 South LaSalle Street, Chicago, is distributing about 7000 glass paperweights which bear small pictures of a Bates one-piece steel pole in combination light and traction service. These paperweights are being given to the principal officials and department heads of various utility companies. A. J. Bates, secretary of the Bates Expanded Steel Truss Company, has stated that they will be furnished gratis to utility men who apply for them.

PAUL TAFEL, president of the H. C. Tafel Electric Company of Louisville, left recently for Washington to enter the electrical department of the construction division of the Quartermasters' Corps. Mr. Tafel had been rejected for active military service, but felt he could be of value in the Quartermaster's Corps and therefore tendered his services to Washington for duties there. He is the eighth man from the Tafel Electric Company to enter the service, the others being Lieut. Robert Tafel with the Signal Corps, Frank T. Kent and William Keuhn in the navy, Louis H. Miller and Banks Kincaid with infantry regiments, Arthur Ochs with the Quartermasters' Corps, and Lowery Marks with the artillery.

GEORGE E. PINGREE, managing director of the London Allied Company of the Western Electric Company, has returned to New York. In the absence of Gerard Swope, vice-president and general sales manager, who has been called to Washington on government business, Mr. Pingree will take up that part of his work which has to do with foreign and export business. Mr. Pingree was first employed by the Western Electric Company in 1903, when he started in financial work at Chicago, and for the next three years held various positions in Chicago, Cincinnati and New York, becoming assistant treasurer in 1907. The next year he was made telephone sales manager, and in 1909 he was sent to China as a special agent. That same year he went to London as manager and three or four years later become managing director of the London house. A short time ago Mr. Pingree was appointed by Dr. Addison, Minister of Reconstruction, to serve on the electrical branch of the engineering trade.

Trade Publications

VACUUM CLEANERS.—The Cadillac vacuum cleaner is described in a circular issued by the Clements Manufacturing Company, 601 Fulton Street, Chicago.

RENEWABLE FUSES.—The Volk Manufacturing Company, Westport, Conn., has issued a price list of its ferrule and knife-blade types of renewable fuses.

MOTION-PICTURE PROJECTOR.—"Economical Projection" is the subject of a circular issued by the Nicholas Power Company, Inc., 90 Gold Street, Chicago.

FACTORY BUILDINGS.—The Austin Company, 16112 Euclid Avenue, Cleveland, Ohio, industrial engineer and builder, has issued a bulletin on standard factory buildings.

CONSULTING ENGINEER.—"Building a City" is the title of a four-page circular being distributed by the Westinghouse-Church-Kerr Company, Inc., 37 Wall Street, New York City.

DISCONNECTING HANGERS.—The Thompson Electric Company, 5606 Euclid Avenue, Cleveland, Ohio, has issued a circular entitled "Why Waste the Light Your Lamps Are Producing?"

VACUUM CLEANER.—A new Bissell Cleaner Model D with aluminum frame is described and illustrated in the circular just issued by the F. Bissell Company, 226 Huron Street, Toledo, Ohio.

BELL-RINGING TRANSFORMERS.—The Cumberland Electric Manufacturing Company, Inc., Memphis, Tenn., is distributing a circular describing and illustrating its "Imperial" bell-ringing transformer. This is the light-weight pressed-steel style.

COMPENSATOR FOR MOTION PICTURE PROJECTION.—Type I Form B "Compensarc" for motion picture projection is described and illustrated in a circular, B-3471, being distributed by the General Electric Company, Schenectady, N. Y.

OUTDOOR SUBSTATIONS.—The Delta-Star Electric Company, Chicago, has issued a four-page circular showing several types of construction of its steel-tower outdoor substation. General specifications and material furnished with these tower stations are also given.

COAL CONVEYOR.—John F. Godfrey, Elkhart, Ind., has issued a circular descriptive of his coal conveyor. Standard installations of this conveyor are illustrated in a diagram, and the ease with which coal can be stored or carried to the boiler house is shown.

INDUSTRIAL LIGHTING UNIT.—"Scientific Industrial Illumination" is the title of a thirty-six-page illustrated booklet discussing a new industrial lighting unit which has been placed upon the market by the Holophane Glass Company, Inc., 340 Madison Avenue, New York.

BALL BEARINGS.—Dragon ball bearings are discussed in a bulletin recently issued by the Fafnir Bearing Company, New Britain, Conn. The design, advantages, applicability and quality of these bearings are given in full. Tables of the load-carrying capacity in pounds at various speeds are given for light, medium and heavy series.

LABOR-SAVING TOOLS.—The Independent Pneumatic Tool Company, 600 West Jackson Boulevard, Chicago, has issued a four-page folder which gives an excellent array of complete data on its pneumatic and electric tools. Drills, grinders, hammers and sand rammers are featured. A valuable part of the publication is a complete table of data giving description, capacity, ratings and applications of the different styles and types of drills.

POWER PUMPS.—Vertical triplex power pumps, single and double acting, are described and illustrated in a booklet D-702 issued by the Worthington Pump & Machinery Corporation, 115 Broadway, New York. The pumps are manufactured at the Deane Works, of Holyoke, Mass. The bulletin illustrates very clearly the details of construction of the Deane of Holyoke triplex power pump. The construction and parts of these pumps are explained in detail and the sizes of the various pumps are listed and described.

SAFETY SWITCHES.—Inclosed switches externally operated for safety service are described and listed in a bulletin just issued by the Trumbull Electric Manufacturing Company, Plainville, Conn. The advantages of these switches enumerated are elimination of fire hazard, minimization of danger of electric shock, convenience, saving time and trouble, and that they can be installed in places where an open switch cannot.

HEATING APPLIANCES.—The G-E Division of the Edison Electric Appliance Company, Inc., Chicago, Ill., has issued a catalog describing and illustrating its line of heating appliances. A new air heater manufactured by this company is shown in this bulletin. One department is given on "Ranges Make Possible the Matchless Kitchen" in which several types of ranges are shown. Circulating-water heaters are also illustrated and described.

HYDRAULIC TURBINES.—The Trump Manufacturing Company, Springfield, Ohio, is distributing a booklet describing and illustrating its hydraulic turbines in steel and open flumes. A diagram showing the correct setting of a vertical turbine directly connected to an electric generator is given. The importance of water-power development is discussed and some special types of turbines are illustrated. Several illustrations are given showing the different ways of installing hydraulic turbines.

MARINE LIGHTING AND SIGNALING APPARATUS.—This is a title of a catalog just issued by Benjamin Electric Manufacturing Company, Chicago, Ill. This comprehensive catalog includes marine fittings such as watertight junction boxes, connecting blocks, receptacles, switches and attachment plugs, and marine lighting fixtures, drop fixtures, hand portables and watertight shade holders, and parts for marine devices. Signaling apparatus, such as watertight and non-watertight buzzers, bells, gongs, horns and push buttons, are also listed in one section.

SOLENOIDS.—"C-H Ironclad Solenoids" is the title of a descriptive bulletin, known as Booklet "F," being distributed by the Cutler-Hammer Manufacturing Company of Milwaukee. The booklet describes the construction of these solenoids and points out such advantageous features as the floating plug which gives the solenoid a high sealing pull without objectionable hammer blow, the connecting rod for attachment to the load to be lifted, which eliminates the necessity of accurate alignment, and the absence of excessive side pull on the plunger due to the patented equalized bushing.

PULL SWITCHES.—"War-Time Control of Light" is the title of a four-page envelope folder, known as publication 271, being distributed by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis. This folder points out that energy, copper and coal may be saved by the judicious use of pull switches properly placed, thus permitting lights not needed to be promptly cut out of circuits. "C-H" pull switches have a rating of 6 amp. at 125 volts, which is said to make them of particular value for controlling large groups of lamps, as for instance for indirect lighting units where a switch of only 3-amp. rating would be of insufficient capacity.

ALUMINUM WIRE AND CABLE.—"From the Falls to the Factory" is the title of a treatise on electric power transmission recently published by the British Aluminium Company, Ltd., 109 Queen Victoria Street, London, England. This publication has been designed with special reference to American practice in transmission line engineering. Nevertheless there is no wide divergence in practice in different parts of the world and the bulletin should prove beneficial to any one interested. It is divided into seven parts which are "Transmission Line Design," Conductance and Tenacity of Aluminum," "Tension and Sag Problems," "Spans and Supports," "Aluminum Steel Cables," "Construction and Costs," "Modern Transmission Lines" and "Tables and Data." Under these main heads is discussed the historical side of transmission lines, the preliminary design, voltage, corona losses, standard resistivity of copper and aluminum at 20 deg., tensile strength of aluminum, physical properties of copper and aluminum, working tension, ice and wind loads, safety factors, sags, span length, extra-long spans, extra-long transmission line spans, wood poles, steel towers, properties of steel-core aluminum cables, joining of aluminum cables, effect of temperature on the tension, cost estimates, data for estimating the weights of steel towers, total steel per mile of line of a transmission line. Under the heading of "Modern Transmission Lines" actual installations showing the towers and lines are illustrated and the main essentials produced. The tables in the book give the various dimensions and notes on aluminum cables. The tables on "Minimum Corona Voltages" should prove valuable to anybody interested in the design of transmission cables.

New Incorporations

THE GOFF MANUFACTURING COMPANY of Collingswood, N. J., has been incorporated by O. P. Wheaton and F. H and Howard E. Goff. The company is capitalized at $250,000 and proposes to manufacture electric brakes, etc.

THE NICHOLSON POWER DEVICES COMPANY has filed articles of incorporation with a capital stock of $200,000 under the laws of the State of Delaware. The incorporators are Samuel C. Wood and Arthur M. Brady of Chicago, Ill.

THE RYAN MANUFACTURING COMPANY of New York, N. Y., has been incorporated with a capital stock of $10,000 by W. S. Ryan, D. J. Dowling and C. S. Ashley, 15 John Street, New York, N. Y., to manufacture automatic cut-out switches, etc.

ELLIS & HOWARD, Ltd., of Kitchener, Ont., Can., has been incorporated by Frank O. Ellis, Samuel F. and Walter H. Howard and others. The company is capitalized at $40,000 and proposes to manufacture electrical machinery, equipment, supplies, etc.

BEATTIE McINTYRE, Ltd., of Toronto, Can., has been chartered with a capital stock of $40,000 by John D. McNabb, 141 Browning Avenue; George A. Robinson, Stuart P. Reesor and others. The company proposes to manufacture electrical machinery, equipment, etc.

THE MISSISSIPPI RIVER TRANSPORTATION COMPANY of Augusta, Me., has been incorporated by C. L. Andrews, R. W. Farris and M. E. Hearin of Augusta, Me. The company is capitalized at $3,000,000 and proposes to build and operate all kinds of public works, street railways, water, gas and electric works, etc.

THE U-NEED-IT DRY STORAGE BATTERY COMPANY of New York County, N. Y., has been incorporated with a capital stock of $75,000 to manufacture and deal in dry storage batteries, etc. The incorporators are E. Leighton, A. H. Jacobson, 337 Pelham Road, New Rochelle, and J. J. Friedman, 966 Hoe Avenue, Bronx.

THE MOOREHEAD RADIO CORPORATION has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $1,000,000 to manufacture and deal in electrical and magnetical mechanical contrivances of all kinds. The incorporators are C. L. Rimlinger, F. A. Armstrong and B. A. Spangler of Wilmington.

THE NEW JERSEY MACHINE CORPORATION of Hoboken, N. J., has been incorporated with a capital stock of $50,000 by M. Gailbert of New York, N. Y.; Martin Feybusch of Sea Cliff, N. Y.; J. D. Reifsnyder of Weehawken and W. B. Devoe of Upper Montclair, N. J. The company proposes to manufacture motors, dynamos and other machinery.

THE LANGER WATER-POWER EXTRACTING COMPANY of New York County, N. Y., has been incorporated with a capital stock of $100,000 to manufacture machinery. The incorporators are: T. Roward, 1755 Madison Avenue, New York City; M. Langer, 96 Manhattan Avenue, Jersey City, N. J., and M. Wyner, 1970 Mapes Avenue, Bronx.

THE WILSON WELDING REPAIR COMPANY of New York, N. Y., has been chartered with a capital stock of $50,000 by F. E. Hasler, D. H. Wilson, Jr., and H. F. Bertine, 2 Rector Street, New York City. The company proposes to do a general electric welding business, manufacture welding and cutting machines and deal in motor trucks, engines, foundry and factory supplies.

THE KENMORE MACHINE MANUFACTURING COMPANY of New York, N. Y., has been chartered by E. M. Morrison, 2 Rector Street; F. H. Waring, 6 Church Street, New York, and E. Claus, 15 Sixty-seventh Street, Brooklyn. The company is capitalized at $30,000 and proposes to manufacture machinery, engines, lathes, tools, etc., and to do a general contracting, mechanical and electrical engineering business.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

BOSTON, MASS.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 15 under Proposal 1951 for generating plant, oxygen, hydrogen and electrolytic, at Boston, Mass.

WEST DUDLEY, MASS.—The Burmas Paper Company is planning to enlarge its plant to four times its present capacity. The proposed improvements include the construction of a hydroelectric power plant to develop 500 hp., utilizing all the water power on the Quineaug River at this point. The cost of the plant is estimated at about $50,000.

WORCESTER, MASS—Ground has been broken for the erection of a new plant at Union and Central Streets for the United States Light & Heat Company of Niagara Falls, N. Y.

NORTH SMITHFIELD (WOONSOCKET P. O.), R. I.—Contract has been awarded by the Andrews Mills Company of Branch Village to the C. I. Bigney Construction Company, 898 Westminster St., Providence, for constructing two-story weave shed, 174 ft. by 220 ft.; boiler house, 24 ft. by 36 ft.; power house, 45 ft. by 60 ft., and recreation building, 45 ft. by 75 ft.; also a concrete dam, 80 ft. long by 18 ft. high, across Branch River, to cost about $265,000.

Middle Atlantic States

BROOKLYN, N. Y.—Contract has been awarded by the Columbia Machine Works & Malleable Iron Company, 269 Chestnut Street, to the Austin Company, 217 Broadway, New York City, for the erection of an addition to its plant, 80 ft. by 158 ft., on Euclid Avenue near Atlantic Avenue, to cost about $50,000. The company manufactures armatures and other electrical specialties.

BUFFALO, N. Y.—Contract has been awarded by the Wheat's Ice Cream Company to C. F. Ernst's Sons, 75 Lathrop Street, for the construction of a new power plant at its works on Hoag Avenue.

BUFFALO, N. Y.—The Prest-O-Lite Company of Indianapolis, Ind., it is reported, is preparing plans for the erection of a new plant at Colgate Avenue and Hopkins Street, consisting of four one-story buildings equipped for charging and other work.

BUFFALO, N. Y.—A permit has been filed by the Monarch Knitting Company of Buffalo for the construction of a boiler house, dye house and storehouse, to cost about $22,000. Plans have also been filed by the company for the erection of a two-story boiler plant, to cost about $60,000.

GLENFIELD, N. Y.—Application has been filed with the Public Service Commission by Hirschey & Lewis of Glenfield asking permission to construct an electric light plant in the town of Martinsburg under a franchise granted by the town authorities in August. The petitioners have a hydroelectric plant in Glenfield and also contemplate securing a franchise in the town of Greig.

THIELLS, N. Y.—Bids will be received by Frank A. Vanderlip, president board of managers of Letchworth Village, 7 Wall Street, New York City, until Sept. 27 for construction heating, plumbing and drainage work, completion of attendants' home and completion of Service Building, female group, Letchworth Village, Thiells. Drawings and specifications are on file in the New York office of the Department of Architecture, Room 1224, Woolworth Building, New York City, and the Department of Architecture, Capitol, Albany, where copies may be obtained. Lewis F. Pilcher is state architect.

WATERTOWN, N. Y.—Plans have been completed for the erection of a new municipal electric plant, to be located about 1½ miles from the city limits. A transmission and distribution system is included in the project. The cost of the entire work is estimated at about $300,000. Thomas L. Tomlines, City Bank Building, Syracuse, is engineer.

BAYONNE, N. J.—Contract has been awarded to Harry Alexandre, Inc., 20 West Thirty-fourth Street, New York, N. Y., for the installation of a new floodlighting system in the Constable Hook section, to cost about $18,000.

BLOOMFIELD, N. J.—The General Electric Company, it is reported, will soon ask for bids for the construction of a power house, 90 ft. by 190 ft., at its local works. C. G. Hulth, Watsessing Avenue, Bloomfield, is engineer.

JAMESBURG, N. J.—The Board of Freeholders has awarded the contract for work in connection with improvements in the electric and heating systems at the State Home for Boys to the Underground Specialties Company, 1476 Broadway, New York, N. Y. The cost of the work is estimated at $24,950.

NEWARK, N. J.—Arrangements have been completed for the installation of new electric lamp standards on the series of new safety platforms for trolley stations to be constructed on the recommendation of the Board of Freeholders at Bloomfield Avenue, Bloomfield; Glen Ridge, Springfield and Irvington.

TRENTON, N. J.—Plans have been prepared by the M. M. S. Metal Company, foot of Fall Street, for the reconstruction of its smelting plant, recently destroyed by fire with a loss of about $25,000. The installation of electrically operated machinery, including engine plant, motors, etc., is contemplated.

TRENTON, N. J.—Contract has been awarded by the Department of Public Works to Harry E. Stahl, Goodwill Place, for the construction of a new electrically operated pumping station at the municipal waterworks, to cost about $150,000.

WEEHAWKEN, N. J.—Plans have been prepared for the constuction of a new plant for the Weehawken Tungsten Lamp Company, 50 ft. by 80 ft., to cost about $10,000.

BETHLEHEM, PA. — Permission has been granted the Lehigh Valley Transit Company by the Public Service Commission to make extensions to its lines in certain parts of the city.

MARIETTA, PA.—Preparations are being made by the Pennsylvania Railroad Company, Philadelphia, for the construction of new shops, including engine house, machine shop, car shop, etc., on a site recently acquired in Marietta.

PERRYVILLE, PA.—Contracts have been awarded by the Pennsylvania Railroad Company to the Roberts & Schaefer Company of Chicago, Ill., for the construction of 1000-ton reinforced-concrete electric locomotive coaling and sand plants at Perryville.

PHILADELPHIA, PA.—Plans are being prepared for the erection of two one-story battery houses to be used in connection with two signal towers at the Erie yards of the Philadelphia & Reading Railroad Company.

PHILADELPHIA, PA.—Plans have been filed by the Philadelphia Rapid Transit Company for extensions to its repair shops at Forty-ninth Street and Woodland Avenue, to cost about $45,000.

PHILADELPHIA, PA.—Plans have been prepared by the Philadelphia Electric Company for its proposed electric generating plant at Beach and Palmer Streets, to cost several million dollars. The Stone & Webster Engineering Corporation, 147 Milk Street, Boston, Mass., is engineer.

PITTSBURGH, PA.—Notice has been filed by the West Penn Power Company of a bond issue of $2,223,000, the proceeds to be used for proposed extensions to its plant and system.

RUTHERFORD, PA.—The Philadelphia & Reading Railroad Company is contemplating the construction of a new compressor plant at its local shops.

WILKES-BARRE, PA.—Notice has been filed with the Public Service Commission by the Wilkes-Barre Company of an issue of $200,000 in bonds for extensions and improvements to its system.

RICHMOND, VA.—The Virginia Baking Company contemplates the construction of a new boiler plant, 40 ft. by 75 ft., in connection with rebuilding its works recently destroyed by fire.

YORKTOWN, VA.—Bids are being received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a fuel-oil plant at Yorktown, including boiler plant, heater houses, mechanical and electrical equipment, etc.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning to erect marine hospitals at Baltimore, Md., Savannah, Ga., and New Orleans, La., each consisting of seven or eight buildings, to cost from $200,000 to $250,000 at each city.

WASHINGTON, D. C.—Bids will be received at the General Engineer Depot, United States Army, 1438 U Street, Washington, D. C., until Sept. 24 for furnishing 100 generator switchbeards and accessories, under Proposal 1110. Bids will also be received under Proposal 1108 for 170 carriages for portable searchlights.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Eastern and Western yards, Schedule 5870½—hand portable electric lights; Schedule 5884½—11,000 snap switches; 5886½—distribution panels. San Francisco, Cal., Schedule 5893½—one 7½-hp. motor with control apparatus. Philadelphia, Pa., Schedule 5922½—14 searchlight trucks. Boston, Mass., Schedule 5925½—turbo-generator set. Brooklyn, N. Y., Schedule 5929½—10,000 ft. copper wire, 5946½—One 3-ton electric hoist. South Charleston, Schedule 5942½—two electric cutting machines. Norfolk, Va., Schedule 5947½—searchlights, switchboards and generators. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Until Sept. 30, New London, Conn., Specification 3410—two subcharging stations, estimated cost $20,000. Until Sept. 23, Specification 3370—air compressors for Norfolk, Va., Philadelphia, Pa., New Orleans, La., and Charleston, W. Va., to cost about $210,000. Bids will also soon be asked for turbo-generators under specification 3352—for Indian Head, Md., Charleston, Va., Mare Island, Cal., Hampton Roads, Portsmouth, Norfolk, Va., New Orleans, La., and Philadelphia, Pa., to cost about $950,000. Cape May, N. J., Specification 3422—for fire-alarm system in Wissahickon barracks and hospital, estimated cost $7,000. Application for proposal should designate the specification desired by number.

North Central States

AKRON, OHIO.—The Public Utilities Commission has authorized the Northern Ohio Traction & Light Company to borrow $750,000 from the B. F. Goodrich Company of Akron for the construction of a high-tension transmission line from Canton to Akron, over which energy will be supplied to the Goodrich company from the plant of the Central Power Company at Windsor, W. Va.

ELYRIA, OHIO.—The Lorain County Electric Company of Elyria, which supplies energy to a number of plants engaged in war work, will enlarge its plant. The United States government through the War Industries Board has advanced $400,000 to the company to be used for extensions.

HICKSVILLE, OHIO.—The old electric plant in Hicksville is being dismantled. Under the new contract recently entered into a smaller plant, of sufficient output to maintain the Hicksville branch in case of emergency, will be installed. The North Western Ohio Light Company of Van Wert furnishes electrical service here.

SALEM, OHIO.—Equipping the waterworks pumping station with electrically driven pumps has been recommended to the Council by Service Director Connors. The purchase of a triplex pump, three deep-well pumps and a small motor-driven compressor, all to cost not more than $15,000, is favored by the service director.

SAVANNAH, OHIO.—Bonds to the amount of $10,000 have been voted for the installation of a municipal electric light plant, in Savannah, to replace the one that was destroyed by fire last April.

TOLEDO, OHIO.—A 12,500-kw. turbine at the Water Street plant of the Toledo Railways & Light Company was recently damaged by a short circuit. The loss is estimated at about $10,000.

WHITESBURG, KY.—The Elkhorn-Jellico Coal Company is considering the construction of a power plant on property recently acquired in Whitesburg.

GARY, IND.—A loan of $203,000 has been granted by the United States government to the Gary Street Railway Company and the Gary & Interurban Railroad Company. The appropriation is $170,000 for the Gary railway and $33,000 for the Gary & Interurban company.

INDIANAPOLIS, IND. — Improvements are contemplated to the local shops of the Pennsylvania Railroad at Washington Street and Jefferson Avenue, including addition to machine shops, improvements to blacksmith shop, boiler shop and the installation of an electric traveling crane, etc. The cost is estimated about $8000.

CHICAGO, ILL.—Work has started on construction of the car repair shop for the Pennsylvania lines at Fifty-ninth and Leavitt Streets, to cost about $250,000. The plans provide for the erection of ten buildings, including machine, tin and forge shops.

EAST ST. LOUIS, ILL.—A portion of the building containing the transformers at the Winstanley station of the East St. Louis & Suburban Railway Company was recently damaged by fire, caused by the explosion of an oil switch. Damage to the building is estimated at about $2,500, and the loss of the transformers is estimated at $20,000. New equipment will be purchased at once.

SADORUS, ILL.—Bonds have been voted for the installation of a municipal electric lighting system. The Council has not yet decided whether to install a generating plant or to purchase electricity.

GREEN BAY, WIS.—Plans are being prepared by Armour & Company of Chicago, for the erection of a cold storage warehouse, 75 ft. by 100 ft., at Green Bay.

MILWAUKEE, WIS.—Bonds to the amount of $200,000 are to be allowed the city of Milwaukee to provide funds for work on the municipal lighting system. The work will be carried on in the parts of the city which are now most poorly lighted.

MILWAUKEE, WIS.—Extensions and improvements are contemplated by the National Brake & Electric Company of Milwaukee, involving an expenditure of about $200,000. Plans have been completed for a new shipping and annealing building. Contracts have been awarded for an addition to casting shop, core rooms, etc. Herman J. Esser, architect, 402 Camp Building, is in charge of the work.

BELMONT, IOWA.—Plans have been prepared for the construction of a sugar factory for the Iowa Valley Sugar Company, to cost about $1,000,000.

MAQUOKETA, IOWA.—At an election to be held Sept. 24 the proposal to issue $65,000 in bonds for the installation of a municipal electric lighting plant will be submitted to the voters.

TRURO, IOWA.—The Truro Light & Power Company is reported to be in the market for 15-kw. and 25-kw., three-phase, 60-cycle, 2300-volt generators.

YORKTOWN, IOWA.—The Town Council has called an election to be held Sept. 27 to vote on the proposal to grant a franchise for the installation of an electric lighting system.

NOVINGER, MO.—The Merchants' Light & Power Company, it is reported, will rebuild its power plant, recently destroyed by fire. A 75-hp. Corliss engine will be installed.

ST. LOUIS, MO.—Contract has been awarded by the Laclede Gas Light Company for construction of a one-story munition plant, 200 ft. by 1200 ft., to the Austin Company of Cleveland, Ohio. The cost of the plant is estimated at about $8,000,000.

CLARKSON, NEB.—Bonds to the amount of $26,000 have been voted for the installation of a new power plant. New equipment, including engines, boilers, switchboard, heater, deep-well pump, etc., will be installed. The Henningson Engineering Company of Omaha, Neb., is engineer. O. A. Clarke is city electrician.

OMAHA, NEB.—Plans are being prepared by the Nebraska Power Company for an addition to its condenser house, to cost about $1800.

FRANKFORT, KAN.—Preparations are being made by the Frankfort Light & Power Company for the erection of a transmission line to the large hydroelectric plant at Blue Rapids. The local plant will be maintained for use in emergency. Copper wire for the proposed extension, it is understood, has been purchased.

SCRANTON, KAN.—The City Council is considering securing electrical service from one of the neighboring cities.

Southern States

MOUNT AIRY, N. C.—Contract has been awarded by the City Commissioners for the construction of an electric power plant, including a dam on Ararat River, 3 miles from the city, to cost about $50,000.

WILMINGTON, N. C.—Extensive improvements are contemplated by the Tidewater Power Company for increasing its transportation facilities (double-tracking its car line) between Wilmington and the shipyards and to increase the output of its plant to supply electricity to the Carolina and Liberty shipbuilding plants. About $400,000 will be expended, to be financed by the War Industries Board.

CHARLESTON, S. C.—The Charleston Consolidated Railway & Lighting Company is contemplating enlarging its power plant. The cost is estimated at about $700,000, of which $350,000 will be borrowed through the War Credits Board.

CHARLESTON, S. C.—Plans have been prepared for the construction of a naval clothing factory, replacing the present plant, to manufacture white summer uniforms and regulation underwear for the entire navy at the Charleston Navy Yard, to cost about $825,000. Two main units, under one roof, connected by a covered pasageway, will be erected; one, 400 ft. by 210 ft., section will contain a power plant, shrinking equipment, baling and shipping department, etc.; the other, 330 ft. by 266 ft., will be equipped with sewing machines, sewing tables, mess hall and kitchen, etc. Captain B. C. Bryan is commandant of Charleston Navy Yard.

COLUMBIA, S. C.—Contract has been awarded to Tucker & Laxton of Charlotte, N. C., for electrical work for additional buildings at Field Artillery Replacement Depot at Camp Jackson, at about $300,000. The cost of the buildings is estimated at $11,000,000.

ALBANY, GA.—The Albany Power & Manufacturing Company is planning to double the generating capacity of its plant. The company is now constructing a 4000-hp. hydroelectric plant and has a 70-mile transmission system and is now contemplating making connection with the system of the Columbia (Ala.) Power Company, 70 miles from Albany.

MARSHALLVILLE, GA.—The Big Indian Power Company, recently incorporated with a capital stock of $30,000, will operate a 6-mile transmission system. Equipment, it is understood, has been purchased. Gordon Simmons of Eatonton is engineer. H. A. Murphy, is manager.

TAMPA, FLA.—The Hillsboro Shipbuilding Company, recently organized, is planning to erect a shipbuilding plant to construct ships for the Emergency Fleet Corporation. The plant will be equipped with electrically operated machinery. W. H. Kendrick is vice-president and general manager.

TAMPA, FLA.—The War Department War Department, Washington, D. C., is contemplating the erection of a plant to manufacture phosphorus for screening ship and troop movements during the war, for which investigations are now being made. It is estimated that 26,000 kw. of electrical power will be required to operate the proposed plant.

CHATTANOOGA, TENN.—The Chattanooga Electro-Metals Company, recently incorporated with a capital stock of $200,000, is planning to erect a plant for the manufacture of silicon alloy, using carbon electrodes, consisting of a main building, with two smaller buildings for transformers and automatic electrodes. The proposed plant will have a daily capacity of 18 tons. G. L. Davidson is manager.

SPARKMAN, ARK.—The local electric plant, owned by Edward Hearn, is reported to have been destroyed by fire recently.

FORT PAYNE, ALA.—Bonds to the amount of $6,000 have been voted for the installation of an electric-light plant in Fort Payne.

NATCHEZ, MISS.—The installation of 500 hp. in boilers and other power equipment is reported to be under consideration by the Southern Railway & Light Company.

DUNCAN, OKLA.—Bonds to the amount of $50,000 have been voted for an addition to the power plant at the waterworks, including the installation of two 500,000-gal. per minute electrically operated pumping units. The Benham Engineering Company, Colcord Building, Oklahoma City, has charge of the engineering work.

MUSKOGEE, OKLA.—The Peabody Battery & Starter Company is planning to install additional machinery, to cost about $10,000.

AUSTIN, TEX.—The trustees of the University of Texas are planning to erect an administration building, six barracks, mess hall, all of brick construction, and four hangars in connection with the enlargement of the radio school, to cost about $600,000. Plans have been adopted for additional buildings for the School of Automobile Mechanics. Additional buildings will also probably be erected for the School of Military Aeronautics.

BROWNSVILLE, TEX.—Bonds to the amount of $350,000 have been voted for extensions to the street-lighting system, road and street work, etc.

ORANGE, TEX.—The installation of an electric power plant at its shipyard is reported to be under consideration by the National Shipbuilding Company.

Pacific and Mountain States

BREMERTON, WASH.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 30 (extension of date from Sept. 16) for improvements to power plant at the Puget Sound Navy Yard.

BREMERTON, WASH.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 15, under Schedule 1958, for generating plant, oxygen, hydrogen and electrolytic, at Puget Sound, Wash.

FILLMORE, CAL.—The Ventura Refining Company is contemplating the installation of a large electrically driven pumping plant in connection with extensive improvements to its local plant, to cost about $100,000.

LA HABRA, CAL.—Plans are under consideration by the city of La Habra for the installation of an electric street-lighting system.

LOS ANGELES, CAL.—Plans have been completed by the City Council for the construction of a new electric railway system between Redondo Beach and Torrance, about 4 miles long, to provide transportation for the workers employed in the various shipbuilding and war plants in the vicinity of San Pedro. The cost is estimated at about $100,000.

OAKDALE, CAL.—Plans are under consideration by the Waterford Irrigation District for an issue of $150,000 in bonds to provide funds for the installation of two large pumping plants, to be operated by electricity.

OROVILLE, CAL.—The Board of Trustees has petitioned the State Railroad Commission for an appraisement of the gas plant and pipes and the electric lighting distribution system owned by the Pacific Gas & Electric Company in Oroville. After appraisement has been made an election will be called to vote on a bond issue to take over the plants.

SAN DIEGO, CAL.—Work will begin about Oct. 1, by the United States government on the proposed new marine post on Dutch Flats, San Diego. The initial group, consisting of fourteen buildings, will cost about $1,500,000. The project includes electric lighting plant, waterworks, etc., to cost approximately $600,000.

OATMAN, ARIZ.—The United Eastern Mining Company is reported to be considering the installation of an emergency power plant at Oatman.

CASPER, WYO.—The plant of the Natrona County Electric Company was recently destroyed by fire, causing a loss of about $150,000. This is the second time within ten months that the plant has been destroyed by fire.

Canada

LACOMBE, ALTA.—The installation of an engine at the municipal electric light plant, to cost about $8,000, is under consideration. N. E. Caruthers is manager.

PORTAGE LA PRAIRIE, MAN.—The City Council is planning to erect an electric transmission line to supply electricity to operate the municipal electric plant. The cost is estimated at about $325,000. R. Pride is engineer.

CHIPPEWA, ONT.—The installation of an electric plant, to cost $6,500, in Chippewa is under consideration.

QUEBEC, QUE.—Plans are being prepared by the Quebec Railway, Light & Power Company for the extension of its street-car line along the Beauport Road, from Limoilou to the city limits.

Miscellaneous

SANTA ROSALIA, MEXICO—Preparations, it is reported are being made by the Mexico Northern Power Company of Santa Rosalia to resume construction work on its hydroelectric plant on the Conchos River More than $2,000,000 has been expended in the construction of a dam across the river. The installation of an electric power plant and the erection of electric transmission lines to the different cities and mining districts within a radius of 150 miles of Santa Rosalia will require an additional $3,000,000. Besides the hydroelectric power development and distribution system, it is proposed to reclaim about 200,000 acres of land by irrigation in the valley of the Conchos River.

Record of Electrical Patents

Notes on United States Patents

1,275,572. Electromagnetic Structure; Albion D. T. Libby, East Orange, and Edward J. Tomlinson, Newark, N. J. App. filed Nov. 11, 1916. Especially adapted for use in connection with the operation of a generator used on a variable-speed engine such as is used in auto-vehicles.

1,275,577. Power Plant; Otis K. Luscomb, Allston, Mass. App. filed Dec. 31, 1917. For use in automobiles and other restricted places; applies more particularly to a power plant comprising both mechanical and electrical parts.

1,275,585. Means and Apparatus for Extracting Static Electricity; John H. Morgan and Charles W. Huntley, Holyoke, Mass. App. filed Feb. 25, 1915. Improvements.

1,275,586. System for Charging Car-Lighting Batteries; Thomas L. Mount, New York, N. Y. App. filed June 23, 1917. Provides means that automatically disconnect the battery from the charging mains when it becomes fully charged.

1,275,601. Current-Rectifying Commutator; Frederick W. Reeves, Pittsburgh, Pa. App. filed Aug. 23, 1917. To provide a simple and practical means whereby the assembled bars interlock to prevent displacement of one or more of the bars.

1,275,606. Electric Clock; Thomas Rushton, Tollington Park, London, Eng. App. filed April 18, 1911. An electromagnetic driving and contact mechanism, including a longitudinally movable worm subjected to end pressure, adapted to rotate the clock train, and itself to be rotated by electromagnetic means, and controlling by its longitudinal movement the electric circuit of the apparatus.

1,275,625. Automobile-Light Controller; Howard F. Bucklew, Kingwood, W. Va. App. filed March 16, 1917. To be used upon automobiles in connection with a magneto or generator for supplying electrical current for the headlights.

1,275,631. Device for Transmitting Fluctuations in the Voltage or Current of an Alternating-Current System to Electroresponsive or Magnetically Operated Devices; Prof. Gerardus J. van Swaay, Delft, and Henri I. Keus, Hengelo, Netherlands. App. filed Jan. 23, 1915. Any fluctuations in the voltage of current of an alternating-current system cause considerably stronger fluctuations in the operation of the device.

1,275,657. Electrically Operating Printing Device; Arthur P. Bullock, Cleveland, Ohio. App. filed April 24, 1913. For automatically causing the selection of printing elements according to a predetermined relationship.

1,275,665. Dynamo-Electric Machine; Herman W. Eichbaum, Venice Cal. App. filed June 25, 1917. To provide an electric machine which may be compactly designed and provided with means whereby its capacity may be increased or decreased in a convenient manner.

1,275,687 Electrical Connection and Art of Making the Same; Wilfred D. Hodgson, Akron, Ohio. App. filed May 16, 1917. Cheap and compact, yet durable, reliable and efficient metallic conducting circuits.

1,275,690. Flush Receptacle; Harvey Hubbell, Bridgeport, Conn. App. filed June 17, 1915. To provide a device comprising a body, a top block and a base or adjustment plate which shall be so constructed that the top block may be removed without disturbing the base or adjustment plate.

1,275,691. Means for Leveling and Aligning Face Plates; Harvey Hubbell, Bridgeport, Conn. App. filed Nov. 17, 1915. To provide simple and inexpensive means for leveling the fixtures in the wall pockets and for aligning the face plates without tentative adjustments.

1,275,692. Adjustable Supporting Device for Switches and Receptacles; Harvey Hubbell, Bridgeport, Conn. App. filed June 22, 1917. To provide an adjusting device which is sold with the switch or receptacle, is attached to the outlet box, and provides a rigid support for the switch or receptacle, parallel with the plaster line and without regard to the position of the outlet box.

1,275,693 Convertible Cap for Attachment Plugs; Harvey Hubbell, Bridgeport, Conn. App. filed Dec. 17, 1917. So constructed that one or both of the contact blades may be readily removed and shifted from one position to another.

1,275,703. Convertible Cap for Attachment Plugs; George P. Knapp, Bridgeport, Conn. App. filed Dec. 5, 1917. Provided with floating contact blades adapted to be moved from one position to another without detachment from the body.

1,275,725. Adjuster for Electrical Attachments; William J. Newton, Bridgeport, Conn. App. filed June 22, 1917. To provide an adjusting device intermediate of the switch or receptacle and the outlet box which will provide a rigid support for the switch parallel with the plaster line and without regard to the position of the outlet box.

1,275,726. Surface Toggle Switch; William J. Newton, Bridgeport, Conn. App. filed Aug. 11, 1917. Improves the construction and mode of operation of surface toggle switches.

1,275,766. Combined Electromagnetically and Manually Operable Organ Stop Key; Fred Schoenwolf, Chicago, Ill. App. filed Oct. 6, 1915. Combined structure including a manually operated stop key which may be operated by means of a solenoid electromagnet.

1,275,776. Telephone Transmitter; Johan Skinderviken, Chicago, Ill. App. filed Nov. 7, 1917. Improvements.

1,275,777. Housing for Electrical Appliances; Elda G. Smith and John J. Dossert, Syracuse, N. Y. App. filed June 18, 1914. For housing a telephone jack used in connection with railway cars.

1,275,780. Electric Controller; Edgar A. Spurr, Euclid, Ohio. App. filed June 5, 1914. Motor is automatically brought up to speed in accordance with the current in the motor circuit.

1,275,782. Alternating-Current Rectifier; Charles P. Steinmetz; Schenectady, N. Y. App. filed Aug. 24, 1914. To provide a method of and means for rectifying alternating currents of higher potential than can conveniently be rectified by commercial forms of rectifiers in use at the present time.

1,275,785. Resistance Unit; Harry F. Stratton, Cleveland, Ohio. App. filed Nov. 9, 1915. For motor starting, heating, etc., relating particularly to what is known as unit-type resistance.

1,275,786. Ohm Meter; Harry G. Stuart, Paterson, N. J. App. filed Feb. 24, 1917. Direct-reading.

1,275,796. Electrical Regulator; Allen A. Tirrill, Pittsburgh, Pa. App. filed Oct. 5, 1911. To provide a simple and exceptionally effective regulator of the kind in which the regulation is effected by adjustment of the field excitation of a dynamo-electric machine.

1,275,802. Electric Signaling Apparatus; John J. Ghegan, East Orange, N. J. App. filed Dec. 20, 1916. To substitute the alternating current from a main supply circuit for the local batteries heretofore employed.

1,275,814. Thermal Switch; George Wilkinson, Harrowgate, Eng. App. filed Nov. 24, 1915. For use as thermostats in which the expansion and contraction of mercury or other fluid, due to heat and cold, is employed to "make" and "break" electric circuits.

1,275,811. System of Control; Charles C. Whittaker, Wilkinsburg, Pa. App. filed May 27, 1916. A rheostat of the type which shall embody means independent of the electrolyte for varying the effective resistance of the rheostat under predetermined conditions.

1,275,817. Electromagnetic Switch; J. J. Wood, Fort Wayne, Ind. App. filed Nov. 20, 1914. Will effect the automatic starting of the motor under the control of the motor current.

1,275,820. Incandescent Lamp; Francis M. A. Wybaillie, New York, N. Y. App. filed Jan. 26, 1917. Adapted to be used in series.

1,275,844. Electromagnetic Switch; Eugene R. Carichoff, Schenectady, N. Y. App. filed Sept. 25, 1916. Holds open when the current in a circuit is relatively high and closes when the current drops to a predetermined value.

1,275,845. Electromagnetic Switch; Eugene R. Carichoff, Schenectady, N. Y. App. filed Sept. 25, 1916. To employ a plurality of electromagnetic switches which close successively to cut out sections of resistance from the motor circuit and bring the motor up to speed.

1,275,846. Switch Structure; Frank E. Case, Schenectady, N. Y. App. filed Dec. 14, 1917. Switches may be efficiently and economically assembled or repaired.

1,275,879. Electromagnetic Switch; John Eaton, Schenectady, N. Y. App. filed May 2, 1916. For controlling the circuits of electric motors; applies more particularly to improved means whereby an electric motor may be started and automatically brought up to running speed.

1,275,880. Control System for Electric Motors; John Eaton, Schenectady, N. Y. App. filed May 11, 1915. Provision of means whereby the motor may be started, stopped and generally controlled in a reliable and efficient manner.

1,275,886. Arc-Controlling Means for Vapor Converters; Sidney W. Farnsworth, Pittsburgh, Pa. App. filed Aug. 6, 1915. To provide means that shall maintain arc in a stable condition upon either the anode or the cathode or upon electrodes of both polarities, if so desired.

1,275,901. Magneto Machine; Harry F. Geist, Racine, Wis. App. filed May 20, 1916. Relates to dynamo-electric machines capable of being used for ignition purposes in association with internal combustion engines.

1,275,903. Electric Signaling Apparatus; John J. Ghegan, East Orange, N. J. App. filed April 12, 1917. Will operate on an alternating-current circuit, as, for instance, the sixty-cycle alternating current commonly supplied for lighting and power purposes.

1,275,908. Liquid Rheostat; Arthur J. Hall, Wilkinsburg, Pa. App. filed Feb. 17, 1915. Employed for the purpose of governing the acceleration of railway polyphase induction motors.

1,275,909. Motor-Control System; Jay H. Hall, Cleveland, Ohio. App. filed Dec. 7, 1917. For motors having shunt-wound fields, in which the speed of the motor may be increased or decreased at will by varying the field strength.

1,275,916. Dynamo-Electric Machine; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed June 4, 1915. Machines of the commutator type which are provided with commutating field-magnet windings carried by auxiliary polar projections disposed intermediate the main polar projections for the purpose of improving the commutating conditions during the operation of such machines.

1,275,918. Switch; Edward M. Hewlett, Schenectady, N. Y. App. filed May 9, 1914. For very high voltages.

1,275,919. Disconnecting Switch; Edward M. Hewlett, Schenectady, N. Y. App. filed Dec. 15, 1914. Quick-acting, rugged, easy to operate and positive in its action.

1,275,924. Electric Locomotive; Fred B. Howell, Schenectady, N. Y. App. filed April 20, 1918. To provide an improved universal joint of simple and rugged construction.

1,275,939. Spring Clip for Storage Batteries; Charles H. Kay, Los Angeles, and Charles F. Hartung, Alhambra, Cal. App. filed Dec. 11, 1917. Means for quickly making temporary electrical connections for the purpose of testing.

1,275,940. Starting Apparatus for Internal-Combustion Engines; August Kazenmaier and Eugene Bauer, Stuttgart, Germany. App. filed March 6, 1914. Improvements.

1,275,941. Starting Apparatus for Internal-Combustion Engines; August Kazenmaier and Eugene Bauer, Stuttgart, Germany. App. filed March 6, 1914. For preliminarily rotating a rotatable element.

1,275,945. Switching Device; Benjamin G. Lamme, Pittsburgh, Pa. App. filed Aug. 2, 1913. To provide simple automatic means whereby the switch controlling the polarity of the direct-current line that is supplied from a rotary converter or the like shall always be closed to the correct position, irrespective of the relative polarity of the machine terminals.

1,275,946. High-Reactance Core-Type Transformer; Charles S. Lawson, Pittsburgh, Pa. App. filed April 4, 1916. To secure high internal reactances in order to limit to safe values the currents that may flow through the windings of the transformers when they are subjected to short circuits.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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A War Basis for California Power

ORDINARILY the war-time needs of the nation are best served by reducing the consumption of fuel oil, but in California the order has been reversed and all steam generating plants are now being operated at capacity while water storage is conserved as much as possible. The seriousness of the situation has passed the point where interconnections are directed toward oil economies. In fact, interconnection may now be said to be serving the higher purpose of facilitating the use of more oil; that is, permitting the substitution at certain hours of the day of energy generated by oil for hydroelectric energy that could at some other time be used more effectively. The dominating purpose is securing the maximum of kilowatt-hours whether generated by steam or water power. This unfortunate power shortage, outlined elsewhere in this issue, is one of the natural results of federal legislation adverse to water-power development. Of course, the drought caused the low water, but the fact that there has been no hydroelectric development in years has greatly intensified the low-water crisis.

Lend your money freely. That is easy. Think carefully of what the boys over there risk for country's sake. They are not lenders, they are givers.

Patriots and Slackers

UNTHINKING men do not always appreciate that there are many types of soldiers. The general public recognizes chiefly but one type, the man in uniform directly engaged in the fight. As a result ridicule and abuse have often been heaped on officers and uniformed men doing executive and other work in Washington and elsewhere, and men engaged in highly essential industries but wearing no uniform have been classed as outright slackers. Public enlightenment is greatly needed here. A soldier on the battlefront can of himself do little. He needs weapons of war, food and raiment and a lot of other things to be effective. Immense industries, mines, farms, railway systems, shipyards and docks are necessary to supply these to him, and hosts of men are required to operate these industries. It has been estimated that as many as ten men are needed in non-uniformed service to supply one uniformed man in the trenches. All these are indispensable and are as essential to the national welfare as the soldiers themselves, although the dangers they face are not so great.

Public utilities are essential industries and are classed as such by the authorities. Necessary employees of utilities should therefore claim exemption from military service if within the draft age, and managers should make sure that they do not claim exemption for any man whose services are not absolutely essential to the industry. Oftentimes women can be and ought to be substituted for men. We must win this war, and we need men to do it with; but the war cannot be won if essential industries are not maintained and operated at full blast. This fact should be brought home to the general public by every agency of information so that all will see in the humblest worker engaged in essential war work as true a patriot as the one in uniform.

Make the Liberty bond totals loom large across seas. Those who dared America's righteous wrath will feel its mighty force. Show them where the home folks stand.

Trusting the Jobbers and Dealers

BY THE regulations of the Priorities Division of the War Industries Board, published in our issue of last week, jobbers and retail distributers in the electrical industry are both recognized as an economic necessity and assured of their supplies for essential purposes. Very properly in the national emergency the distributing branch of the industry will be under strong pledges. These correspond to the pledges forthcoming from the manufacturers not only in our industry but also in other industries in a similar position. In sympathy with the preference plans held necessary by the Priorities Division, and patriotically ready to meet war requirements of the nation, the vast network of distributers throughout the country will readily coöperate in carrying out the broad principles as well as the details of the program agreed upon. We believe that the utmost efficiency in the use of distributers' stocks for the purposes determined to be requisite for the public welfare is certain. No other course would be tolerated by the great body of men in the industry.

It is with a fine recognition of the useful place of the distributers that Judge Parker, the Priorities Commissioner, states so unequivocally his finding in the following clear language: "It is in the public interest that all jobbers, wholesalers and resale distributers of and dealers in electrical equipment, apparatus, appliances and supplies should be permitted to maintain reasonable stocks from which government agencies, war industries, contractors and the civilian population may draw to meet essential requirements." What follows in the regulations is amplification and interpretation of the foregoing extract. With the nation keyed to energetic prosecution of the war to victory over the common enemy of free mankind, it would be idle nonsense to let the stocks of electrical materials be unduly large or to let them be devoted in haphazard fashion to any other than essential uses. This has long been recognized and accepted by the industry, and the task of policing will be made easier rather than harder by the exact policy now laid down by the War Industries Board.

It will be remembered by the representatives of the agencies of distribution that they are made in effect trustees, that they continue in business bound morally to enforce the spirit of the government regulations. They will be free to do business as heretofore subject to the limitation which the condition of war imposes. They may well be proud that the War Industries Board depends upon their "experience and patriotism" to assist in "securing an equitable distribution of all products and their application solely to essential uses." They are part of the vast industrial army whose voluntary discipline and mobilization will be of material weight in proving the worth of our democratic government, our capacity for rigid self-discipline. The course which they follow will greatly strengthen their position for after-the-war trade.

Beat back the bloody Hun to his waiting people, taught by our righteous wrath that his Might is only temporal, but Right is eternal.

Applications of Artificial Daylight

WE HAVE often discussed artificial daylight and its properties. While illumination of this sort has been tried and used for some years past, its progress has been rather gradual, and it is of great interest to learn from M. Luckiesh's paper in the current issue how far the new art has really progressed. It has had serious obstacles to overcome, for the loss of efficiency in moderating any illuminant to a daylight value is very considerable, and there neither has been nor is any general consensus of opinion as to the kind of daylight to be approximated. In fact, daylight is a thing so variable that could one see simultaneously sunlight at end of day and the light of the north sky at noon he would be astounded by the difference and filled with wonder that color matching even in real daylight is possible, let alone practicable. Of course, the secret of the matter is that color matching is not color judgment in the abstract but merely color comparison, and that save under unusual conditions this is quite simple, just as is relative pitch in music, though few indeed have a precise judgment of absolute pitch.

Thus it is that colored goods can generally be easily matched by any kind of daylight, the relative lines remaining fairly constant even when the quality of the light varies greatly. On the other hand, as Mr. Luckiesh shows, there are cases in which a color difference is lessened or increased by the quality of the light in a way which is both curious and troublesome. Such differences are more likely to exist in faint and delicate shades than among strong and striking colors. In such work of color comparison the value of artificial daylight is conspicuous, especially because its hue remains constant while natural daylight changes.

The wide variety of uses cited by Mr. Luckiesh for the daylight units is striking evidence of the real need which has been met. There is now and then to be found also use for light deliberately thrown wide of daylight in some particular direction, just as the mercury arc is found convenient in the inspection of certain metal work. At times, too, nearly monochromatic light is of high importance, so that when one comes to consider the whole situation the great desirability of color screens of various kinds is altogether striking. Again, it is useful to have available both artificial daylight and ordinary lamps—for instance, where the true night hue of goods must be shown. Mr. Luckiesh mentions also the ease with which artificial and natural daylight may be mingled, thus averting the trying time of twilight. We are hardly disposed to think, however, that the daylight unit can boast yet an efficiency considerable enough to justify this use in general, since some of the twilight difficulty usually is due to changed direction as much as to varying color, shifting the direction of shadows in a way that is at least temporarily inconvenient and uncomfortable.

Your mobilized dollars go with our splendid men and limitless resources to carry the message that Liberty is triumphant, that freedom lives and evil militarism dies.

The Choice of Induction Motors

THE paper by A. P. Lewis on this subject is written especially from the standpoint of the large user, his data being derived from a plant operating several thousand motors in a wide variety of applications. Nevertheless, the conclusions drawn may well be taken to heart by the small user, since in the last resort the relation of working properties to economy is a matter of kind and not of number. The one thing that is uppermost in the problem is the question of repairs as bearing on the choice of machines. If a motor has to be repaired, one faces not only the cost, which may be small, but the loss of working output, which may be great. Hence Mr. Lewis attaches fundamental importance to the motor repair record, which in effect tells the story of the real reliability of the machine. Repairs may be necessitated by failure of insulation or by failure of bearing. The former commonly implies overheating from one cause or another, the latter improper mechanical installation. Further, motors differ more in their ability to stand misuse in the way of overload than in mechanical sturdiness of bearings, so that the former matter is a subject for greater anxiety than the latter.

The major part of the really small trouble with induction motors lies in a certain maladaptation of the machine to its particular use. Motors are more generally fully loaded to-day than they were earlier in the industry, and they are also rated rather higher up in the heating scale, so that failure of insulation from overheating is by no means uncommon, despite the great improvements that have been made in insulation. Hence every care should be taken that motors shall not be subjected to serious and protracted overload in either steady or intermittent use. They should be inclosed when exposed to much dirt and should be inspected and cleaned to prevent the choking of the ventilating flues. In case of danger from corroding vapors a very rigid system of inclosure will have to be adopted. In this connection extra cost of the machine may be cheerfully borne if this will insure freedom from likelihood of repairs.

Coming to the mechanical end, drives that put unusual strains on the bearings must be shunned, and geared drives which may produce serious vibration require particular attention. The oiling system is a matter of importance, especially when the motors are installed in places inconvenient to get at for inspection. Mr. Lewis has evolved an interesting scheme, based on long experience, for evaluating the various properties of motors. Its main feature is the comparatively small weight given to the electrical characteristics, showing, first, that most motors are nowadays well designed from the electrical standpoint, and, second, that, thanks to the general tendency toward standardization, they do not vary much from a common basis. The mechanical features are not so standardized, and it is in these that the maker is most likely to scamp both material and labor. The small user cannot copy the nicety of Mr. Lewis' classification, but he can at least take some broad limits from it and keep a keen eye out for the mechanical details which are of such importance.

Liberty, the heritage of our forefathers, needs your money to complete the victory, to put the unspeakable Hun where he belongs, to make the world wholesome.

Insulation for High Voltage

SOME exceedingly practical information about the insulation of high-voltage transmission lines was given in these columns recently. The esential point of the matters treated is the undesirability of relying in any measure upon poles and cross-arms for insulation. The porcelain insulator, whether of the pin or suspension type, is provided for the purpose of securing the necessary insulation and should be made under all circumstances adequate to provide this unaided by the rest of the structure. On moderate-voltage lines in dry climate cross-arms and wooden pins may in a measure provide an added factor of safety, but, broadly speaking, no reliance should be placed on them, and the higher the voltage the more danger in so doing. The pole is really neither here nor there in the discussion, the wooden parts affected being chiefly pins and cross-arms. When a season of rains comes on, any leakage over or through the insulators finds its way through the wood and sooner or later chars or "digests" it, the latter when the voltage is so extremely high as to produce discharges through the air. The result is failure of pins or cross-arms. Particular trouble has developed in the case of the pins provided with wooden thimbles at the insulator, a practice once not uncommon.

When metallic pins are used there is still a possibility of burned cross-arms which must be seriously reckoned with, and it has been found very useful to bond together electrically metallic pins or the metallic supports of suspension insulators. This has been usually done by small galvanized-steel cable clamped to the respective bolts. The effect, of course, is to throw the whole insulation strain upon the insulators, where it properly belongs. An interesting test of the efficacy of this device appears in the record obtained from a 70,000-volt line running immediately along a California coast. Here there was an exposure to sea air and moisture as well as to rain. Eighteen miles of the total seventy-five had the suspension insulator unbonded. The rest was carefully bonded. Within less than two weeks three cross-arms had burned off, and an examination of the unbonded section of line showed that every cross-arm was charred at the point of contact with the suspension bolt, and in some cases the bolts holding cross-arms to the pole showed considerable char. Bonds were then installed and the trouble stopped.

Another insulator problem was met in guying poles. California law requires strain insulators to be used in all guys attached to wooden poles. Ordinary strain insulators are not sufficiently reliable electrically, and suspension insulators mean considerable extra expense. The remedy found was a very simple one, that of putting in strong strain insulators of the ordinary type and then grounding the bonding wires at each pole so guyed, thus short-circuiting the strain insulators. It has always been found good practice to replace wood thimbles by lead where it is not considered desirable to provide entirely new pins. Of course, conditions along the California coast, where the salt ocean mist drives in perhaps for a couple of miles, are extremely severe, and doubtless some of the difficulties referred to would not have occurred on inland lines; but they certainly point the moral that an adequate factor of safety in the insulators themselves, irrespective of their mounting, is essential in carrying out high-voltage transmissions.

The Coming Issues

AS MORE men are drawn into army service those who remain at home will be confined more and more to their jobs and will not have the opportunity to study personally how others engaged in similar work are solving their problems. To be of service to these men the ELECTRICAL WORLD will, therefore, as in the past but with greater concentration, devote practically its entire space to the presentation of different engineers' opinions on the pressing problems brought about by the war. Such articles will not only outline the problems that exist and what has been done to solve them but what further investigation is needed to remove the obstacles completely. All engineers are invited to contribute their opinions and accounts of their experiences so that the electrical industry will have the tools with which to cope with its problems. Among subjects which will be discussed are the following: Methods of handling the labor problems; how engineers are getting along with substitutes for scarce materials and apparatus, and how economy of operation is being improved. In the issues which will appear in the immediate future there will be a résumé of industrial electrical applications, information on spot welding, suggestions on how to maintain reliable service in industrial plants, results of studying the conductor heating effect of intermittent loads, ideas on outdoor substation construction, problems connected with storing coal, and information on hydroelectric development.

Speeding Production by Using Graphic Meters

How a Paper Products Company Has Installed an Elaborate System of Circuits in Order to Permit the Management to Check from the Executive Office Any Operation Going on Within the Plant

IN ITS plant at San Francisco, Cal., the National Paper Products Company has spent considerable money to install circuits and graphic metering equipment to check the operations of its machines and men. The machines, which are of the type required to fabricate paper in rolls into paper products such as paper cans, crimped paper novelties and the like, are driven mostly through direct connection by fifty-three motors ranging from 0.5 hp. to 10 hp. in size. Every motor is arranged for connection to the checking circuits. The design of the checking system is such that its control is centralized in the office of the general manager of the plant. No one except this officer of the company knows what combinations of switches will check the different machines, but all of the employees are aware that some machine and its operator are continually under scrutiny.

The need for such a system has been well explained by A. L. Bobrick, the general manager. He said: "The principal object in installing this equipment was to get an absolute record of the running time of our machines and to check up the report sheets turned in by the operators every day. In the paper-converting business there is a great deal of time lost in making changes on the machines, and our big problem is to keep all of our machines running to full capacity at all times, as our profits depend upon the tonnage we can convert per day.

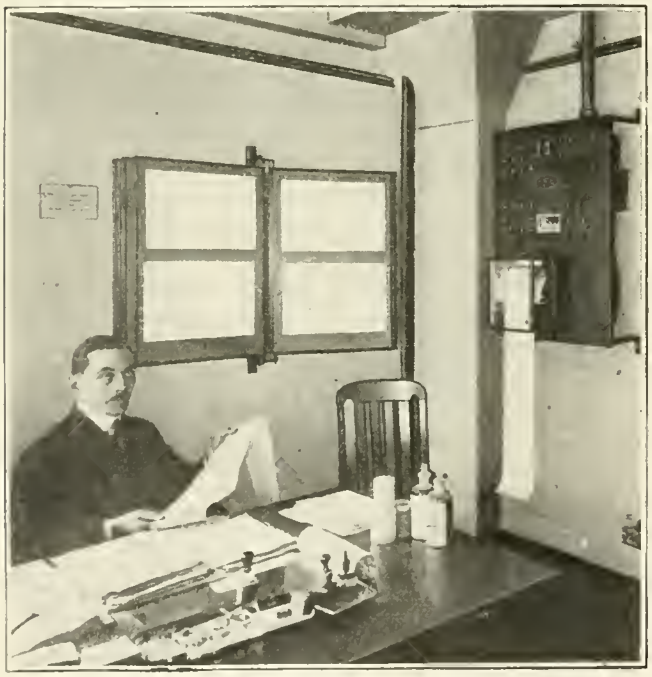


FIG. 1—SWITCHING AND GRAPHIC METERING INSTALLATION INSTALLED IN EXECUTIVE OFFICE TO GIVE DATA ON PRODUCTION

"Every morning at 10 o'clock I have production reports on my desk, showing just what each machine has done for the last twenty-four hours, this report being up to 8 a.m. of that morning. Our meter is always on some machine in the building. I usually take reports of about four machines during the twenty-four hours, and these reports are compared with the production report of the particular machine. If there is any discrepancy, either a mistake of the operator or falsification of the report, it shows up.

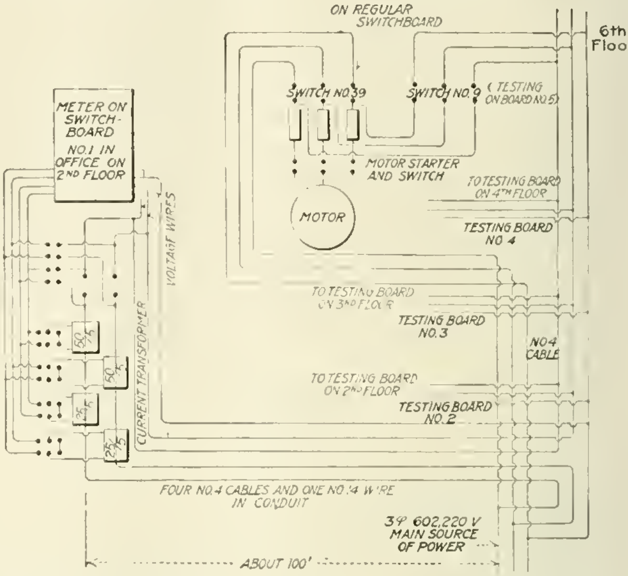

ON REGULAR SWITCHBOARD
6th Floor
SWITCH NO. 39
SWITCH NO. 9 (TESTING ON BOARD NO. 5)
METER ON SWITCH-BOARD NO. 1 IN OFFICE ON 2ND FLOOR
MOTOR STARTER AND SWITCH
MOTOR
TO TESTING BOARD ON 4TH FLOOR
TESTING BOARD NO 4
VOLTAGE WIRES
TO TESTING BOARD ON 3RD FLOOR
TESTING BOARD NO. 3
NO 4 CABLE
50/5
50/5
25/5
25/5
CURRENT TRANSFORMER
TO TESTING BOARD ON 2ND FLOOR
TESTING BOARD NO. 2
FOUR NO. 4 CABLES AND ONE NO. 14 WIRE IN CONDUIT
3Φ 60Σ 220 V MAIN SOURCE OF POWER
ABOUT 100'

FIG. 2—WIRING DIAGRAM SHOWING COMPLETE CONNECTIONS BETWEEN POWER SUPPLY, METER AND ONE MOTOR

"Since most of the operations in the paper-converting industry are cutting and since the machine uses more power during the cut, it is very easy to obtain a clear record showing distinctly each operation."

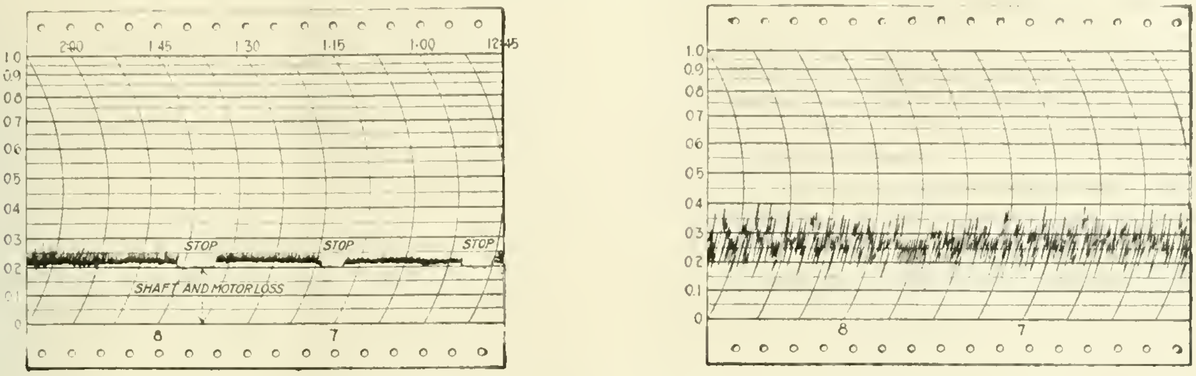
The electric features of the system are of especial interest. The apparatus consists of an Esterline 220-volt, 5-amp polyphase graphic wattmeter with switchboard and circuit arrangements to connect it easily to any motor or group of motors in the plant. This meter, together with two 50/5-amp. current transformers, three 30-amp, single-throw, four-pole, non-fused switches, one single-throw, two-pole, non-fused switch and two 30-amp. fuse clips with two 5-amp. fuses, is mounted on a panel in the executive office. On this panel clips are also provided under two of the switches for short-circuiting the secondary windings of the instrument transformers when they are not in use.

When the plant was originally wired for motor drive, distribution panels were installed on each floor with a knife switch in each motor circuit. Alongside each of these panels an additional panel, also equipped with knife switches of the same size, was installed to carry the checking system equipment. In Fig. 3 the switches numbered 32 to 47 are on the original panel, and those numbered 1 to 12 are on the new board.

The checking system circuits are laid out so that by manipulation of the switches on the office switchboard and on the panelboards on each floor any motor can be taken off its regular supply circuit and transferred to a circuit running through the metering equipment in the office without interrupting the flow of energy to the motor. The method by which this is accomplished can be easily understood by reference to the wiring diagram (Fig. 2), which shows complete connections between the source of power and one motor. This diagram also indicates where similar taps are made for motors on other floors. To keep secret the switching arrangement the knife switches on the panels in the factory are numbered and the number combinations are known only to the general manager. These switches are opened and closed only on his orders. The effect of opening and closing them is to connect certain motors through the office and disconnect the regular supply, as may be seen in Fig. 4 at the switch positions marked 9 and 39.

In actual operation there are two or three methods of using this equipment. First, the meter may be switched on a certain machine and the chart arranged to feed at the rate of 6 in. (15.2 cm.) per hour. This method can be used to check a production record for the machine. Such a chart as that shown in Fig. 3 will then be produced. It clearly indicates the machine stops made by the operator on the 64-in. (162.6-cm.) corrugator, which in this instance was under observation. If a more detailed study of a man's ability to run a machine to its limit is desired, the meter can be set to run at 6 in. (15.2 cm.) per minute. This produces a record like that in Fig. 5 and shows every individual operation. In this case the record was taken on a 0.5-hp., 220-volt, three-phase, 60-cycle motor driving a crimping machine making 4⅞-in. (14.4-cm.) paper cans. Every peak on the chart means one can crimped. The closely grouped and lesser fluctuations show idle time. A third method of operation is to connect through the meter the motors of two or more machines of different horsepower ratings and different characteristics. With this plan a record will be produced which can be interpreted by one with a prior knowledge of the characteristics of the machines. Mr. Bobrick has been able to take intelligible records on four machines at once by this method. This, however, is a possibility that developed after the system was installed, as it was originally intended to give only the records of one machine at a time.

This installation was designed and installed under contract for the National Paper Products Company by C. F. Henderson, Call Building, San Francisco, representative for the Esterline Company of Indianapolis.



FIGS. 3 AND 5—GRAPHIC-METER CHART FROM MOTOR DRIVING LARGE CORRUGATOR, AND TYPE OF RECORD USED TO STUDY AND COMPARE SPEEDS OF OPERATORS

In making the first record the chart speed was 6 in. per hour; with the second it was 6 in. per minute. The chart in Fig. 5 was obtained on a crimping machine for 4⅞-in. paper cans. The input (in kw.) to the 0.5-hp., 220-volt, three-phase, 60-cycle motor driving the machine can be obtained for any instant by multiplying the ordinate by 2. Every deflection means one can crimped.

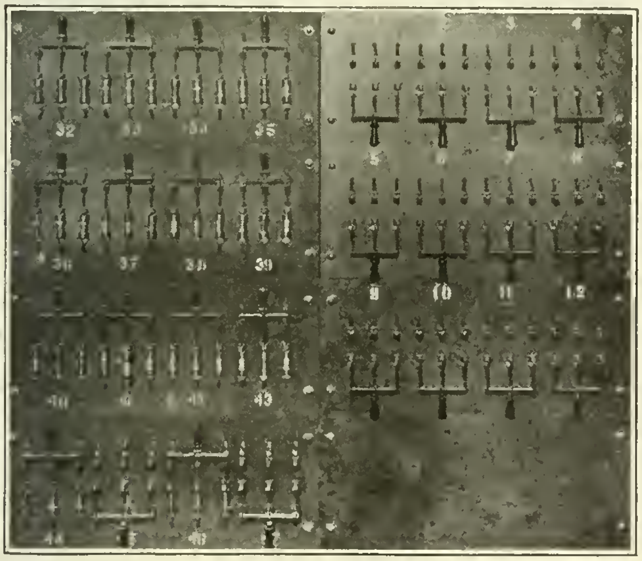


FIG. 4—A SWITCHBOARD OF THIS TYPE IS INSTALLED ON EACH FLOOR OF THE PLANT

Switches for original motor-circuit control on board to left, and additional switches for production system on panel at right.

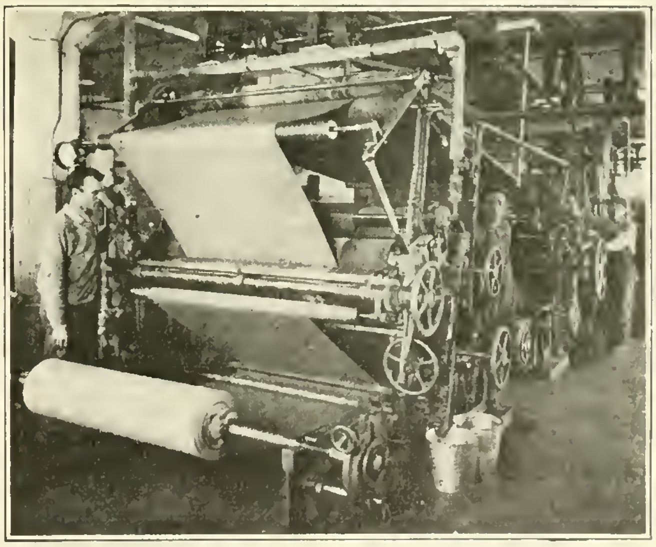


FIG. 6—64-IN. CORRUGATING MACHINE DRIVEN BY A 10-HP., 220-VOLT, THREE-PHASE, 60-CYCLE MOTOR

Economics of Pole Timber

The Life of Poles May Be Practically Doubled by Proper Treating with Preservative—Decay May Also Be Arrested Even When Decomposition Has Reached an Advanced Stage

BY ERNEST F. HARTMAN
President Carbolineum Wood Preserving Company, New York

SINCE we have been at war we are beginning to realize that new conditions must be met. Thrift and economy have become national watchwords, but we seem to have overlooked the ever-present decay of poles at the ground line and annually renew millions of poles still sound and serviceable above the ground.

It is estimated that approximately 40,000,000 poles are in use to-day. Their value in 800,000 miles of lines has been fixed at $400,000,000. As a general average the life of poles has been placed at ten years, making annual renewals cost in the neighborhood of $40,000,000. On the basis of five poles per mile per annum for renewals, the drain on our forests will best explain the increasing cost of pole timber. While the treatment of poles before they are set is always to be recommended, this will not check the increasing consumption until a greater percentage are treated. At present only 25 per cent receive some kind of preservative treatment. Much can be accomplished in the way of more immediate saving by arresting the decay on poles already in service as hereinafter described. Such treatments will be a direct economy, as they save in the cost of poles as well as in the expense of resetting. It may also be taken into consideration that costs for line timber for some time after the war will remain at a very advanced level.

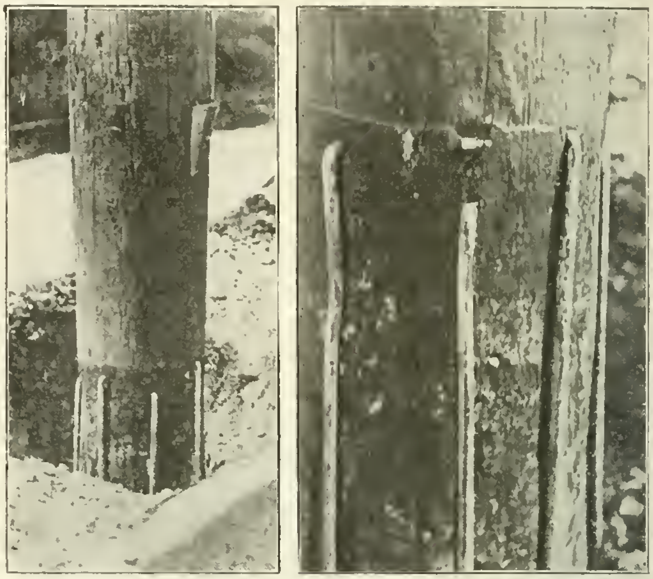
About eight years ago the writer made his first experiments on arresting the decay of standing chestnut poles. An examination just made shows that these poles, whose ground-line circumference was greatly reduced in preparing them for treatment, are still perfectly sound. After making a thorough search of all the literature on pole preservation for data on arresting decay, the desirability of gathering reliable information based on practical experience was realized. Accordingly the methods described represent a correlation of the available experience. It is the object of this discussion to encourage extension of such forms of prolonging the life of poles to the millions actually in use.

TREATMENT OF POLES

The decay of timber can be prevented, retarded and, what is more important, arrested. If the poles are sound at the ground line, no great difficulty will be experienced. In this case it is only a matter of opening up the ground around the poles to a depth of at least 2 ft. (0.6 m.), allowing the poles to dry out and, after cleaning the area to be treated, applying three hot brush coats or sprayings of preservative*, allowing just enough time between coats for the preservative to be absorbed by the wood. Treatment should extend 2 ft. (0.6 m.) above the ground line where the base of the pole is surrounded and shaded by vegetation. After filling in again one may rest assured that from five to eight years have been added to the life of the pole.

If decay has set in, then it becomes a question of the extent to which the pole has been weakened at the ground line. Varying with the extent of the decay one of the following forms of procedure will be found applicable:

When only the sapwood shows decay, open up the ground around poles to a depth of from 2 ft. to 3 ft. (0.6 m. to 0.9 m.), shave away all the decay and allow the poles to dry out. Scrape surface checks clean with a chisel or other sharp instrument. Brush the shaved surface with a flexible wire brush, after which apply three heavy brush coats or a spraying of heated preservative to the part at least 2 ft. (0.6 m.) above and 2 ft. below the ground line, allowing sufficient time between coats for the absorption of the preservative.



POLE WHICH HAS BEEN TREATED AND IS NOW READY FOR REINFORCING WITH CONCRETE

If the decay has gone beyond the sapwood and safety limits are not affected, it is recommended that the shaving away of the decay be followed with a heat treatment. Go over the shaved or scraped area with a plumber's torch and thus make certain that all wood-destroying organisms have been killed. A wire brush should be used to remove any charred wood. Then proceed with the application of preservative as before directed. Fill in with small stone (this will add a year or two to the life of the poles) or fresh ground, not sand. The old ground has in it the germs of decay and should not be used if the full benefits of the treatment are desired. Where poles show considerable checks at the ground line spray applications are preferable to the brush. An added life of five years can easily be secured

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*Where specific directions are given for the application of preservative these apply to the use of "Protexol" (formerly "Avenarius Carbolineum").

Where the length of the pole permits shortening give a thorough three-brush coat or spray treatment with heated preservative to the part that will be in the ground and have the treatment extend well on each side of the proposed ground line; cut off the pole and reset it in a freshly dug hole. The common practice of removing the decayed butt and resetting in the old hole cannot be recommended since the ground about the hole is infected with rot-producing organisms. Where it is necessary or desirable to reset in the old hole the soil may be sterilized with preservative. In sections where crude oil can be obtained cheaply this may be mixed with the ground and tamped well around the pole, thus aiming to secure a waterproof jacket for the pole.

The cost of any of the treatments for arresting decay so far discussed is trifling in comparison with the cost of a new pole, and an increased life of one year will more than pay for the expense.

Boring of holes, sometimes resorted to for poles already set, consists of boring a number of holes ½ in. to 1 in. (1.25 cm. to 2.5 cm.) in diameter and 5 in. to 8 in. (12 cm. to 20 cm.) diagonally downward into the pole about a foot (0.3 m.) above ground and injecting the preservative under pressure or pouring into such holes, renewing the supply of preservative as soon as it has been absorbed by the wood, then finally plugging the hole with a treated plug. This treatment the writer unhestitatingly condemns, since not only is the pole weakened where the greatest strength is desired but the preservative will not diffuse throughout the wood and actually only follows the grain of the wood, while, besides, the added life will not pay for the trouble or cost.

When decay at the ground line is in a fairly advanced stage and poles approach the limit of safety recourse may be had to the use of brush or open-tank-treated stubbing poles or to filling in with concrete.

Using Old Poles or Stubs

The most economical stubbing poles can be secured from scrapped old poles, size permitting. Give them a thorough three-brush treatment taking care to run the preservative into all seasoning checks, or if a tank for treating cross-arms is available, immerse the poles in preservative heated to 180 deg. Fahr. (82 deg. C.) for from fifteen to thirty minutes. Stubbing poles of about the same dimensions as the pole butt are placed in the ground alongside of the pole and should extend from the bottom of the pole to about 3 ft. (0.9 m.) above the ground line. They may be fastened by heavy wire wrappings or by using U-bolts and running at least two straight screw bolts through both poles to hold them permanently together. The value and permanence of the line will frequently determine the best course to pursue. The pole to be so reinforced should be treated as suggested for poles with sapwood decay.

There are a number of patented methods for reinforcing decayed poles with concrete jackets, but in any of them the method of treatment above given for decayed poles should also be used.

An engineer for one of the large electrical systems reports that he has had marked success in treating poles which were originally set in the ground without treatment, and on which slight decay was apparent at the surface of the ground, by digging down 2 ft. (0.6 m.) below the surface, shaving the decayed portion away, giving the pole a brush treatment of preservative extending 12 in. (30 cm.) above the surface of the ground and 18 in. (46 cm.) below the surface, then filling the excavation around the pole with concrete, extending out from the hole 10 in. (25 cm.) in every direction and brought a little above the surface of the ground.

For arresting decay use the preservative heated to 200 deg. Fahr. (93 deg. C.) and apply it hot. The thermal effect thus secured materially aids the effectiveness of the preservative in the destruction of fungi and considerably increases its penetrability. The spray method will permit the treatment to reach all seasoning checks and is therefore preferable to the brush. Since the brush or spray methods will flow only a given amount of preservative upon the surface, it is important that the most permanent preservative be used.

Treatment for at least 2 ft. (0.6 m.) above the ground line is always recommended for country lines, first, to counteract the influence of shading by vegetation which holds the moisture after rains, and, second, to minimize the danger from grass fires. Rotten wood burns like tinder. For treatment of city lines 12 in. (30 cm.) above the ground line is ample. Treatment should be given according to the decayed area (it will vary with the soil); at the very least it should extend 6 in. (15 cm.) above the ground line and 18 in. (46 cm.) below.

The lack of attention to details will frequently determine the difference between success and failure. Every care is necessary to remove all the decay. Then dry out the surface and apply the coatings of preservative carefully.

Supplementary procedure for poles treated when set is also deserving of consideration. The present advanced prices of pole timber make it decidedly important that the greatest life be obtained from the poles now in use. It will be readily apparent that, regardless of the treatment originally given, moisture conditions at and near the ground line make desirable a renewal of the supply of the preservative at that point according to the severity of the conditions in each line.

More than half of the decay on treated poles is caused through the opening up of seasoning checks, exposing untreated wood to fungus attack. A thorough spray treatment can easily be given to such seasoning checks at the time of applying a supplementary treatment, and a very material increase in the life of poles will result.

A case that recently came to attention concerned a line that was rerouted and on which green brush-treated poles had been used. The engineer who inspected this line reported in March, 1918, that the poles were in remarkably good condition, practically no decay at the ground being apparent. This line had been in place about nine years. The superintendent who was present at the inspection estimated that the life of the poles had been doubled by the treatment. A saving of $2,500 on a mile of line for poles is no small matter. A supplementary treatment for poles treated when set at, say, five-year periods will indefinitely retard decay.

That a material saving can be affected from the adoption of a definite policy of arresting the decay of poles is evident. It is certainly conservative to estimate an added life of from five to ten years. Doubling the life of poles will cut the pole bill in half and reduce maintenance charges, and by decreased consumption of poles their cost will be kept down.

Low Over-All Cost and Continuous Production

Factors That Must Be Taken Into Consideration in Purchasing, Installing and Maintaining Induction Motors Designed to Assist in the Accomplishment of These Important Objects

BY A. P. LEWIS*
General Devices & Fittings Company

REFINEMENTS hitherto unthought of in industrial engineering are becoming more and more justified to-day as material and labor costs continue to rise because of the abnormal conditions. Many, if not most, of the large industrial concerns of the country are engaged in the direct or indirect production of war necessities. Hence maximum output is paramount, but coupled with it are the prime requisites of lowest over-all costs and continuous productive facility. These spell economy; in fact, that word has become a slogan of the day. Inasmuch as induction motors play an all-important part in our industries to-day, some suggested methods of purchase and installation will be given.

THINGS TO CONSIDER IN PURCHASING MOTORS

It will be observed at a glance that the scheme hereinafter described applies principally to the large users, but its adoption by engineers of the smaller plants will result in greater over-all economy of operation, though in a smaller way.

Certain assumptions will be made, in order to draw conclusions therefrom, and these can be varied to suit plants with any other status than that here considered. It will be taken for granted that it has been found advantageous to have a yearly contract for the purchase of motors, first, to benefit by a reduction in the price thereby given, and second, because the manufacturers will, under contract, hold for subsequent orders a small stock of motors in recurrent sizes—both features which are highly desirable to-day.

The next step in the usual procedure would be to get prices, characteristics, etc.; weigh one against the other and close the business with the logical manufacturer. This method will not, however, result in obtaining motors sure to fill requirements peculiar to existing conditions. So the commercial side of the problem will be passed by, for the minute, and the behavior of the apparatus already in use will be investigated.

In the electrical engineer's office of the plant involved access can be had to his "motor repair record," a card index giving the repairs required on each motor in the plant and extending over a period of years. The assembly of this data might be made as shown in Table I. This shows at a glance in the hypothetical plant of 800-odd motors where trouble is occurring in the motors and the proportion of each kind. A study of this record, which is an excellent criterion of future trouble, should certainly enable one to dissect a motor and see what particular manufacturer is turning out a machine which will reduce repairs to a minimum.

Fundamentally, the induction motor may be divided into its mechanical and electrical characteristics, the former, in this discussion, to include both mechanical repairs and those incidental to insulation trouble, and the latter only the value of electrical design. By a rather extended operation considering capital investment, cost of power, etc., an approximate figure can be obtained for the latter which permits the assumption that the values of these two divisions stand in the ratio of 90 per cent and 10 per cent.

Proceeding further with the subdivision of these two considerations, a final percentage weight list may be made up and percentages assigned as shown in Table II, column A. This column is arrived at by reference to the "repair record" and also by consideration of local plant requirements, such as difficulty of belt drives, dirty surroundings, vapors or acids present, any established duty cycle affecting temperature rating, starting conditions, value of power factor or efficiency predominant, etc.

TABLE I—SUMMARY OF MOTOR REPAIR REPORTS

Period January, 1916, to January, 1918, Number of Motors in Use About 850

Low Bearing	Dirty	Shorted Coils	Open Rotor	Rewound	Worn-Out Shaft	Grounded	Open Stator	Loose Rotor	Miscellaneous
120	12	1		11	5	...	...	...	...
4	36	...	...		...	...	...	...	...
1		25		3	...	...	...	...	...
3	...	1	20	1	...	...	...	...	...
	...	...		3	...	...	...	...	...
3	...			...	9	...	...	...	...
1	...	2	1	...		8	...	...	...
1	...	...	...	...	...	...	5	...	...
	...	...	...	...	...	...	...	3	...
	...			...	...	...		...	5
133	48	29	21	19	14	8	5	3	5
Per Cent									
47	17	10	7	6	5	3	2	1	2

Other points may be more important in certain plants. For the purpose of this discussion a plant will be considered with the following features desired or present. Continuity of operation (essential), cost of power low, a rebate given on purchased power for good power factor, dirt present in surroundings with high specific heat and causing a cutting action on bearings, difficult belt drives, variable load characteristics but no duty cycle, overload capacity necessary and severe starting duty.

The next step is to obtain complete data, from the manufacturers to be considered, on a line of motors within the ranges considered, with stock samples of several sizes. By inspection, averaging dimensions, weights and characteristics, each item of the competitive makes can have assigned to it its relative portion of the whole percentage of the item considered. For example, as bearing bushing construction carries a value of 12 per cent, the manufacturer whose design is best, all things considered, obtains full 12 per cent. The others fall below in direct ratio as determined by careful study. Proceeding in this way with all items and totaling each manufacturer's column, a result will be obtained which should show, all things considered, the motors which fill the requirements best.

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*Formerly electrical engineer of large industrial plant.

The cost of the machines has been intentionally left out of the tabulation, because the difference in price of standard motors to-day is small in comparison with repair expense, which may be of the order of 50 per cent of the first cost. Engineers may well insist in this case that over-all economy is established by the reductions of repairs, particularly where it is considered that a repair charge on a motor costing less money than another could be taken as a carrying charge on the higher-priced machine. For example, if the repairs, as shown in the record (Table I), cost $7,500, and these could have been reduced 50 per cent by paying $20 apiece more for the motors and obtaining a better design, it is evident that there would be available $3,775 to cover interest charges on the extra investment of $17,000. At current interest rates the extra investment would have earned roughly 15 per cent. These figures are not exact and only exemplify the possibility of saving considerable amounts by judiciously purchasing motors to fill a required service.

TABLE II—PERCENTAGE WEIGHTS OF MOTOR CHARACTERISTICS WITH MANUFACTURER'S RATINGS

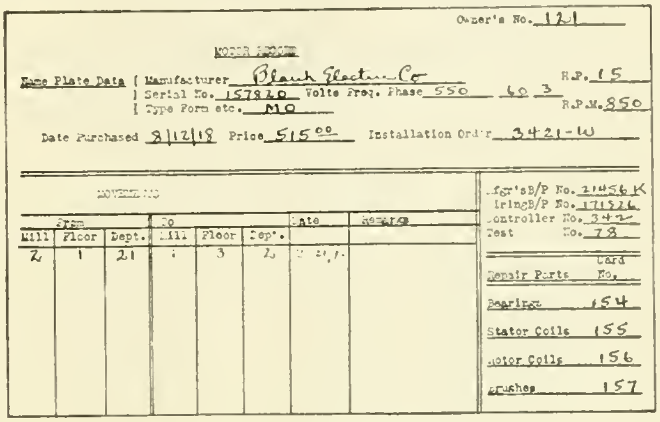
Item	A—Percentage	B—Mfr. B	C—Mfr. C	D—Mfr. D	E Mfr. E
I MECHANICAL; total, 90 per cent					
a End bells; total, 52 per cent					
1. Bushing construction, rings, etc	12	12	10	9.5	11
2. Oil well, cover, etc	10	10	9.5	9	10
3 Alignment, bow made and retained	7	6	7	6.5	6.5
4 Holding bolts, size and number	5	5	5	4.5	3
5. Size and rigidity	5	5	4.5	4.5	4
6. Weight	3	3	2.5	2.5	2
7. Design for dust prevention	10	9	10	8.5	8
b Stator; total, 26 per cent					
1. Material and construction	3	3.0	30	2.5	2.5
2 Iron, how held	1	1.0	1.0	1.0	1.0
3. Ventilation methods	4	4.0	3.5	3.5	4.0
4. Open or closed slot	3	3.5	4.0	4.0	3.0
5 If open bridge, construction	2	2.0	2.0	1.5	1.0
6. Cell insulation	4	3.5	4	3.5	3.0
7. Coil insulation	5	5	4.5	5	4.0
8. Phase insulation	3	3	0.0	0.0	3.0
9. Terminal block	1	0.5	1.0	0.0	1.0
c. Rotor; total, 12 per cent					
1. Shaft size in bearings					
2. Bearing size	7	7	6.5	5	6.0
3 Bearings, center to center					
4. Rotor insulation	2	1.5	1.25	1.25	2
5. Air gap, in inches	0.5	0.5	0.5	0.4	0.35
6. End-ring construction	2	1.5	2.0	1.75	1.75
7 Attachment of iron to spider					
8. Attachment of spider to shaft	0.5	0.5	0.4	0.35	0.35
II. ELECTRICAL; total, 10 per cent					
a. Power factors	4	4	3.5	3.5	3.0
b. Efficiencies	3	3	3.5	3.5	4.0
c. Temperature rise on test:					
1. 75 per cent load					
2. 100 per cent load	3	3	2.5	2.0	3.0
3. 125 per cent load, two hours					
Total	100	96.5	91.65	83.75	87.45

INSTALLATION AND MAINTENANCE

Certain fundamentals should be specially recognized in making motor installations—namely, that their life is determined by two things, bearing and insulation deterioration. Low bearings are usually caused by tight belts, dirt cutting the bushing or obstructing the proper flow of the lubricant, and vibration resulting from improper design of gear drives. Insulation deterioration may result from several causes—overloading with resultant heat, dirty ventilating ducts restricting heat dissipation, chemical action on insulation resulting from oil seepage or presence of harmful vapors, and precipitation of actual conducting dust in and around coils. The elimination of these or similar causes cannot but reduce repair costs.

Tight belts should be avoided by installing drives with long centers and by furnishing millwrights with the necessary instruments, tools and tables of tensions to fill any probable requirement and then insisting on their intelligent use. Dirty bearings and oil wells are the most common source of trouble. Frequent inspections and periodical washings with gasoline help. Engineers should insist on carefully designed dust rings, oil-well caps which cannot be removed and which close by gravity, and should consider the use of ball bearings, which practically remove the chance for catching dirt and require only repacking in grease every few months or so.

Vibration on gear drives is always present in greater or less degree. Its transmission to the bearings of induction motors can result in nothing but trouble.


Owner's No. 121

MOTOR RECORD

Name Plate Data { Manufacturer Black Electric Co H.P. 15
} Serial No. 157820 Volts Freq. Phase 550 60 3 R.P.M. 850
{ Type Form etc. MQ

Date Purchased 8/12/18 Price 515.00 Installation Order 3421-W

MOVEMENTS

From			To			Date	Remarks
Mill	Floor	Dept.	Mill	Floor	Dept.		
2	1	21	[illegible]	3	2	[illegible]	

Mfgr's B/P No. 21456K
Irl'ng B/P No. 171526
Controller No. 342
Test No. 78

Repair Parts	Card No.
Bearings	154
Stator Coils	155
Rotor Coils	156
Brushes	157

FIG. 1—MOTOR RECORD

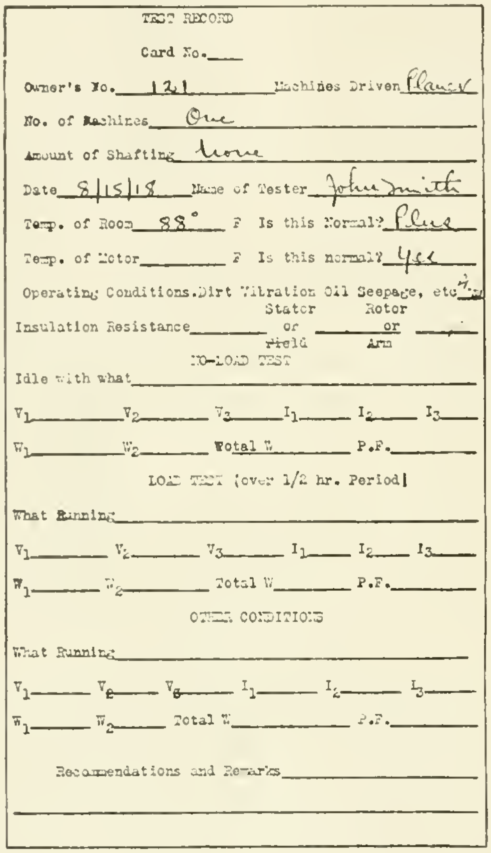
A machine driving through gears should be installed on as solid a base as possible and then have interposed a flexible coupling between it and the pinion shaft. Engineers who make the statements that their gear drives with pinions on motor shafts are satisfactory lose sight of the fact that the statement is a comparative one and that often a satisfactory drive can be made more satisfactory by the use of a flexible coupling at these points.

Insulation deterioration from overloading can be prevented only by the proper use of fuses or relays and more particularly by a careful study of the load characteristics. If insulation is failing because of dirt lodging in the air ducts and a consequent retention of heat, inclosed motors may be the solution of the trouble.

They may cost 30 per cent more than open motors, but one repair against the open motor may make up the difference, to say nothing of the cost of continual inspection required on the open motor to keep its ventilating ducts in proper condition. Vapors present in the air may also require the use of motors depending on radiation rather than convection for heat dissipation.

A common source of insulation failure results from the improper oiling of bearings, the well being filled above the shaft clearance, whereupon it runs down the end bell and ultimately works into the winding. An overflow should be provided well below this point and the oiler equipped with a pump filler of which the nose can enter the well cover and the body be placed below to catch the discharge from the overflow pipe. In this way the well can be filled with no loss and the oil running out used again if it is in proper condition. At least it cannot get into the windings. In machine shops the writer has found a dust precipitation, consisting of iron particles and oil, in open motors that will actually break down on 440 volts with conducting points an inch apart. The residue is evidently dust as no gritty feeling is noticed. Inclosed motors are the remedy for this persistent trouble.

Intelligent inspection is the surest way to prevent failures in induction motors. The number and kind of inspections, of course, depend on local conditions. The inspectors should, however, be equipped with certain necessary data and should have considerable mechanical experience. A table of proper fuse ratings or overload settings, air-gap feelers or gages and bearing feelers should be provided. Their proper use anticipates trouble and allows adjustment before production is curtailed. The inspector should also be provided with means for taking oil samples and, if necessary, renewing oil in poor condition. Insulation resistance readings are desirable at frequent periods; complete rewinding may be avoided where this resistance is low by carefully washing the insulation in gasoline, drying in a vacuum and impregnating with an insulating varnish. The repair record previously referred to in this article should serve as a guide showing what to look out for and inspections be directed accordingly, experience dictating the number and kind, together with desirable notations to be kept.


TEST RECORD

Card No.___

Owner's No. 121 Machines Driven Planer

No. of Machines One

Amount of Shafting None

Date 8/15/18 Name of Tester John Smith

Temp. of Room 88° F Is this Normal? Plus

Temp. of Motor____ F Is this normal? Yes

Operating Conditions. Dirt Vibration Oil Seepage, etc. [illegible]

Insulation Resistance____ Stator or Field ____ Rotor or Arm ____

NO-LOAD TEST

Idle with what____

V_1____ V_2____ V_3____ I_1____ I_2____ I_3____

W_1____ W_2____ Total W____ P.F.____

LOAD TEST (over 1/2 hr. Period)

What Running____

V_1____ V_2____ V_3____ I_1____ I_2____ I_3____

W_1____ W_2____ Total W____ P.F.____

OTHER CONDITIONS

What Running____

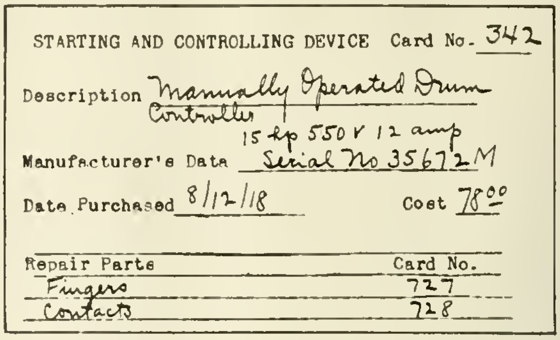
V_1____ V_2____ V_3____ I_1____ I_2____ I_3____

W_1____ W_2____ Total W____ P.F.____

Recommendations and Remarks____

FIG. 2—TEST RECORD

Properly kept motor records are a valuable asset to the engineer responsible for maintenance as well as statistical reports, etc. With properly kept records available, he is at once aware of the investment involved therein, the number and size of motors in the plant, the stock available for emergency use, the connected horsepower by department, building or floor, and has therein a ready reference for determining any repair parts required as well as the tabulated load characteristics of motors in operation.


STARTING AND CONTROLLING DEVICE Card No. 342

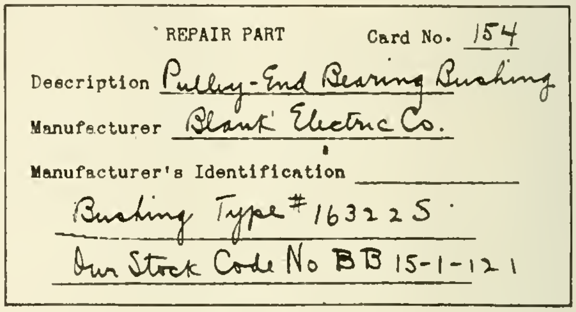
Description Manually Operated Drum Controller

Manufacturer's Data 15 hp 550 V 12 amp Serial No 35672 M

Date Purchased 8/12/18 Cost 78^{00}

Repair Parts	Card No.
Fingers	727
Contacts	728

FIG. 3—STARTING AND CONTROLLING DEVICE RECORD


REPAIR PART Card No. 154

Description Pulley-End Bearing Bushing

Manufacturer Blank Electric Co.

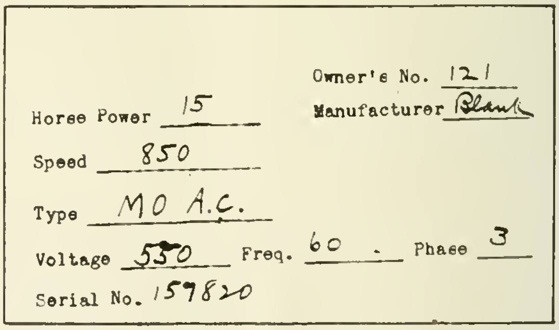
Manufacturer's Identification

Bushing Type #16322S

Our Stock Code No BB 15-1-121

FIG. 4—REPAIR-PART RECORD

Five form cards are all that is necessary to file these data and to have as elaborate a cross index at hand as is necessary in the average plant. Fig. 1 shows a preferred form of motor record card, which is filled in as far as possible at the time the motor is purchased, additional information being entered as it becomes available after receipt of motor and its installation. The various headings and items on this card need no elaboration. On the reverse side thereof is the repair record of the particular machine, which shows the date, kind and cause of the trouble and identifying means for determining the cost, such as the order


Owner's No. 121

Manufacturer Blank

Horse Power 15

Speed 850

Type MO A.C.

Voltage 550 Freq. 60 Phase 3

Serial No. 157820

FIG. 5—DIGEST OF MOTOR-RECORD INFORMATION

This card may be used as manufacturer's mill, department, horsepower or speed classification to locate any motor if any of its characteristics are given, and it also enables total connected load records to be kept for any desired portion of plant.

number. This form (Fig. 1) refers to three other forms—the test card (Fig. 2), the control card (Fig. 3), and the repair-part card (Fig. 4).

The test card contains such data as are necessary to study intelligently the load characteristics of the motor in question. On the reverse side of this card is a brief description of the method of drive together with pulley or gear sizes. The control card describes the starting or controlling device of the motor, with repair parts for it, and with space on the reverse side to show any changes in its location. The repair card contains sufficient information to identify properly the repair part in question, permits prompt ordering of replacements, saving laborious investigation, and the stock code number allows the stock clerk to pick out immediately from his bins a given bushing or coil, provided that he knows the motor it is to be applied on.

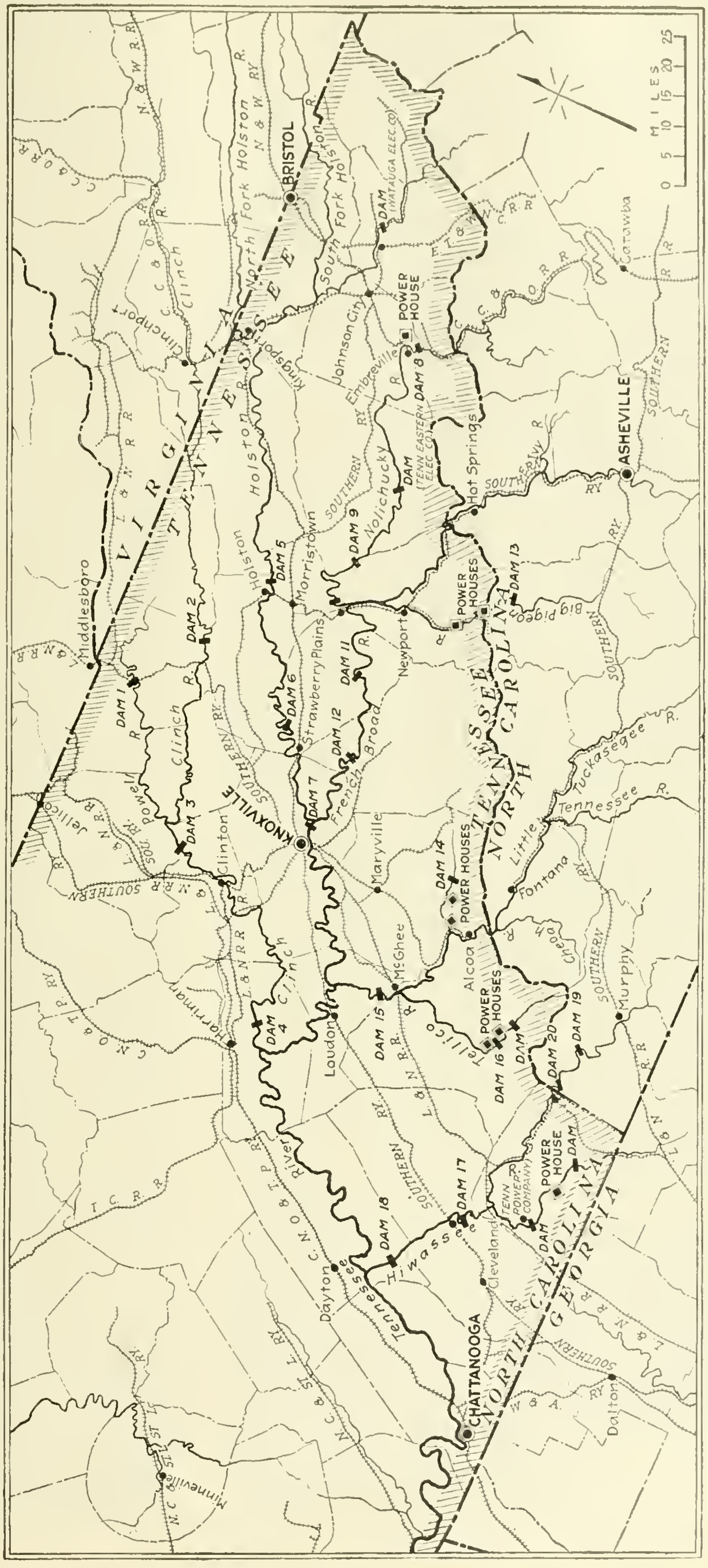
Each one of the cards mentioned is filed in its order, and information thereon is kept up to date by the proper coöperation of the records department, the testing department and the operating or maintenance department. The arguments in favor of a system similar to this are many, and even in a smaller plant the time saved and the valuable information accumulated by the tabulation of this data are surprising to one not accustomed to the system.

CONCLUSION

The preceding discussion is the result of investigations and studies in a plant using several thousand motors and covers many years' experience with troubles incidental to their operation. The repair record is merely typical, to illustrate the point of the discussion. The motor record is substantially one which is in very satisfactory use to-day.

Tennessee Water Powers

An idea of the water powers that await development in a single state may be had from the accompanying map. Similar maps for the rest of the nation would show a prodigious total.



SITES OF UNDEVELOPED WATER POWERS IN TENNESSEE OF OVER 5000 HP., COMPILED BY J. A. SWITZER, KNOXVILLE, TENN.

Artificial Daylight in the Industries

Qualifications of Light Required for Color Discrimination, with Examples of the Industrial Use of Daylight Lamps Installed in Many Establishments Varying Greatly in Kind

BY M. LUCKIESH

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SATISFACTORY industrial lighting from the standpoint of distribution and intensity of illumination began with the advent of efficient and adaptable light sources; therefore this class of lighting may be considered a development of recent years. In viewing the great progress in the industrial activities during the past two decades it is interesting to speculate regarding the contribution of artificial lighting toward the impetus which industrial development has received in the present age. Man bores into the earth, navigates under water or in the air, and maintains his activities every hour of the day aided by light of his own making. A twenty-four-hour load in the industries must necessarily be reckoned as a mighty factor in industrial development, and artificial lighting makes this possible.

But there has been at least one deficiency in industrial lighting which manifests itself in many activities, namely, that due to a lack of proper color quality or spectral character. That artificial illuminants are generally quite different from daylight in quality or spectral character is a fact of common observation, although the influences of this difference in color quality are not so generally recognized. Daylight has become the standard illuminant for the prosecution of work involving color perception, and incidentally it will surprise the uninitiated to learn how many industrial activities depend considerably upon color discrimination. The arts have developed under daylight, so this light has become the standard for accurate color discrimination. Furthermore, artificial illuminants which are generally adaptable to industrial lighting are usually so deficient in certain colored rays (notably the blue and violet) that many colors can be distinguished with difficulty or are so distorted as to be unrecognizable to the eye trained to discriminate under natural daylight. These facts are easily demonstrated by experiment, and the importance of color in industrial lighting may be readily ascertained by observation. In fact, many industrial processes cease when natural daylight fails.

ARTIFICIAL DAYLIGHT

There are special applications of colored light in the industries, but at the present time these are of small magnitude with the exception of the application of artificial daylight, which has recently assumed large proportions. The future will bring forth other special illuminants for the purpose of aiding vision in various ways, but in the present article the uses of artificial daylight will be discussed.

Daylight varies greatly in quality or spectral character from the bluish light of the clear north sky to the reddish light of the setting sun. Clear north-sky light and noon sunlight are fairly definite in color quality and are naturally taken as standards in the development of artificial daylight. Many factors, such as efficiency, cost of lighting, natural prejudices, degree of approximation to natural daylight, etc., influence the development and adoption of artificial-daylight lamps and accessories. A few years ago before the commercial exploitation of such lighting units there was much speculation as to the requirements, but to-day we are able to draw conclusions from thousands of installations.

COMMENTS ON ACTUAL INSTALLATIONS

It appears unnecessary to discuss here the theoretical considerations involved and the many aspects of color encountered in the applications of artificial daylight, for such data will be found elsewhere. It appears that these uses will be best illustrated by actual cases and brief comments upon them. For the most accurate color discrimination north-sky light is generally used, and an artificial-daylight unit giving this quality of light is often called a color-matching unit. Some of the examples and comments given below are drawn from many installations of these units.

For less accurate color work noon sunlight is satisfactory, and artificial daylight units emitting light of an approximate noon sunlight quality are available both as an accessory to an ordinary illuminant and as the "mazda C-2" lamp. The wide application of the latter, which approximates noon sunlight in integral quality, is proof that it is unnecessary to approximate daylight quality more closely than is required by the color-perceptive ability of most individuals. Furthermore, north-sky-light quality when emitted by an artificial lighting unit is generally considered too "cold" owing to the prejudices arising from continued association of a "warm" color with artificial light. A discussion of the many factors involved would lead far afield; therefore only the principal facts will be briefly commented upon. Examples of the installations of the latter quality of artificial daylight will be drawn from a large number of installations of these units. These units will be termed sunlight units for the sake of brevity in expression.

Color Factories.—North-sky-light units are in use for the more accurate color discrimination and color matching, and sunlight units are employed for general illumination of processes less exacting in the requirements of color perception. The products of such factories when exhibited in stores or used in paint shops are also at present illuminated in many cases by means of approximate daylight units.

Paint Shops.—North-sky-light units for accurate color mixing and for the standardization of colors are used in considerable numbers, but in general in this field the approximate daylight units are used. The final product is well displayed under such illumination, and as a consequence many automobile display rooms, for example, are illuminated by these general-lighting units.

Textile Mills.—In dye mixing and testing, many color-matching units are in use at the present time. Rows of such units are also used parallel to the perches upon which the dyed materials are hung. An angle unit is found necessary in many cases in order to illuminate the material, which hangs vertically and is inspected by the light transmitted as well as by that which is reflected by the material. In accurate dyeing even the most experienced colorist who is thoroughly familiar with the spectral characteristics of his dyes is often unable to be sure of his ground without an illuminant of daylight quality. The sunlight units, or those emitting light roughly approximating daylight in quality, have found many applications in various textile mills. The same difficulties in discriminating the colors of textiles persist in the wholesale and retail stores, so that many of these establishments have been equipped with various types of artificial daylight units.

Garment Factories.—Both types of artificial daylight have been applied to these industries, including woolen mills and cotton mills.

Cotton Exchanges.—Although the discrimination of different qualities of cotton is included in the foregoing classification, this activity deserves special mention. Raw cotton is sorted into a vast variety of grades and the color is an important factor. The colors vary from a white to a yellowish white, and the tints are so weak in color that it is quite impossible to discriminate many of them from each other under ordinary yellowish artificial light. The more accurate artificial daylight illuminants are in use for this work.

Furs.—All the difficulties of color discrimination are met in the fur industries. Not only do the lighter tints present difficulties under ordinary artificial light, but especially the dark shades which are so commonly encountered in furs. Artificial daylight units are also being installed by wholesale and retail furriers.

Color Printing.—In mixing inks and in inspecting proof many color-matching units are employed. For the presses the approximate daylight units find wide application. An interesting feature of artificial daylight in color printing, besides the satisfactory rendition of the blues, violets and purples, is the resulting contrast of yellows upon white backgrounds under this quality of light. Under ordinary artificial daylight it is very difficult to distinguish the yellow impression on white paper in three-color printing. Pressmen find great difficulty in distinguishing flaws under such conditions, which often results in considerable spoilage. In lithography, art work on the original drawing and the work on stones is now being favorably done in many places under artificial-daylight illuminants. Wall-paper displays are well illuminated by the sunlight units, hence the latter have found their way into wholesale and retail wall-paper stores.

Art Studios.—Many installations of artificial daylight have been made in studios of pure and applied art. Oddly enough, artificial daylight of a sunlight quality is often prefererd, notwithstanding the general choice of natural north-sky light for such studies. This seeming contradiction is likely to lead one astray if further inquiry is not made. North exposure has not been chosen in general by artists for the sake of the quality or color of the light but because north-sky light is the most constant natural daylight both in intensity and quality or spectral character. Some discerning artists prefer to paint from models in the "warmer" light in order to have their paintings tend toward the warmer tone.

Metal Work.—The discrimination of the various colors of such alloys as brass and commercial gold is very difficult under ordinary yellowish artificial light because the various mixtures appear nearly if not exactly the same in color. Under artificial daylight the differences are readily distinguishable. Difficulties arise with other metals and alloys in which color discrimination is of considerable importance. The sunlight units are usually satisfactory in these cases. Lacquering is often more satisfactorily done under light of daylight quality.

Ore Refineries.—Color plays an important part in the selection and judgment of ore concentrates, and as a consequence this field has been invaded by artificial daylight units. An ore with a bluish-gray tint appears gray under ordinary yellowish artificial light, and a yellowish ore cannot be distinguished easily if at all from another specimen of a gray or yellowish tint. In the former case the specimen is found to be a blue-gray under artificial daylight, and in the latter case the yellows are easily distinguished. An actual case encountered in practice is the presence of yellowish pyrites in lead or zinc concentrates.

Chemical Analysis.—In such work color discrimination is often of importance. The requirements vary so that either the north-sky-light or sunlight units are satisfactory, depending upon the case. In titrating, the north-sky-light units appear to be more satisfactory. The concentration of a weak solution is sometimes estimated by the color of a considerable depth of the solution. An example of this is the yellowish color of chlorine solutions. When of low concentration this yellowish tint can be distinguished with difficulty if at all under ordinary artificial light.

Laundries.—Dirt, spots due to scorching and other blemishes which are generally yellowish in color are more readily distinguishable under artificial daylight than under ordinary artificial light. "Bluing," which is used to neutralize the yellowish tint of white fabrics, can be applied with more certainty under artificial daylight. The approximate daylight units are usually satisfactory in laundries.

Paper Mills.—In the manufacture of paper the problems of distinguishing delicate tints of approximately white papers and of tinting pulp to match certain standards are commonly met. Artificial daylight has met these problems satisfactorily.

Flour Mills.—In a similar manner various types of artificial daylight units are in use for distinguishing the delicate tints of flour.

Sugar Refineries.—Accurate color-matching units are in use for distinguishing the colors of sugars.

Jewels.—Color is an important factor in the value of jewels. The illuminant influences the colors of jewels quite markedly. Diamonds present special difficulties because commercial diamonds vary in color from blue-white to a decidedly yellowish tint. The former lose their bluish tinge and the latter appear less yellow under ordinary artificial light. The more accurate artificial daylight illluminants are desired for purposes of examination of jewels. Pearls and opals often lose some of their beauty under ordinary artificial light owing to the suppression of the blues and violets and to the shifting of the pinks toward red.

Dentistry.—Matching artificial teeth, cements, porcelain inlays, etc., presents difficulties both in factories and in the dental offices. North-sky-light units are in use for the more exacting work, but the sunlight units are found quite satisfactory for much of the work.

Medicine and Surgery.—Artificial daylight has found its way into hospitals and private offices for use in surgical operations and in diagnosis. Various types of units are in use, depending upon the requirements and upon desires of the users. It is difficult to distinguish the various tints of healthy and diseased tissue, and manifestations of skin diseases are sometimes unrevealed under yellowish artificial light.

The foregoing are a few of the activities in which artificial daylight units have been installed. The different activities are far more numerous and include other classes of stores, show windows, barber shops, hairdressing establishments, tailor shops, art galleries, etc. Many unique and unexpected applications have been met in practice, and it appears that the field for such lighting units will be greatly extended. Instances have been found in which users have declared that a light of a daylight quality is easier on the eyes for close work than yellowish light. In the absence of a decisive method of testing this point such statements must be given some attention, especially because they present a reasonable possibility when viewed from the standpoint of evolution and adaptation.

One of the most prominent features is the miscibility of artificial daylight with natural daylight. There appears to be an unsatisfactory condition of lighting when natural daylight must be reinforced with yellowish artificial light. As a result of this many installations of artificial daylight have been made in offices, drafting rooms, etc., where the discrimination of the colors of objects is of little or no importance. In all of these applications esthetic taste is a secondary consideration. Where this is a primary factor the scientific aspect, which this article bears upon, is subordinated. There are ways of using artificial daylight and yet satisfying the esthetic taste, but these cannot be discussed in this article.

Dollars Buy Liberty—Fourth Call

WISCONSIN COMMISSION SERVICE RATING SYSTEM

Adopted to Aid Inspectors in Making Uniform Interpretation of the Rules, It Results in Improved Utility Service

To assist the different engineers to make uniform interpretations of the standards for electric service governing electric utilities in Wisconsin, a percentage system of grading the service furnished by each electric utility was adopted in July, 1914. It was decided that the rules relating to the continuity of service, voltage regulation and routine meter testing were of about equal importance, with the rule regarding meter testing a little less important. It was therefore decided to give eighteen points each for the complete elimination of interruptions and for keeping the voltage regulation within the limits prescribed by the rules, and fourteen points when the meters were tested according to schedule. The remaining fifty points were divided among the ten other rules according to their relative importance. The first thirteen rules relate to gas. The number of points given each rule for electric service and the bases of marking when partial compliance is found follow:

Rule 14 (4 per cent)—Where no meters are found creeping full credit is given, but where a number (depending upon the number installed) are found creeping no credit is given.

Rule 15 (7 per cent)—Where the utility has competent metermen who give the best of care to meters full credit is given.

Rule 16 (5 per cent)—Where all meters are tested in place of service within thirty days after installation full credit is given

Rule 17 (14 per cent)—Where routine tests are made according to the schedule prescribed in the rules full credit is given. Credit is reduced in proportion to the number of meters overdue for test.

Rule 18 (5 per cent)—Where meter test records are complete and up to date full credit is given.

Rule 19 (5 per cent)—Where complete meter-testing equipment is owned by the utility full credit is given.

Rule 20 (4 per cent)—Where request tests are made willingly and without charges full credit is given. Delay in making tests or charging the consumer for such tests reduces the credit.

Rule 21—This rule relates to referee tests by the commission and does not depend upon any action of the utility and so carries no weight.

Rule 22 (4 per cent)—Meter readings with dates on bills, 4 per cent; meter readings without dates on bills, 2 per cent; meter readings not on bills, 0 per cent.

Rule 23 (18 per cent)—No interruptions, 18 per cent; interruptions, few, long, unavoidable, 16 per cent; interruptions, few, short, avoidable, 15 per cent; interruptions, few, long, avoidable, 12 per cent; interruptions, many, short, avoidable, 5 per cent; interruptions, many, long, avoidable, 0 per cent.

Rule 24 (6 per cent)—Complete log sheet without record of interruptions, 3 per cent; with record of interruptions, 6 per cent.

Rule 25 (18 per cent)—Where voltage records of the utility and inspector show regulation within the requirements during lighting hours, 15 per cent; where within requirements for power and day service add 3 per cent.

Rule 26 (6 per cent)—Where utility exercises care and intelligence in selecting locations for making voltage tests, has proper equipment and does the work, full credit is given.

Rule 27 (4 per cent)—This rule relates to the giving of information to the consumer to assist him in securing the most efficient service from the system, and the grade given is left to the judgment of the inspector.

A number of managers asked for detailed ratings so that they could determine which departments were responsible for their low rating. They also wanted to know if they were relatively high or low on the list and where they stood in relation to other utilities of their size or other utilities in their vicinity. To give this information to the utility men, the commission now makes up tables, which are exhibited at the annual convention of the Wisconsin Electrical Association, listing the utilities by cities in which they operate, the number of their consumers, the rating which they were given at the last inspection, and the relative rank of each utility. The tables have shown that the larger plants do not always give the best service. The results show an improvement in the class of service rendered by the utilities. The average ratings of thirty-seven electric utilities in one inspection district for the years 1915, 1916 and 1917 are 73 per cent, 76 per cent and 80 per cent respectively. These thirty-seven utilities vary in size from 65 to 1773 consumers.

How the Central Station Has Sold Liberty Bonds

A Number of Tried and Proved Suggestions Which Show How the Special Opportunity of the Lighting Company Has Been Made the Most of in the Three Previous Campaigns—Comprehensive Plans Under Way for the Fourth Drive Now Opening

SEVENTEEN MILLION men, women and children bought bonds in the third Liberty loan campaign. This time many more people must purchase and the individual must go down deeper in his pocketbook to provide the government with the $6,000,000,000 asked for. It means twice as much money in three-fourths the time. It is up to every industry, therefore, to see what it can do to sell more bonds of this fourth loan.

The electrical industry has already shown its attitude, its point of view. Manufacturers are laying plans to campaign even more energetically among their employees to make their united contribution bigger and better than before. Many new clever ways are being devised to boost the campaign. Jobbers, central stations, contractors and dealers are following the same course. Every other industry will be striving in these same compelling ways, and, of course, the more the power the more the sales. But it has been demonstrated before that the electrical industry may employ to advantage its own individual distinctive contact with the great American public for the selling of more bonds and other bonds.

Methods Tried Successfully

There follow a dozen or more of these "different" ways in which central stations have helped the sale of former Liberty loans and which seem to have considerable merit:

1. *Monthly Bill Publicity.*—The space devoted on monthly bills to advertising appliances has in a large number of cases been devoted to bond publicity, because it was recognized to be one point of contact with the public which was peculiar to the lighting utilities. Individual advertisements written by the utility itself have as a rule been used.

2. *Meter Readers.*—Reports have come in that some utilities have had their meter readers hand the person who opened the door of the home a printed statement to the effect that the lighting company was in a position to handle the subscription of its customers. In certain instances the meter reader was instructed to inquire if those in the home had received subscription blanks and if not to leave as many as were wished. It was found that the meter readers had, besides, an opportunity to present Liberty loan arguments to servants.

3. *Repair and Service Men.*—In a manner similar to that followed by meter readers, repair and service men have been able to distribute announcements.

4. *Salesmen.*—Salesmen, of course, have been used in each of the loans. In one Eastern city the utility announced in the papers that its salesmen would make a thorough canvass of the city, going from house to house. Of course, when doing this the salesman had no time for his regular work. This form of activity has always resulted in large sales.

5. *Cashier.*—Because so many people come into the office to pay their lighting bills in person it was early recognized by a number of utilities that this was an opportune time to tell the customer that the company was taking Liberty loan subscriptions and that initial payments could be made then and there.

6. *Display Room.*—There is hardly a utility that has not at least put up a Liberty loan poster or two in its office and display room. Some have gone still further and made elaborate loan displays. Perhaps the most appealing have been those featuring war relics. When it was impossible to get more than a single souvenir of the present war some companies went ahead and placed on display souvenirs of other wars in which the United States has participated.

LIBERTY BONDS
ACT
WAR
LIBERTY BONDS
ACT
LIBERTY BONDS
ACT
IF YOU CAN'T FIGHT YOUR MONEY CAN
Uncle Sam Needs Your Money
Uncle Sam Needs Your Money
Uncle Sam Needs Your Money
END THE WAR
YOUR LIBERTY YOUR FOREFATHERS DIED FOR IS AT STAKE
BUY A LIBERTY BOND
END THE WAR

A LIBERTY BOND SHOW WINDOW ARRANGED BY INDIANAPOLIS CENTRAL STATION

7. *Posters.*—It has been rather a common sight, particularly in the larger cities, to see the utility wagons, automobiles, lamp distributers, motorcycles and lamp posts, and in the outlying districts the transmission-line poles, decorated with loan posters. In Philadelphia, for instance, from each of the downtown lighting standards were hung two original placards each with a pithy bond sales argument. Some companies even pasted posters on the outside of their different buildings.

8. *Combination Companies.*—In certain cases of combination properties there has been keen rivalry between the separate branches to see which could utilize its own opportunities to the most advantage. It was found that frequently the efforts could easily be duplicated in the different branches.

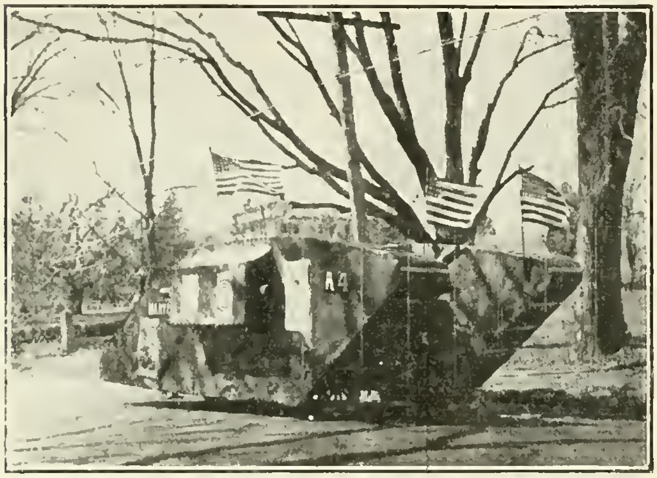
9. *Newspaper Advertising.*—It was not unusual to

find utilities devoting their newspaper space to loan advertising. This, of course, was being done by the other businesses, but it was found to be very valuable for directing the attention of the public to the utility loan activities.

10. Mail Advertising.—The envelope stuffers with the monthly bill and other direct-by-mail advertising have in many instances been put to work for the Liberty loan during the campaign period. Already some electric light companies are doing this for the Fourth loan in an attractive and appealing manner.

11. Bond Coupons.—As a part of the general propaganda, it has been reported that some utilities have offered to accept coupons at face value in payment for appliances.

12. Window Displays.—In devoting their display windows to Liberty loan advertisements utilities have probably done more than in any other way. Some have merely used the official posters in the windows, while others have gone to the extreme of getting up original displays on which they have spent considerable time and money.



A LIBERTY LOAN PARADE "TANK" BUILT BY EMPLOYEES OF THE NARRAGANSETT PIER (R. I.) ELECTRIC COMPANY

13. Floodlighting.—Each district usually has in some public place a dial for showing the progress made locally. As a rule these "clocks" are floodlighted free of charge by the lighting company. Also American flags are floodlighted. One utility operating in a town of only a few thousand conceived the idea during the first loan drive of offering to floodlight any American flag in its district every night at regular rates with all installation charges and equipment at cost. A number of people took advantage of this offer, and the spectacle of the Stars and Stripes thus illuminated aroused general interest and admiration.

THE COST OF LIGHTING STREETS AT GALESBURG, ILL.

Unit Cost of Installing System Amounts to $197.70 for Five-Light Clusters and $177.84 for One-Light Pole on System

The city of Galesburg, Ill., has recently added 47 one-light standards and 116 five-lamp cluster standards to its street-lighting system. In the former system the main street of the city, from the public square to Seminary Street, four blocks east, was lighted by eight 400-cp. nitrogen lamps per block. These lamps were mounted in Westinghouse "Luxo-lite" fixtures supported on ornamental brackets attached to the street-railway trolley standards. The city's residential districts were lighted by five-series circuits made up of a total of 366 400-cp. and 86 250-cp. nitrogen lamps. These lamps were mounted in open-type fixtures. In addition to this, the city possessed in the downtown district 104 cluster poles containing 110-volt multiple lamps.

In the new installation the forty-seven one-light standards carry lamps of the 6.6 amp., 100-cp. series type, while the five-lamp clusters carry one 100-cp. and four 60-cp. series 6.6-amp. lamps. The standards were furnished by the King Foundry Company, St. Joseph, Mo., and the lighting units were furnished by the General Electric Company. The following are the specifications for the poles for ornamental lighting:

Cluster Poles.—Height, 13 ft. 9 in.; weight, 700 lb.; base, 20 in. square; shaft, top 7 in. in diameter, bottom 8 in. in diameter.

Single-Lamp Poles.—Height, 12 ft. 3 in.; weight, 475 lb.; base, 18 in. in diameter (round); shaft, top 7 in. in diameter (round), bottom 8 in. in diameter (round).

On the cluster poles are carried one 16-in. opal globe, four 12-in. opal globes, one 100-cp. series lamp and four 60-cp. series lamps, while on the single-lamp poles there are one 16-in. pole globe with porcelain reflector and ventilator and one 100-cp. series lamp.

All poles were set on 2-ft. by 2-ft. by 2½-ft. concrete bases. The conductors are all No. 8 lead-covered cables laid in fiber conduit 18 in. below the surface of the ground. The top lamps are all connected in one series circuit and the lower lamps are divided into two circuits.

While the contract was let before war conditions became acute and the costs may not be a fair indication of present prices, they at least indicate the trend of street-lighting costs. The contractor, who was H. H. Gunther, of Galesburg, Ill., was paid a total of $29,881.13. The legal expense involved amounted to $1,510.65, making the total cost $31,391.69. Figured on a unit basis, this makes the cost of one five-lamp cluster pole $197.70 and the cost of one one-lamp pole $177.84. The old five-lamp clusters installed in 1915 cost the city $100.51 per pole.

NO AMERICAN can come in touch with the admiration, with the trust and faith of the allied nations toward our country, without feeling even more profoundly and reverently than before the high privilege of being an American citizen, and without being stirred by a solemn sense of the obligation to do whatever he individually may be capable of doing to prove himself a worthy servant of the great Republic in war as well as in peace, and an earnest and sincere helper, however modestly and humbly, toward the realization of her high ideals and lofty mission.—*Otto H. Kahn.*

STATION & OPERATING PRACTICE

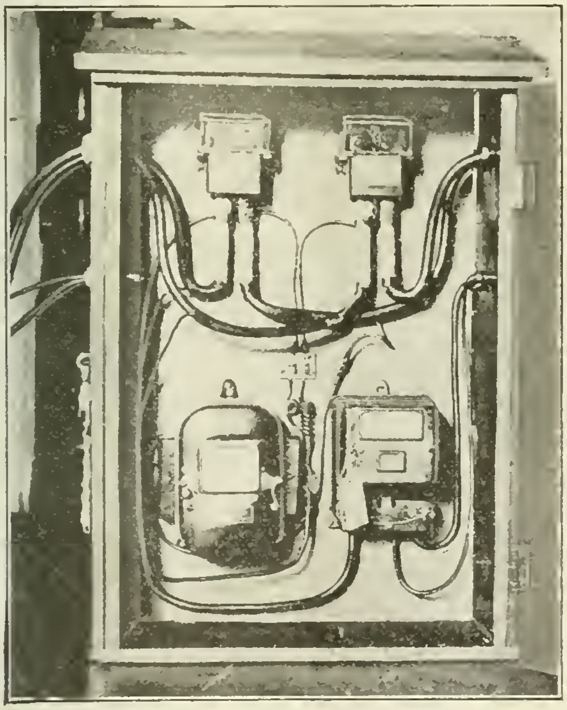
A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

PRE-ASSEMBLING METERS FOR SHIPYARD SERVICE

Weatherproof Box Equipped with Meters and Current Transformers in Meter Laboratory in Spare Time of Employees

Instead of mounting power and lighting service meters for shipyard operation outdoors or within the plant interior, the Cumberland County Power & Light Company, Portland, Me., is assembling in its meter laboratory the box illustrated herewith, which is equipped with meters, current transformers and wiring leads. It is then taken to the point of installation and is easily and quickly erected between the standard poles which the company employs in transformer mounting by means of small block-and-tackle.

The box, made of pine with reinforced sides, of ⅞-in. (22-mm.) stock, stands 3 ft. 3 in. (98 cm.) high, 2 ft. (61 cm.) wide, and is 8 in. (20.3 cm.) deep. Sufficient length of cable is allowed to permit convenient connections between the transformers and meters when the unit is mounted for use. The power and lighting leads are carried through the reinforced sides of the box in 1-in. (2.5-cm.) and ¾-in. (19-mm.) porcelain tubings re-ctively. With inclined top, padlock and chain, the is weatherproof and free from molestation by un-horized persons. The equipment is assembled at odd times by the staff of the meter department, which thus saves considerable labor cost. The cost of this construction will not exceed $25, it is thought, or probably not over 5 or 10 per cent of the cost of erecting the meters in a special meter and switch house by a regular line force and with the extra material required in the latter case.



METERS AND CURRENT TRANSFORMERS INSTALLED IN BOX WHILE STILL IN METER LABORATORY

Do You Help the Men Over There?

SPEEDING UP SHOPWORK WITH ELECTRIC EQUIPMENT

Automatic-Control, Adjustable-Speed Motors in New Shipyard Machine Shop Cause 100 per Cent Gain in Output

Time and labor as measures of production cost have become so important in the Union plant of the Bethlehem Shipbuilding Corporation at San Francisco that extensive changes in equipment have been made to speed up the rate of doing work and decrease the labor required. Many of the older machine tools have recently been provided with automatic control or equipped with new adjustable-speed motors outright. Experience with these improvements has been such that the new machine shop has been equipped throughout with adjustable-speed direct-current motors with dynamic brakes and entirely automatic control.

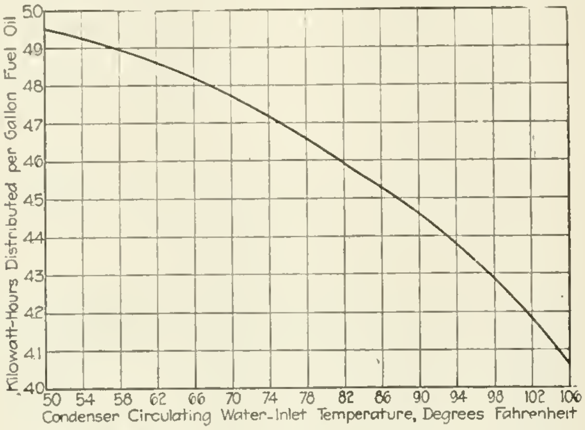
This shop is 550 ft. by 175 ft. in plan, divided into three longitudinal bays. A total of eleven overhead cranes are used in the three bays. Although all the equipment has not yet been installed, there are now about 100 motor-driven machine tools in service in the shop. The motors are all sizes ranging up to 35 hp., the total installed capacity being about 500 hp. It is interesting to note that, although all the tools are continually busy, the power demand is not sufficient to warm up a 200-hp. rotary converter used for supplying the energy. The shop schedule is such that no equipment is allowed to stand idle except when repairs are necessary. As soon as new tools are received they are put in service immediately.

The direct-current equipment and the automatic features are working out very satisfactorily. With about thirty speeds extending over a ratio of four to one and controlled by conveniently placed push-buttons, operators work much more effectively than where only four speeds could be attained, and that with some effort in shifting pulleys. Moreover, the dynamic brake brings the work to a stop so quickly that time is saved in the inspection and the operator is inclined to examine it more frequently. Foremen regard this as a most important factor in speeding up the work, and the workmen themselves prefer it because of its "convenience." The automatic control gives a fixed rate of acceleration

PLANT-OPERATING EFFICIENCY COMPARED DAILY WITH AVERAGE

Per Cent Efficiency Above and Below "Bogie" Curve Posted on Bulletin Board Each Day—Effect of Temperature of Circulating Water

Because the efficiency measured in killowatt-hours at switchboard per unit of fuel oil used varies with the temperature of the condenser circulating water, the Houston (Tex.) Lighting & Power Company was obliged to find some method of comparison for informing the station engineer whether or not he was operating the plant to obtain the best results. The water is obtained from a bayou which is a sluggish stream and which becomes very warm during the summer months. The variation in efficiency is a function of the circulating water and, according to Frank G. Frost, general superintendent of the company, the summer and winter loads have been very carefully analyzed to get average values. From the steam curve of the turbines a "bogie" curve, reproduced herewith, has been worked out which gives the relation between the station outputs with variable circulating-water temperatures. The percentage that each day's results are above or below this curve is posted in the station turbine room so that the operators at all times are familiar with the actual economies of the station. Fuel-oil and electric meters are read hourly.



CURVE OF POWER-PLANT EFFICIENCY USED AS STANDARD

TRACK SCALES SAVE THEIR COST IN VERY SHORT TIME

Central-Station Company Weighs Coal and Pays for What It Gets at the Power Station—Soon Gets Back Cost of Equipment

E. S. Hight of the Illinois Traction System, Peoria, Ill., which operates light and power properties in many cities in the Middle West, is a firm believer in the value of track scales for central-station companies. Several properties of this company have bought track scales and installed them at their plants. When a car of coal is received it is weighed before being dumped. If the track scales show that the car contains only 88,000 lb. (40,000 kg.) of coal, while the invoice shows that it contains 100,000 lb. (45,000 kg.), the central-station company pays for only 88,000 lb. (40,000 kg.) of coal. The money which it has saved through this process, Mr. Hight says, will soon pay the cost of the scales.

When this view was recently presented before the Iowa Section, National Electric Light Association, the question arose as to whether this plan should be employed where the contract which the central-station company had with its coal company specified that the coal was to be paid for at "mine weight." Mr. Hight expressed the opinion that this provision in the contract carried little weight if the central-station company through the use of track scales showed that car weights were short. He said further that he believes no coal company would go into court with a case where accurate records kept by central-station companies showed that the weight of cars at the central station was less than it was represented to be at the mine.

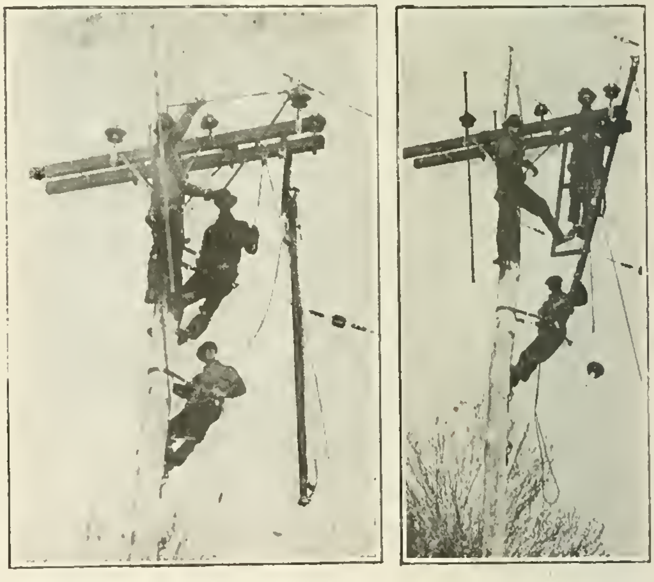
End the German Evil—Buy Bonds

FACILITATING THE HANDLING OF HIGH-TENSION LINES

Improvised Bolt Cutter Used with Safety Is Easily and Cheaply Made by Linemen—Ladder Provides Support for Men Working on Line

When changing insulators on high-tension lines without interrupting service, one of the main requirements is to cut the tie wire neatly without injuring the conductor. For doing this effectively the transmission department of the Elmira (N. Y.) Water, Light & Railway Company uses an ordinary 14-in. (35.5-cm.) bolt cutter by attaching 40-in. (101-cm.) round sticks to the handle end, as shown in the accompanying illustration. These two sticks were made of well-seasoned wood paraffine impregnated and fastened to the iron handles of the bolt cutter with two small bolts. The handles were then made rigid by a wrapping of copper wire.

The cost of this device, according to C. M. Bange, superintendent of transmission, was almost nothing outside of the expense of the small bolt cutter used, because the linemen can make it in their spare time.



EASILY AND CHEAPLY MADE WIRE CUTTER PROVIDES SAFE METHOD OF HANDLING "HOT" WIRES

The photograph also shows the use of an angle guy hooked to the conductor and holding it in place while the insulator is changed. Another economical device is the ladder shown in the photo on the right. This is used when only one cross-arm is mounted on the pole.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

CUSTOMERS ARE ADVISED OF "LIGHTLESS NIGHTS"

Government Order Published in All Newspapers Printed in the Territory of a Large Middle West Utility

An advertisement quoting the government order on the subject was printed during August in all the publications used by the Public Service Company of Northern Illinois for advertising purposes, announcing the inauguration of so-called lightless nights Monday and Tuesday of each week. Many of the newspapers printed local articles in addition. The reason why ornamental lighting is forbidden on these nights is now understood.

"Our Country, 'Tis of Thee—"

CONSERVATION RESTRICTIONS ON SUMMER RESORT LIGHTING

Investigation Held by New England Fuel Administrator Into Electric Consumption at Beaches Near Boston

In connection with the establishment of "lightless" nights, so called, in Massachusetts, under the orders of the federal Fuel Administration, an important issue was recently raised relative to the curtailment of illumination at the great beach resorts outside Boston. The popular idea is that a large amount of coal could be saved by cutting out display lighting at these places, and an investigation was held by James J. Storrow, New England Fuel Administrator, to ascertain whether it would be necessary to impose drastic regulations cutting down the use of electricity at such places as Revere Beach and Nantasket Beach, each of which is sometimes visited by 100,000 persons in a day.

At a public hearing that was held in Revere, C. F. Chisholm, manager of the Suburban Gas & Electric Company, appeared before Mr. Storrow and other officials and stated that the popular impression of the fuel saving to be gained from display lighting curtailment at this famous shore resort is a greatly exaggerated one. In the seventy-eight days from May 1 to July 17 the total energy consumption of the lighting and power users at Revere Beach required the burning of only 164 long tons of coal. Mr. Chisholm pointed out that if all the lamps on the boulevard and in the amusement places at Revere Beach were cut off for the rest of the season (which virtually closed on Labor Day) the saving in fuel thus attained would total only about 80 tons. The boulevard is illuminated by 2600 incandescent lamps installed on arches and consuming 78 kw. Only 4 tons of coal per month are required for this lighting, which adds materially to the cheerfulness of the beach. The energy used at Revere is produced in the large and efficient plant of the Salem Electric Lighting Company, which operates on about 2 lb. of coal per kilowatt-hour, the Revere station being held only as a reserve.

As has been described in the ELECTRICAL WORLD, these plants are connected by a tie line which also includes the station of the Malden Electric Company, and the delivery of energy in the entire Salem-Malden-Revere territory is carried out with the most scrupulous attention to operating economy, full advantage being taken of the load factors and diversity factors of the connected stations. The peak load of the Revere company occurs in summer and that of the Salem company in winter, so there is a substantial capital saving in the interconnection program as well as a fuel and labor saving in station operation.

Mayor Alfred S. Hall of Revere and Charles Ridgway of the Ridgway Company, representing amusement resorts, also appeared on behalf of continued illumination. The speakers said that they were in entire favor of enforcing any regulation to the advantage of the United States in the winning of the war, but that they desired Mr. Storrow to investigate the situation carefully and first to make sure that the trivial saving on coal would be worth while during the remainder of the season, in view of the injury to the investments associated with the beach business, the loss of revenue to the central-station company and the closing of wholesome entertainment for the thousands of persons visiting the resort after their day's work. Such a curtailment would also seriously reduce the federal revenue from war taxes on show admissions and incomes from the businesses affected. Representatives of the Revere and the Metropolitan Park Police boards also opposed the curtailment of lighting, on the ground that such a course would draw thieves and immoral persons to the resort. It was also pointed out that many thousands of soldiers and sailors visited the beach nightly.

Mr. Storrow was much impressed with the small amount of fuel consumed by the lighting of the beach and its concessions. He requested that a committee, of which Mr. Chisholm was made a member, investigate the possibilities of curtailment of illumination without injurious effects upon the beach business, and this was done. The interior lighting of the concessions was carefully gone over, and it was found that much effective work could be done by substituting smaller-sized lamps in many cases. After going over the matter with Mr. Storrow, it was decided to curtail the outline lighting to a considerable extent, and this was done, with various substitutions indoors.

In Boston restrictions placed upon the lighting of parks were removed not long since upon the protest of Mayor Peters and the police authorities.

HOW WOMEN ARE TRAINED TO BECOME METER READERS

Experience of Chicago Company in Operating School for Selection and Training to Increase Man Power of Nation

Chiefly because the government has indicated that industries must help produce the needed additional military man power, the Commonwealth Edison Company of Chicago has begun to use women as meter readers. To train these new employees a temporary meter readers' school in charge of the foreman of meter readers has been opened. The equipment consists of chairs and tables, an exhibit of a number of meters and parts of meters, and a large model of a meter dial. This latter is used in meter reading practice, and examinations are held after the class has been thoroughly instructed by talks accompanied by demonstrations concerning the construction and working of meters.

Twenty or thirty changes are made on the large dial, each student marking down her record each time on a sheet of paper. These sheets are then collected and checked for accuracy. Three days is the usual duration of the school course, whereafter the graduates start out in their districts, accompanied by one experienced meter reader the first day to pilot them through the difficulties of practically applying the training they have received. Then each woman is given her own route and book of meter cards and is on her own responsibility. Only half routes are assigned at first. After about one week their work is usually good enough for strict supervision to be dispensed with.

METER-READING CLASS IN SESSION

To secure pupils for this school an advertisement was placed in one of the daily papers asking for mature women to learn meter reading. Those who were selected from the applicants are nearly all between thirty and forty years old. They came from many walks of life and include even some who have been trained nurses. Many of them are married.

During the selection of the applicants every attempt was made to explain fully the arduous character of the work, even to the point of attempting to discourage them. Further elimination occurred during the three days of schooling, about 30 per cent of the classes being dropped during this period. It is notable, however, that of the applicants who have satisfactorily finished their schooling only a small percentage have since found it necessary to drop out. This is in sharp contrast to the usual practice of young men who were formerly used, as 40 per cent of the male force was lost during August. While it is, of course, too early as yet to draw decisive conclusions, it appears that women will work out more satisfactorily than the class of male help available, being able to do as much work and being more accurate, principally on account of their greater sense of responsibility.

Neat leather handbags are given to the women in which to carry the meter seals, sealing tool, etc. They are wearing their usual street clothes for the time being, but something in the nature of a uniform suit will be adopted in the near future.

Does It Thrill You?—Buy Bonds

HOW INCREASED RATES AFFECT GAS AND ELECTRIC REVENUE

Experience Shows that Higher Gas Rates Produce Full Amount of Revenue Expected but Increased Electricity Rates Do Not

Tabulating the results of rate increases in utilities of several hundred communities has made it evident that increasing rates in some classes of utility service gives the full measure of expected relief, while in other classes of service the increased revenue actually derived is not so great as the extent of the rate increase would indicate that it should be. When the need for rate increases in utility business became apparent commercial men began to speculate as to the probable effect. It was remembered that on the occasion of each decrease in rates it had been possible by intensified sales effort so to increase the volume of business as to keep the company's revenues from falling off markedly because of the lower schedule. Moreover, the constant tendency was for patrons enjoying a rate decrease to use more service, so that the actual money paid for service remained about the same after the decrease as before it. Reasoning conversely on this proposition, in anticipation of the coming necessity for increasing rates, it would seem that a curtailment in the use of energy might be expected to follow. This, of course, was taken to mean that rate increases of, say, 15 per cent would not produce a 15 per cent increase in utility revenue.

In some measure this line of reasoning was correct, but with the gas utilities it was totally incorrect. It appears to be almost universally true that a given percentage of increase in gas rates will produce the same and in some cases even a greater percentage of increased revenue. Utility managers believe this is attributable to the difficult fuel situation. Customers, instead of curtailing gas consumption on account of increasing prices, have been forced to use more gas because it was more available and perhaps cheaper than coal or oil.

Electric utilities have not enjoyed the same experience. As an average figure it may be said that a given percentage of increase in electric service rates will produce an increase in revenue equal to only 75 per cent of that indicated by the rate advance. In other words, a 20 per cent increase in rates increases the revenue only 15 per cent. Not only do patrons cut down on the use of energy when the rates go up, but there are other external factors that must be taken into consideration, including the daylight-saving measure and the curtailment of service for classes of lighting not sanctioned by the Fuel Administration.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Bearings for Electric Motors.—G. BASIL BARHAM.—In this article the writer advocates liberal bearing dimensions, especially where the motor is to be subjected to considerable vibration effects. He states that present designers consider that certain maximum products of bearing pressure per square inch and peripheral speed should not be exceeded. He also discusses maximum temperatures at which bearings should operate and the selection of oil and bearing metal, with especial reference to friction losses. He says genuine babbitt metal is the best material thus far developed for bearings. The present tendency toward the use of ball bearings for the operation of high-speed electrical machinery is also pointed out.—London *Electrical Times,* Aug. 15, 1918.

Oerlikon Three-Phase Variable-Speed Motors for Mine Ram Pumps.—Centrifugal and turbine pumps are making great headway for raising water from the mine pit bottom up to the surface, but in certain circumstances the hydraulic ram still offers decided advantages. The Oerlikon Works have applied their variable-speed, three-phase motors for direct coupling to the main ram pump. These motors have large flywheel effect for equalizing the variation of the pump demand. They are squirrel-cage, and control of speed is obtained by changing the number of poles in the stator winding. The motor stators are provided with two entirely independent winding systems, of which one is built for twenty-four and forty-eight poles and the other for thirty-six and seventy-two poles. By combining the load transformer and the pole change-over device in one apparatus it was possible to supply the two winding systems of any pole number with current at a voltage most suitable for the construction of the windings.—London *Electrician,* Aug. 23, 1918.

Lamps and Lighting

Determination and Study of the Lighting Characteristics of Searchlamps.—A. BLONDEL and CH. LAVANCHY.—This treatise deals with the variation in the division of the light in the luminous spot, theoretically circular, thrown by searchlamps, as, for instance, upon a wall perpendicular to the ray, the authors' aim being to solve the problem of illuminating that part of the object on the edge of the beam as brightly as the part in the center. They determine the characteristics, first, in the case of a circular source of light not hidden and placed in the center of the mirror, and, second, in the case of a circular source unconcealed but not exactly in the center. The influence of exfocalization upon the homogeneity of the ray, the angle of flux, the dimensions of the zone illuminated and the luminous power of the ray is considered, and the conclusion arrived at is that with an equal orifice a mirror of minimum focal distance lighted by an exfocalized source, although its coefficient of homogeneity and its utilization of flux are good, has a much feebler luminous power than a mirror where the source is in the center. By a trifling displacement of the lamp it is possible to modify the value and the division of the illumination, but only at the expense of luminous power. The conditions of employment must therefore indicate in every case the respective parts to be assigned to the three properties, luminous power, homogeneity and amplitude of ray. Results will depend not only on the characteristics of the reflector but also on those of the lamp. Light sources of spherical form lend themselves well to obtaining a ray with a luminous central spot of wide dimensions compared with the circumference of the circle lighted. This method is capable of wide application, not being limited to parabolic reflectors but being susceptible of employment with other optical systems, such as Fresnel lenses and Mangin mirrors.—*Annales de Physique,* Ninth Series, May-June, 1917.

Long-Distance Lighting with the Fresnel Apparatus.—A BLONDEL and CH. LAVANCHY.—A similar study to the one just noted, but dealing with the division of light when the Fresnel optical system is used. Recognizing the complexity involved in the study of a refractive system of lighting, the authors have nevertheless established for the usual forms of apparatus (those employing simple lenses, dioptric and catadioptric rings), and for light sources in the form either of disks or of spheres, generalized characteristics which apply to different orifices and permit account to be taken of the influence of constructive characteristics upon the division of the light by means of simple comparisons.—*Annales de Physique,* Ninth Series, May-June, 1917.

Generation, Transmission and Distribution

The Heavy Oil Engine.—CHARLES E. LUCKE.—As stated by the author: "The heavy oil engine is of particular interest at this time because those who are familiar with the problem believe a change is coming in the situation. It is my intention to present, in a more or less informal way, some of the ideas involved in the development up to the present time and also those which lead us to believe that a change is about to take place, and in about what direction." The author takes up the design and construction of heavy oil engines in considerable detail, and points out the fact that there is great room for improvement in these engines.—London *Engineering,* Aug. 2, 1918.

Development of Electricity in Germany.—According to an article in the *Génie Civil,* whereas in 1910 only 28 per cent of the territory of the German Empire was served by electrical networks, to-day 74 per cent is thus served and for another 18 per cent plans are under way. Eighty per cent of the population, it is estimated, used electricity in 1915. In the smaller states electrical development has been left to private enterprise, but in the larger ones, particularly Prussia, Bavaria and Württemberg, the state plays a great part. In Bavaria the government has brought about the consolidation of powerful hydroelectric interests, and an installation of 500,000 hp. is contemplated on Lake Walchen. Another project involves the utilization of the Iller River, which is on the boundary of Bavaria and Württemberg. In Alsace-Lorraine an installation near the mines of Houve is intended to develop electricity from the inferior coal and distribute it at 50,000 volts.—*L'Industrie Electrique*, June 25, 1918.

New Hydroelectric Development on Dead River, Michigan.—Morgan H. Wright.—The new hydroelectric power plant of the Cleveland-Cliffs Iron Company in northern Michigan, when completed, will generate from 5000 kw. to 10,000 kw. and is designed to be operated by natural river flowage without storage equalization. The site of the dam is well adapted to economic construction, as sand and boulders for the concrete were easily procurable and a good anchorage for foundations was provided by the many pot holes in the river bottom. The energy is to be paid for by the operating company on a meter basis and will be used at its Marquette range mines.—*Engineering and Mining Journal*, Aug. 17, 1918.

The Use of Pulverized Coal.—H. R. Collins.—Methods of preparation of pulverized coal are detailed and the advantages in the adoption of the system enumerated. The principal features of the modern practice are presented in condensed form, and the economies said to result from the substitution of pulverized coal are discussed, with details of saving effected in various types of furnaces.—*Engineering and Mining Journal*, Aug. 17, 1918.

Traction

Why Not Use Wasted Energy to Help Heat Cars?—The possibilities of utilizing the heat from car motors and resistance grids are discussed and the results of some tests are given.—*Electric Railway Journal*, Aug. 17, 1918.

Installations, Systems and Appliances

Soot Blowers for Vertical and Hollow Stay-Bolt Boilers.—Details of the various systems employed are illustrated. The protection necessary for blower elements in high-temperature zones is pointed out. Blowers for hollow stay-bolt blowers and other special makes of blowers are described. The article also gives a system designed for continuous soot removal.—*Power*, Aug. 13, 1918.

Effect of Power Factor on Central-Station Operation.—Will Brown.—A discussion showing that good voltage regulation and transmission efficiency can be obtained by installing synchronous motors. The advantage to customers is also pointed out.—*Electrical Review*, Aug. 10, 1918.

Remote Control for Squirrel-Cage Motors.—L. E. Wood.—In this paper the risks involved in electrically operated bleacheries are described. In the case of a certain bleachery in Canada dangers from shock are removed by push-button control of motors and by the isolation of controlling switch gears.—London *Electrical Review*, July 12, 1918.

Electric Power Supply in Germany and Austria.—It is said that as early as July, 1916, in a speech at a war conference in Germany Dr. J. Klingenberg advocated government control of generation of electrical energy, leaving the problem of distribution and sale to the local companies. He suggested that the Prussian government should erect twenty-five to thirty large power stations and interconnect them by long-distance circuits. He calculated that the total cost would be 900,000,000 marks, but that when the system was in full working order there would be a return of 9.56 per cent. Professor Ballod advocated that all the railways and all industrial and agricultural plants should be electrified and that electricity should be produced in large plants of 100,000 kw. and distributed in high-tension mains of 100,000 volts. He calculated that by electrifying the railways it would be possible to save at least one-third of the coal consumed by them, which amounted to about 20,000,000 tons in the year immediately before the war. The cost of coal to home industries should not be increased, nor should the state attempt to make much profit out of the sale.—*Electrical Times*, July 18, 1918.

Miscellaneous

Production of Continuous Current at High Tension for Testing Laboratories.—Jean Sarolea.—Description of apparatus designed for the trial at very high tension with direct current of electric material submitted for final test, particularly that designed for armored cable and aërial lines. Specially constructed Fleming valves are made use of, and these are shown in halftones and diagrams.—*Revue Générale de l'Electricité*, July 6, 1918.

Private Power-Plant Questionnaire.—A. P. Connor.—A specific questionnaire developed by the Fuel Administration and the Geological Survey for the accumulation of data dealing with the development and use of electricity in private plants. It is primarily intended for all plants generating electricity which are not operating as public utilities or are not recognized as such by the public authority. The detailed purposes of the information and its use are not officially announced at this time and may not be later. The intention is to obtain the information first and develop the possibilities afterward, as the needs of the country require or conditions or emergencies make necessary. Much valuable information is expected to be derived from this census of private power plants, and it may form a basis of definite recommendations as to the needs of specific communities that the government or country is particularly interested in.—*Power Plant Engineering*, Aug. 1, 1918.

Charging for Reactive Energy.—The Union des Syndicats de l'Electricité appointed a committee in April, 1917, to investigate the excessive reduction in power factor that occurs in great electrical networks. The committee has not finished its work, but the conclusion can already be drawn that it would be equitable to charge for the reactive energy consumed, but at a lower rate than that charged for "active" energy. There seem to be no obstacles to such contracts being made with customers, and manufacturers are now prepared to supply meters of reactive energy. The short article here noted is written to explain the plan to customers not already familiar with the matter.—*Revue Générale de l'Electricité*, July 20, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ESSENTIAL INDUSTRIES FINANCE CORPORATION

Organized in New York with Strong Banking Support, It Will Aid in Financing Utilities After Liberty Bond Flotation

Plans are announced in New York for organization of the Essential Industries Finance Corporation to aid in financing utilities and other necessary industries. Eugene V. R. Thayer, president of the Chase National Bank, will be president, and Frederick Strauss of J. & W. Seligman & Company and Gerhard M. Dahl, vice-president Chase National Bank, will be vice-presidents. On the board of directors will be represented the Chase Securities Company, Guaranty Trust Company, Central Union Trust Company, First National Bank, J. P. Morgan & Company, J. & W. Seligman & Company, E. W. Clark & Company, Philadelphia, General Electric Company, Westinghouse Electric & Manufacturing Company, and United Gas Improvement Company, Philadelphia.

Organized under New York laws, the corporation will begin business with $3,000,000 capital, divided between $1,000,000 stock, $1,800,000 ten-year debentures and $200,000 surplus. Of the stock $200,000 of Class A shares will be limited as to dividend and will be sold at par; the $800,000 B stock, with no restrictions, will be sold at 125, providing the $200,000 surplus As the business expands, it is planned to increase the capital, probably reaching $20,000,000 ultimately. On that basis the corporation will be able to borrow about $50,000,000 from the War Finance Corporation. Pending the flotation of the fourth Liberty loan the Essential Industries Finance Corporation will not do any financing.

N. E. L. A. POLICY FOR THE WINNING OF THE WAR

To Do No Other than Essential Work During the Year—National and Sectional Committees to Be Ready for Service

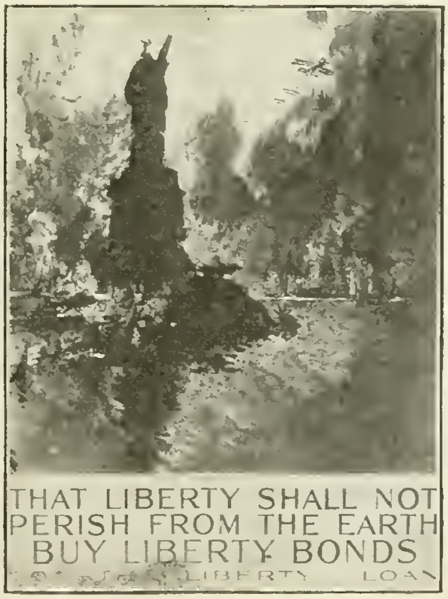
At the meeting of the executive committee of the National Electric Light Association at the association offices, New York, on Sept. 13, President W. F. Wells said that a number of people had asked what the policy of the organization is to be during the coming year. A resolution was then passed, as follows:

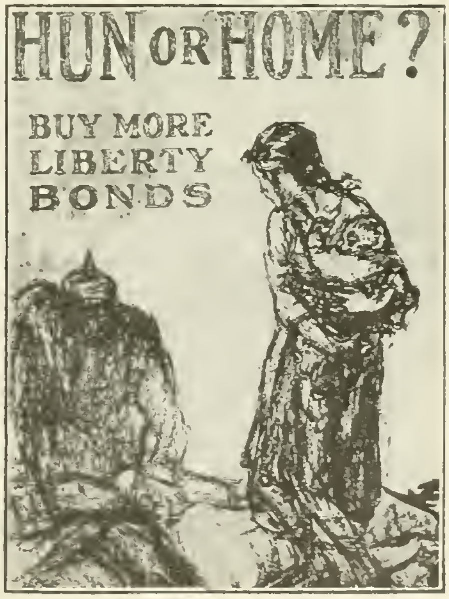
> Resolved, that this association undertake to do no work during the present association year other than that which is absolutely essential for the winning of the war, but that national and sectional committees, familiar with their respective lines of endeavor, be organized so that they may be called into active service in case any emergency arises and consider such other matters as the executive committee deems necessary.

GERARD SWOPE IS IN GOVERNMENT WAR WORK

Vice-President of the Western Electric Company Appointed Assistant to Major General George W. Goethals

Gerard Swope, vice-president and general sales manager of the Western Electric Company, has been appointed assistant to Major General George W. Goethals, director of purchase, storage and traffic. The announcement authorized by the War Department says that "upon the reorganization of the general staff" Brigadier General Hugh S. Johnson and Mr. Swope have been appointed assistants to General Goethals.


THAT LIBERTY SHALL NOT PERISH FROM THE EARTH
BUY LIBERTY BONDS
LIBERTY LOAN



Action Nearer on $200,000,000 Power Law

Steps Taken in Congress and Active Support of President Wilson Strengthen the Prospects of Passage of the Measure to Provide Government Credit for Enlarging Power Resources

PRESIDENT URGES PASSAGE OF THE POWER BILL

In view of the possibility of three-day adjournments by the House and the absence of a quorum from the city, I venture to write you this hurried note to urge that the emergency power bill be pressed to passage, if possible, before adjournment, as it is of capital and immediate importance as a war measure. I hope that it will be possible for you to obtain consent of the House to this action.—*President Wilson to Representative Sims, Chairman of House Interstate Commerce Committee.*

FURTHER testimony before the committee on interstate and foreign commerce of the House of Representatives, the issue of a letter by President Wilson urging prompt action, and the assurance of Chairman Sims of the committee that the measure will be given a preferred position on the calendar of the House, to which it has been reported favorably, strengthen the probabilities of early action by Congress on the bill appropriating $200,000,000 for war emergency power-plant construction.

Charles E. Stuart

Charles E. Stuart, chief of the power section of the United States Fuel Administration, discussing the need for power in the coal fields, spoke of the Central Illinois Public Service Company, the demand on which has doubled within eight months. As the result of insufficient water supply, the fifty-odd mines on this plant were closed down nearly a month. The capacity of the plant is also insufficient to take care of the mining load. Until a radical improvement with respect to both the generating system and transmission system is made it will be impossible to supply to all of the mines power to give continuous service. These mines supply very largely by-product coal, and the blast furnaces of the United States Steel Corporation in Illinois have been closed down on account of a lack of supply of by-product coal. The eastern Kentucky coal fields have had a heavy loss in production from similar causes.

Mr. Stuart added that various improvements to safeguard the service with the money available could be made in three to six months. In the coal fields of Colorado and Wyoming there has also been a loss of production on account of power troubles, he said. These troubles could be remedied quickly were it possible to finance the requirements. "In using the word 'quickly,'" said Mr. Stuart, "I have reference to a period of from three to six months to apply temporary improvement, and possibly a greater period in which to make improvements of a broader character.

"In the central Pennsylvania coal fields they are losing heavily in production on account of insufficient generating capacity and line trouble. The power company serving these fields has just canceled an order for a 10,000-kw. turbine, in spite of the fact that this field now has insufficient generating capacity, because it thinks it has no way of financing it."

SITUATION IN CENTRAL ILLINOIS

Mr. Stuart then quoted from a letter from a group of mines in Ohio operated by the Jefferson Coal Company. The president wrote that the mines were idle on the previous day for lack of power. These mines are in what is known as, broadly speaking, the Pittsburgh district, where there is a great deal of power trouble at the present time.

Mr. Stuart also referred to a letter from Mr. Honnold, the district representative of the United States Fuel Administration in central Illinois. Mr. Honnold asked whether there is any chance that the power bill will get through and through quickly. He referred to the fact that the mines of the central Illinois district are being seriously curtailed, as a result of insufficient generating capacity. "In other words," Mr. Stuart declared, "it is a case of—well, it is a case that the biggest coal-producing districts of the country are suffering seriously from a shortage of power and of generating capacity, and on account of conditions which, were the money available, could be quickly remedied."

Several other cases were cited by Mr. Stuart. The Bethlehem Steel Company of Bethlehem, Pa., on the electric system of the Lehigh Navigation Electric Company, is short of power. To supply its requirements 25 per cent of the power for the cement companies in that district has been cut off. The Bethlehem Steel Company's requirements are increasing every day, and unless an increase in power can be supplied within six months some very important industries, like coal mines, will have to shut down on power to give the supply that is needed. The immediate remedy in this case is the installation of additional horsepower in the Hauto plant of the Lehigh Navigation Electric Company, at an approximate cost of $1,250,000. An increase can be made in from four to six months.

A very serious shortage exists around Newark, N. J., on the lines of the Public Service Electric Company. Such shortage can be partially remedied by taking power from New York to the extent of 20,000, at an approximate expense of $1,500,000. Such relief can be obtained in about four months and is greatly needed for very important war work.

The district supplied by the Mahoning & Shenango Railway & Lighting Company from the station at Lowellsville, Ohio, is very short of power, and it is planned to install 20,000 hp. additional. With the money available such an addition could be made ready for service by May 1 next at an approximate cost of $1,500,-

000. This company supplies many steel companies which are very important for the war program. The Pittsburgh and eastern Ohio district is acutely short of power at the present time and will be much more so during the year 1919.

The large power plant at Windsor, W. Va., can be increased so that 40,000 hp. additional could be ready by about July 1 next, and 40,000 hp. more by Nov. 1 next, with the money available to go ahead immediately. Also a tie line between this place and Pittsburgh is required. The total approximate cost of such extension is $9,000,000.

PITTSBURGH DISTRICT CONDITIONS

"Those are simply a few of the typical cases," Mr. Stuart testified. "To illustrate further, I made a survey in what is known as the Pittsburgh district about three weeks ago, on account of the serious complaints that were coming in from the 200-odd operations receiving power in that district to the effect that they were forced to close—that power was cut off from two to four times a day for a period of from ten to fifteen minutes each time. When mine power goes off the mine stops. The ventilation stops and the men leave the mine. In the first place they are not allowed to stay in the mine. In the second place, no man will stay in a coal mine when the ventilation goes off. When the miners leave the mine they don't come back. The result was a very heavy curtailment of production in the Pittsburgh district, where the bulk of the coal is of the by-product character.

"Now the question was how that service interruption could be relieved. There were three alternatives—one, that of throwing everything possible on night service; second, that of closing a certain number of coal mines down, and third, that of closing the steel mills down. To-day the limitation on the output of steel is by-product coal. By-product coal was being produced in that district, so actually in order to take care of that situation it was decided to shut down the steel mills for lack of power.

"We were warned by England that England's program was set back from nine to twelve months by the fact that she went ahead and built up her plants for manufacturing war materials and failed to provide power to take care of those factories. We are to-day in exactly that same position. We are already in that position where there is a serious curtailment, as I have just cited in the case of the Pittsburgh district there, but the worst part of it is that this shortage is growing steadily and will really become the limitation on the output of our equipment."

Mr. Stuart displayed a chart that was made to illustrate the situation in the Pittsburgh district. It was made by the Fuel Administration working in conjunction with statistics from the Westinghouse, the United States Steel and the power companies. It shows, for instance, that an investment of $18,000,000 in central-station power equipment and plant produces $366,000,000 of corresponding manufactured products. It shows that an additional development of $32,000,000 in central-station equipment will produce an additional $452,000,000 worth of corresponding manufactured products.

Mr. Stuart—In order to use that $32,000,000 to advantage we will have to put in some very extensive transmission lines. We will be covering a larger area from the central generating points, and that would account for a considerable increased cost.

Representative Esch—You mentioned the Illinois field, did you not?

Mr. Stuart—Yes sir; the central Illinois field.

Representative Esch—This same list indicates that there is a surplus of power in the Chicago district.

Mr. Stuart—That is true.

Representative Esch—And also in the district of Davenport, including Moline, Rock Island, etc.

Mr. Stuart—Yes sir, all of which are outside of the district which I speak of.

Representative Esch—Which coal district did you have more particular reference to, the central, southern or northern?

Mr. Stuart—Central Illinois. In fact, we have gone very carefully into the question of whether power could be brought into that district from one of the nearby centers where there is an available surplus, but the nearest point apparently is about 100 miles away.

Representative Esch—Is there any surplus of power at the Keokuk dam?

Mr. Stuart—Very little; none that we could call upon for this district.

MORE GENERATING CAPACITY NEEDED

In explaining one point in his testimony Mr. Stuart said that he referred to those centers in which there is a lack of capacity or a lack of equipment. "It would do no good to take over the plants in those sections nor for the government to operate them, because they are now being operated," he continued, "as a general proposition, to the best advantage. For instance, in this central Illinois coal field that I speak of we are actually administering the power to the coal mines, in order to see that that power is most advantageously distributed. The power company has made no objection to doing that. We have had a man with that company telling them how to do it to the best advantage, and there is no trouble from that standpoint. But that does not solve the question because what they need there is additional generating capacity and equipment. . . .

"You may say that we have exercised power in the case of the Central Illinois Public Service Company. You understand we haven't done it in the sense of commandeering it. It has been a mutually agreeable understanding between the Fuel Administration and the power is being distributed to the best advantage. But, as I say, even after that we haven't got the surplus to take care of the situation. The bare fact of our taking it over doesn't do more than help, that is all. Those people need money. They need equipment, and the question is how are they going to get it?

Representative Esch—Well, your point is that the law under which you are operating does not give you power to enlarge an existing plant for power development purposes.

Mr. Stuart—No, it does not. In other words, Secretary Baker thoroughly appreciates the seriousness of this condition, but there is nothing that he can do by commandeering, for instance, that would help. After he commandeers he has still got to have the money to do this work with, and there is no appropriation covering that. . . . For instance, Admiral Harris has just taken over the Norfolk central-station system, because Admiral Harris felt he could operate that to better advantage. He did it, of course, under this law that you mention, but Admiral Harris has no money with which to put in additional equipment.

Representative Snook—This bill also carries the power to build and equip new plants, and from your statement as I understand it, so far as the coal situation is concerned, the need can be supplied by giving aid to plants that are already in existence?

Mr. Stuart—Yes, sir.

Mr. Snook—Would it require the building of any new power plants?

Mr. Stuart—In no single case where the coal fields are concerned would it be necessary or advisable to build a new plant. In all cases it would be an enlargement of existing plants—at least that would be the practical way to go about it and the quick way to get results.

Seriousness of the Power Situation

In concluding Mr. Stuart said: "I assume that the various people who have testified here have made clear to you how immensely serious this power situation is. It is absolutely inconceivable that something has not been done about it before; that some means has not been extended in order that power necessary for war industry should have been developed. We have the precedent in the case of England, as I stated a little while ago. We can't make shells unless we have power to make them with. The curtailment of power or the lack of power in the central districts has a direct effect on the production of shells, of guns, and of all other material necessary on the other side. We have millions and hundreds of millions for the ammunition that we need, yet the power that goes into the making of those shells is just as essential as the steel that goes into the making of them.

"We don't ask what becomes of these shells when they go to the other side, yet we are raising an awful row about any money that is extended to these power plants to produce the power that is making the shells, in spite of the fact that any money we do put into these power plants is not wasted money; it is a good investment and should be regarded as such. In other words, when these two or three or four hundred million or one or two billion dollars' worth of shells goes over to France we know that it is going into thin air. The $200,000,000 which Congress has been asked for to produce that stuff becomes a permanent investment, and that is just as necessary as the material itself. It is simply incomprehensible how any question can be raised over the necessity of a measure of this character—at least it is incomprehensible to the engineers who know the seriousness of the situation. It should have been taken care of a long time ago."

Howard R. Gans

Howard R. Gans, counsel for the Treasury Department, testified that he drew the bill after consultation with the people in the power section of the War Industries Board, who told him how immediate and urgent the demand was for increased power. He felt that there was only one theory to adopt and that was to treat it as an emergency matter, practically as a military necessity, and therefore to endeavor with such safeguards as would not interfere with prompt and efficient action to vest the President with all possible power to control the situation.

Representative Parker of New Jersey asked whether the general power given to the President in the bill was intended to authorize him to build as many plants as he deemed necessary, whether water or steam, and hold them as long after the war as he thought advisable and operate them.

Mr. Gans replied: "My theory was that he ought to have the authority to build as many plants as in his opinion the exigencies of the war situation demanded, and that he ought to be permitted to operate them until such time as he could make an advantageous transfer of them, so that the United States should be protected in the sale or transfer of them from absorbing an undue amount of loss. My theory was that if you try to limit that period specifically, and the limitation of it was considered in the drafting of the bill, in many places you might come across this situation: That there was only one financial interest or one group of financial interests who would be prepared to take over a power plant that had been built by the government, and that as soon as you fixed a limitation to the time during which the government could operate, they would practically be in the situation where they could get that plant at their own price or force the government to scrap it, and I thought that the United States ought not to be put in that situation and that it would be much better to vest the President with broad discretionary power, after you had defined the purposes for which he should exercise that power, by saying 'for such time as he may deem necessary or advisable for the purpose of selling or otherwise disposing thereof.'"

Use of Hydraulic Power

In replying to another inquiry by Representative Parker, Mr. Gans said that the bill would permit the President to build a power plant to be operated by hydraulic power anywhere within the United States. "But my thought was," he added, "that the water-power bill contemplated primarily the erection and maintenance of power plants as commercial ventures, such as would be possible in normal times when construction costs were normal, and was bound to be ineffective for the purpose of increasing our power facilities during this period of strictly abnormal costs."

Defining the purpose for which he felt plants might be built, Mr. Gans said: "For military purposes, defining that term as it must be defined in the present exigency broadly enough to include the provision of power for purposes subsidiary to what might be called the limited military purposes."

Representative Montague—You mean to say by that then that the object would be military but that there might be necessarily an incidental output that might be devoted to commercial uses?

Mr. Gans—Precisely so, sir.

Speaking further on this point, Mr. Gans expressed the opinion that the language of the bill leaves a wide discretion in the President in defining what is military and what is not, and that under the language of the bill he might possibly erect a plant for the purpose of supplying a necessity that might not ordinarily be conceived as a military one.

Representative Montague—Then, how would you justify that under the purposes of the bill?

Mr. Gans—I was told that the exigencies of this situation were—and my information in other relations with other departments of the government substantiated that—that the need of war production is such and the lack of power facilities for that production is such that it is almost impossible to conceive that any power administrator under the President, and much less the President himself, could divert any of the funds supplied or any of the labor that would be necessary for material for the construction of power plants to any purpose other than that which directly or indirectly appealed to him as being a military necessity.

Representative Montague—In other words, that under the present exigencies all economic and industrial output is, *ipso facto*, military output.

Mr. Gans—Well, I wouldn't go so far as that, because, let us say, for instance, pianos—one would say definitely that pianos, the making of pianos and the diversion of labor and material and power to the making of pianos was not a military necessity. . . . I should say that in this present situation everything that is necessary to support the army is a military necessity.

Representative Parker—Or the people.

Mr. Gans—Or the people. And I think that the President or some authority ought to be in the situation to enable the country to provide for those necessities, whether for the army and navy or for the civilian population, so that we may survive during this war.

Mr. Gans explained that "one of the problems put to me when I started the drafting of the bill was situations in some municipalities where, as I was told, the municipalities would be quite ready to have that power vested in the federal government so that their plants and private power plants, either in existence or those that might be built, should be brought together and operated as practically a single unit, either through the leasing of power or the interchange of power or the hooking up of two plants by transmission lines."

The Government and the Street Railways

Representative Snook brought up the point that the government is being asked to appoint an administrator over electric railways.

Mr. Gans said that the bill would go far enough to take over the power plants that supply the street railways, but it would not go far enough to permit the government to operate the street railways under any provision in the bill that he intended to have there or that he knows is there.

Representative Montague—May I ask this question? It is not contemplated to take over all the power plants in America, is it?

Mr. Gans—I should think not, sir.

Mr. Montague—What will become of those not taken over, if you throw them into competition with those that are taken over by the government?

Mr. Gans—I think probably that where power plants are operating in places where they are sufficient the government won't enter the field at all.

Representative Montague—Won't they all be inefficient to a sufficient extent to justify them, in their own opinion, in asking the government to aid them by loans?

Mr. Gans—Well, I think not, and I think that if they do, they will probably find that their applications will be turned down.

Cost-Plus Plan Not Favored

Referring to the question of construction and costs, Mr. Gans said that from what he had learned of the experience of the government he was inclined to think that the cost-plus plan is not likely to be adopted under any circumstances where any other plan can be adopted. Generally speaking, better results are obtained by not trying to limit the administration in such detail.

Representative Esch asked whether the contractee had any recourse in case he feels that the terms imposed by the President are unreasonable.

Mr. Gans said in reply: "Only the general power that is provided and protected by the Constitution, that is, that property may not be taken without due process of law, and the provision in this bill for appeal to the Court of Claims."

In speaking of the provision for acquiring private power plants Mr. Gans said, "Dr. Maltbie has suggested an amendment which I think ought to be inserted, and that is that power might very well be limited with respect to municipal plants." He will consult with Dr. Maltbie about such an amendment.

Mr. Gans, replying to a question by Representative Esch, expressed the opinion that, under the provisions of the bill, where the government takes over a plant its rates supplant any rates that are fixed by the regulatory body of the state.

Mr. Esch asked if that would lead to any clash of federal and state authority.

Mr. Gans—I consulted with one of the public service commissioners of New York City with respect to that feature, and his opinion was that the public service commissions throughout the country would be ready to coöperate and to acquiesce in anything that the government thought necessary for the effective conduct of the war.

Representative Esch brought up the suggestion that it would be better if the rate-making were left in the hands of an existing body like the Interstate Commerce Commission.

Mr. Gans thought that the making of rates would probably be an individual matter to be determined with respect to the situation in a particular community.

Before concluding his testimony Mr. Gans made the following statement: "In some particular locality, conceivably, the difference between the war cost and the value of the property at the end of the war may be very slight. The growth of the community, the demands of the community, may be such that at the end of the war the value of this property will be equal to its war cost. In other places, where the installation has been solely by reason of the war needs and where some plants have been created in an area that is not going to grow, the absorption of the difference between the cost of installation and the value after the war may be very great, and it is one of those things that will be determined only by experience. Therefore it seems to me that in order to make this provision workable, it is necessary to leave the agreement to provide that whatever that loss is may be absorbed by the government."

NEW ENGLAND-BOSTON POWER INTERCONNECTION

Transmission Line Between the Two Large Systems Will Assure 15,000 Kw. to 20,000 Kw. for War Industries

By the construction of a high-voltage tie line, to cost $620,000, between the systems of the Edison Electric Illuminating Company of Boston and the New England Power Company, war industries in central New England will be supplied with 15,000 kw. to 20,000 kw. of off-peak energy and the production of war material increased at a time of vital importance in the country's history. The necessity for the new line has been declared in a decision of the Massachusetts Gas and Electric Light Commission dated Sept. 18, and the government has approved the issue of the requisite capital. The new line will connect the two largest systems of electrical energy supply in New England.

During the past year the New England Power Company has dispensed with its soliciting department and has endeavored to avoid taking additional load whenever possible. The increase in the demand in the territory, however, has been so great that the tie line has become essential to the handling of the load during the coming winter. Practically the entire supply of the power company is taken up by war or essential industries, including public utilities.

In December, 1917, the load of the New England company reached a demand of 68,000 kw., and a canvass of customers recently completed indicates that 35,500 kw. in addition will be demanded this year, making a total of about 103,000 kw. to be delivered in December. The engineers of the New England company assume that the company must have available sources of supply sufficient to carry its load, (a) with the largest generating unit either in its own plant or in that of its steam auxiliaries out of commission, and (b) upon the assumption of low water at the hydraulic plants of the system. The maximum capacity of the hydroelectric plants of the system under the most favorable conditions of stream flow is approximately 50,000 kw., and 27,000 kw. has been assumed as a fair average value of the corresponding production in times of low water. This is not the lowest condition the system has known, as in the last week of August, 1918, the daily ten-hour average of the system was only 22,000 kw.

The load of 68,000 kw. in December, 1917, was carried to the extent of 6000 kw. by the Turners Falls Power & Electric Company. That company's load has now grown to such an extent that it can no longer furnish the New England company with any energy. Hence the present sources of supply of the New England Power Company based on the average low-water condition referred to above are: Hydraulic plants, 27,000 kw.; Wachusett (state) plant, 3000 kw.; Uxbridge steam plant, 5000 kw.; Worcester Electric Light Company, 5000 kw.; Narragansett Electric Lighting Company, Providence, R. I., 20,000 kw.; miscellaneous, 2000 kw.; total, 62,000 kw.

The additional sources of supply to which the New England company is looking for energy are: Increase in capacity of Narragansett plant, 9000 kw.; Shore Line Electric Railway plant, near New London, Conn., 9000 kw.; additional capacity at Uxbridge, 10,000 kw.; Boston Edison tie line, 15,000 kw. With all the above sources of supply the New England company will just be able to carry the load now in sight. The estimated load of 1918, not including the Fall River (Mass.) Electric Light Company, Lansdale Company, Nashua Manufacturing Company, etc., whose load will not come on before November, is as follows, for the New England Power Company:

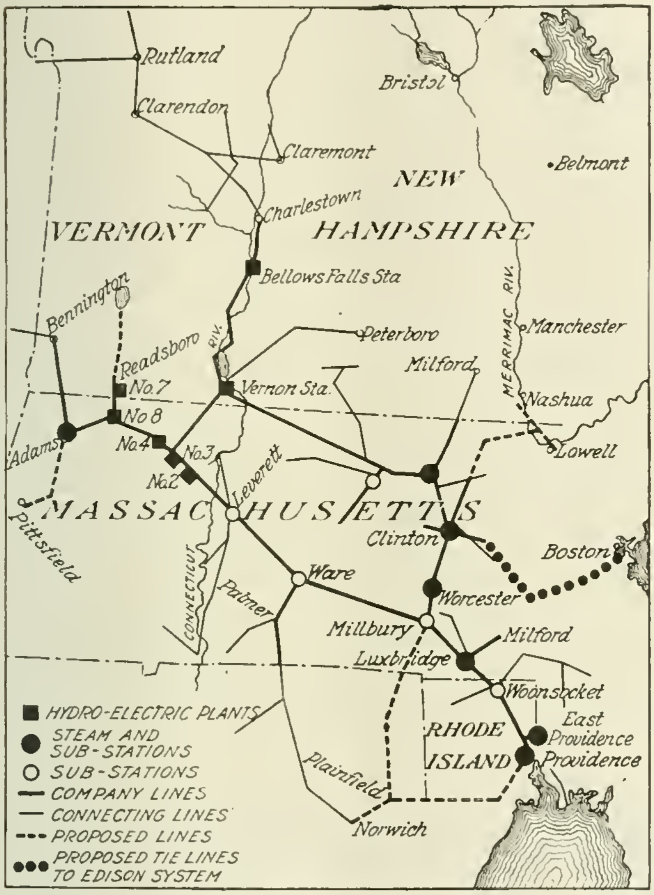
Class of Power	Annual Consumption, Kw.-Hr.	Per Cent.
Trolleys	36,915,000	14.0
Electric light companies	99,544,000	38.0
Textile	40,549,000	15.5
Steel and wire	21,651,000	8.0
Machine shops	26,052,000	10.0
Paper mills	30,891,000	11.5
Rubber and miscellaneous	8,552,000	3.0
Total	264,154,000	100.00

At the public hearing before the commission relative to the necessity for the tie line between the Edison and New England systems, President Henry I. Harriman of the latter said that it would take two or three times the capital to be invested in the line to supply the power by new steam plant equipment. The market is far oversold on turbines, something like 14,000,000 hp. being on the books of the manufacturers for land, naval and merchant marine purposes. The $600,000 or thereabouts which the line will cost will not build in a steam plant more than 5000 kw. Put into a connection it enables an interchange of about 20,000 kw. The War Industries Board states that it would much rather have the money spent in pole lines than in turbines because of the enormous demand for the latter. The New England company has no more water power at present. It had hoped to build a million-dollar development at and above Davis Bridge, in Vermont, but the scarcity and high cost of money have precluded that work at this time.

The Edison interconnection will conserve fuel through production of energy at maximum station efficiency on tidewater. The New England company expects to take from 30,000,000 kw.-hr. to 40,000,000 kw.-hr. yearly over the tie line, which is planned to extend from Forest Hills, Boston, through Dedham, Westwood, Dover, Natick, Sherborn and Framingham to the state plant at the Sudbury dam in Southboro, which is connected via Clinton with the New England system. The New England company guarantees to take off-peak from 30,000,000 kw.-hr. to 40,000,000 kw.-hr. yearly for ten years at a fixed price of 2.5 mills to cover interest upkeep, depreciation and taxes (15 per cent on $600,000 to $650,000), and an agreed price of about 8 mills total, including the former and depending upon the generating cost to the Edison company and the use of the line by the latter.

The New England company has canvassed all the tidewater generating plants between New York and Boston in an endeavor to secure an additional energy supply, and the Boston system appears in the best position to render such service. The Boston company will place a new 35,000-kw. unit in service in the near future, and it is hoped that the arrangements for serving additional energy at Uxbridge and elsewhere will work out satisfactorily before winter.

The tie line is to be operated at 25,000 volts through the Boston district, principally through underground cables. From Forest Hills to Dedham it will be operated at 25,000 volts, with overhead construction, and from Dedham to Clinton at 66,000 volts. From Dedham to the Sudbury dam it will be necessary to build a new pole line designed for 66,000-volt operation, and from the Sudbury dam to Clinton the existing 66,000-volt line of the Metropolitan Water & Sewerage Board will be utilized. The Sudbury station of the latter will be equipped with transforming and switching apparatus by which it can be used to feed into the 66,000-volt tie line to Boston if desired. The hydroelectric plants at the Clinton and Sudbury dams are owned by the State of Massachusetts, being associated with the Boston water supply system. These two stations will be operated as a part of the interconnected Edison and New England Power systems when the line is completed.



HOW INTERCONNECTION MEANS MORE POWER FOR WAR INDUSTRIES

Valuable Connection for Boston District

During four hours of the day in the three winter months the Edison company reserves the right to cut off the supply to the New England company. It is expected that the construction of the new line will afford a connection of permanent value to the important industrial territory in the Framingham-Natick district of the Boston Edison system, the existing lines having reached practically their limit of capacity. The Boston company feels that the investment in the interconnecting line will not be lost even if the contract with the New England Power Company is not renewed at the end of ten years. At present the Boston company is receiving about 1400 kw. from the state plant at the Sudbury dam, which is delivered at the Hopkinton substation, the present extreme point of the Edison transmission system. Without that supply the company would have had to build a line some time since to supply the service now required. The Edison company has purchased a right-of-way down the Medway district from a point in Hopkinton and proposes to extend a tap into the Medway district to improve the service conditions. The company owns a right-of-way across country nearly to the Rhode Island line.

In view of the fact that the New England Power Company's load will be supplied off the Boston Edison peak, it is anticipated that the effect on the latter company's plant at L Street, South Boston, will be beneficial to operating economy. The arrangement means much in the way of reduced coal consumption per unit of output, as the boiler plant will be more evenly loaded. The Boston company's customers are being solicited to modify their working hours next winter in order that the Edison peak may be reduced and coal saved. The company expects, if the coal question becomes serious, that it can get 10,000 kw. of the existing load to stay off thirty minutes of the peak and effect a material saving in fuel.

In the decision authorizing the project, the Gas and Electric Light Commission said in part:

> The legislation under which this authority is sought was enacted at the suggestion of the board. It involves no new principle or policy, but is in furtherance of the development on sound economic lines of the production and distribution of electricity already in progress. But the shortage of coal and its high cost and the tremendous stimulus of the war to the industrial activities of the commonwealth have revealed as never before the importance to the public interest of cheap and reliable power. In view of the necessity of marshaling all industrial resources to the support of the government in this great national emergency, it was the purpose of the legislation in question to require the interconnection of existing power systems, where not undertaken voluntarily, whenever it should appear that the public welfare would be promoted thereby, and incidentally, whether undertaken voluntarily or involuntarily, to relax some of the restrictions which had been deemed wise in peace times relative to the construction of the necessary transmission lines.
>
> In this case the companies are acting on their own initiative and upon terms suggested by themselves. The only issue, therefore, which calls for decision by this board is whether or not the public welfare will be promoted by the construction of the line. This is not a question which should be answered on any narrow grounds, nor solely with respect to the embarrassment of the New England company should it be unable to fulfill its obligations to its customers during the coming winter. The question is broader and involves the interests of the commonwealth as a whole and of the nation as well. Started as an enterprise for the sale of hydroelectric power to private industries in bulk, the lines of the New England system, as pointed out, reach practically all of the industrial communities in the middle section of the commonwealth. Not merely to the industries which they supply but to the communities as well they have become integral parts of an increasingly essential public service. It is doubtful if the company could refuse additional service if it would, and certainly in the public interest there must be no curtailment of power necessary to support to the full the government war program.

Let Your Children Have Peace

NORTHWEST ASSOCIATION HOLDS ANNUAL MEETING

Delegates Oppose the Arbitrary Limitation of Rate Increases to Duration of War—L. B. Faulkner of Olympia Elected President

The eleventh annual convention of the Northwest Electric Light and Power Association met in Portland. Ore., on Sept. 13. Because of the abnormal conditions in the central-station industry it had been determined by the executive committee that in place of the usual three-day convention a one-day session should be held at which representatives from Class A (member companies) should be invited to participate. About forty representatives attended.

The morning session was devoted to the address of the president, Guy W. Talbot, Pacific Power & Light Company, Portland, Ore., the report of the secretary and treasurer, George L. Myers, and the appointment of the resolutions committee and the auditing committee.

A telegram was read from President W. F. Wells of the National Electric Light Association conveying his best wishes for the success of the convention and suggesting that the association "renew the resolve made at the Atlantic City meeting to pledge all that we have and all that we are to carry this war to victory."

The afternoon session was taken up with reports of committees and general discussions.

REPORT OF THE PUBLIC POLICY COMMITTEE

The public policy committee reported that it had met and adopted resolutions on the rate situation. One of these urged the members to exercise all proper endeavors to amend the act limiting the power of the Washington commission properly to discharge its duties as a regulating body and to provide fares adequate to meet the conditions of street-railway operation.

While the association is not representative of the electric railway industry, it had knowledge of the serious plight in which that industry had found itself by reason of the arbitrary provision of the public service commission act of Washington that fixed a maximum fare of 5 cents. Inasmuch as many of the light and power companies also own and operate electric railways, it was deemed just and proper that the association should pledge itself to coöperate and aid with a view to remedy the condition.

The second resolution follows:

> Resolved, that in applications for rate increases due to increased cost of materials and operations we are opposed to the system of adding surcharge to existing rates as inconsistent with the theory of regulation, and be it
>
> Further resolved, that we advocate the establishment of rates by regulating bodies based upon existing conditions, reserving unto the regulating bodies, as now by law provided, full power to change or alter such increased rates at any time conditions may justify.

The purpose of this resolution was to take a stand opposed to any arbitrary limitation of rate increases to the duration of the war, which would particularly apply in the case of any surcharges or surtaxes. It was agreed that the fixing of rates upon the basis of existing conditions with the reservation of full power to change or alter any increased rates at any time that conditions justified would serve as a protection both to the public and the industry. No doubt immediately subsequent to the war the abnormal conditions of high prices will remain for some time, even though probably in a less degree, and if the public is to have adequate service and the industry to remain solvent and in a state of requisite efficiency to meet service demands, there must be sufficient revenue. Any limitations of increased rates to the war period are inequitable and uneconomic, because they would not be responsive to the conditions that prevail at the close of the war.

The auditing committee found the finances of the association to be in excellent condition, with a much more favorable cash balance than at any previous time, due to restricted expenditures, and recommended that as there was a rather large working fund perhaps 50 per cent of it might well be invested in some manner, either in Liberty bonds or other securities.

H. H. Schoolfield, Pacific Power & Light Company, Portland, a member of the hydroelectric and technical committee, gave a brief résumé of that committee's activities. He was followed by F. H. Murphy, Portland Railway, Light & Power Company, chairman of the committee on coöperation with electrical contractors, jobbers, manufacturers, etc.

The presiding officer then asked each representative to recite briefly matters of interest to him and the problems of his particular property. This proved an interesting diversion from the routine of reports and gave a personal touch to the proceedings.

When reports were resumed the first report was that of the labor study committee. This report was made by John Harisberger, Puget Sound Traction, Light & Power Company, Seattle, as representative of W. H. McGrath. This committee had been especially active, sending out an extensive questionnaire to light and power companies in association territory and some Western states outside of its territory. This made pos-

WAR RESOLUTION ADOPTED BY NORTHWEST ASSOCIATION

RESOLVED, that we, the officers and members of the Northwest Electric Light & Power Association, in annual meeting assembled, do hereby confirm and renew the assurances to the President and all others in authority of our support and coöperation in maintaining and carrying on the war, as set forth in the resolution adopted by our representatives at the annual convention of the National Electric Light Association at Atlantic City on June 13, 1918. At this moment, as the heroic, war-tried armies of our allies and the new and mighty American army have so successfully begun the final march to victory, and as this nation has completed the enrollment of additional millions of its sons to assure the speedy, unlimited exercise of the nation's power in the supreme effort before us, we again solemnly pledge every effort and every resource of ourselves and our industry, unqualifiedly and unreservedly, to the support of the President and of the nation to the prosecution of the war to a victorious and complete realization of the noble aims for which we have taken up arms. Come whatever burden or whatever sacrifice, no hand will falter or no spirit fail until these objects shall have been definitely and permanently accomplished.

sible a very complete report on wages, hours and working conditions. However, owing to the rapidly changing situation as affecting labor, the committee felt it impossible to make any fixed recommendations as to labor policy. No policy of uniformity in labor conditions and wages could be undertaken in view of the keen industrial competition for labor, the demands of the military and naval establishments and the revenue situation as it affected each utility.

A. C. McMicken of the electric range committee informed the meeting that it was the opinion of the committee that as range work in the West was so far ahead of any other parts of the country, and even ahead of the manufacturers, the committee should be discontinued for the ensuing year. Chairman Coldwell of the executive committee stated that this would be a subject for consideration by that committee.

Secretary Myers then submitted the report of the resolutions committee. One resolution provided for the appointment of a committee of two by the incoming presiding officer to address Secretary of the Treasury McAdoo, asking him to request the legislators of the Northwestern States to refrain from introducing and passing any legislation detrimental to the public utility companies of these states.

The nominating committee, of which Lewis A. McArthur, Pacific Power & Light Company, is chairman, then made its report, which was adopted. The new officers are:

President—L. B. Faulkner, Olympia (Wash.) Light & Power Company.

Vice-president for Washington—H. L. Bleecker, Washington Water Power Company, Spokane.

Vice-president for Oregon—H. L. Walther, California-Oregon Power Company, Medford, Ore.

Vice-president for Idaho—William T. Wallace, Idaho Power Company, Boise.

Vice-president for Montana—J. F. Roche, Montana Power Company, Butte.

Members of the executive committee—H. J. Gille, Puget Sound Traction, Light & Power Company, Seattle; Lewis A. McArthur, H. L. Walther and H. L. Bleecker.

GOVERNMENT LOAN FOR THE LORAIN (OHIO) PLANT

War Industries Board Decides to Loan $400,000 to Lorain County Electric Company to Aid in Power-Plant Construction

B. M. Baruch, chairman of the War Industries Board, authorizes the announcement that, in order to help out the situation in the Lorain (Ohio) industrial district, where the present power is inadequate for the government and other work placed there, the board has decided that aid shall be extended the Lorain County Electric Company in the construction of its power plants now under way.

To carry through the plans of the company the government will make a loan of about $400,000 and will share with the company the war wastage. Officials of the company have shown complete willingness to agree with the government officials as to conditions imposed in connection with government aid.

There is much important War Department and Emergency Fleet Corporation war work under construction at Lorain.

The Lorain County Electric Company is a subsidiary of the Cities Service Company.

The World Power Is Liberty's

AID NEW CONSTRUCTION PLAN IN CHARLESTON, S. C.

Cost of Installation of 5000-Kw. Turbo-Generator Is to Be Met in Part by Advance from War Industries Board

The Charleston (S. C.) Consolidated Railway & Light Company is expending $750,000 for additional construction machinery. A 5000-kw. turbo-generator is to be installed. Of the above amount $350,000 will be financed by the War Industries Board.

SOME OF THE DELEGATES AT THE BEDFORD SPRINGS CONVENTION OF THE PENNSYLVANIA ELECTRIC ASSOCIATION

INTERCHANGE OF ENERGY IN CALIFORNIA CRISIS

Securing of Additional Kilowatt-Hours Is Properly Given Precedence Over Fuel-Oil Saving Under Present Conditions

The power shortage in California has become so serious that the energy supplied to many of the largest consumers has been curtailed, and still further reductions in energy allotments are in prospect if rain does not afford early relief. The driest season in forty-nine years has occurred at a time when there has been practically no hydroelectric development for several years, and demand has been increasing at the rate of about 25 000 kw. a year in the territory served by the group of companies in central and northern California. To meet this situation the power companies have made new interconnections to unite all the lines into one closely knit common system, and authority to interchange energy for the good of the interconnected system considered as a whole has been centralized.

A significant feature of the situation is that the conservation of stored water takes precedence over the conservation of fuel oil. In other words, the highest economies are considered to be attained by those methods which will keep the maximum number of consumers on the lines rather than by those methods which will reduce the consumption of oil to the minimum. As the situation stands now, 40 per cent of the power used is generated by steam and there is insufficient hydroelectric power even in normal years to carry the entire load.

In some of the plants it is possible to use 100 per cent of the power available, while in other plants on a continuous twenty-four-hour run only about 50 per cent of the available capacity can be utilized. Since the combination of the systems, and with a free hand in the interchange of energy, the director of operations has been able to draw upon the several generating stations in such a way that a greater number of kilowatt-hours can be taken from the combined systems than would otherwise be possible. For example, in the Stanislaus plant of the Sierra & San Francisco Power Company the most economical plan of operation has been to shut down the plant and utilize the forebay for storage during six hours of the day in order that it may be run at full load and at higher efficiency for the remaining eighteen hours of the day. In this particular plant the capacity of the installed machinery exceeds the capacity of the supplying canal. It could not be utilized at higher efficiency if the load of the Sierra Company alone were considered, but considerably more power for the same water supply was secured when the plant could be operated as part of the interconnected system.

Additional interconnections now under way will provide for the delivery of about 8000 kw. to 12,000 kw. from the northern part of the state to the large central group of companies. This additional energy required the closing of two gaps in the transmission-line network. One between Colusa and Colusa Corners is being built by the Pacific Gas & Electric Company. It will have a capacity of 12,000 kw. and will operate at 60,000 volts, connecting that company with the Northern California Power Company. The other is between Kennet and Castella, connecting the California-Oregon Power Company and the Northern California Power Company. This is a 33-mile line being built by the California-Oregon Power Company and will have a capacity of 10,000 kw. Both lines are expected to be in service about Oct. 15.

The interconnection of California systems has not had as much effect on load factor as would be expected by one not familiar with the Pacific Coast situation. The California systems were already inclusive in the character of load on the lines, and the diversity was such as to afford high load factors. For example, the annual load factor of the Pacific Gas & Electric Company for 1917 was 61½ per cent on a total delivery of 854,000,000 kw.-hr. The load factors of the several companies have not been materially improved by the interconnection, the chief gain being, rather, the increase of total output. The efficiency in each of the large systems had already been brought to a high plane. The largest water-power developments have not spilled any water unused for the past two years.

Even with the most careful load dispatching and highest economies in all plants on the combined system, the available hydroelectric power is not sufficient to meet the demands in the central and northern portions of the state. There is little prospect for immediate development of water power, and to avoid the possibility of a repetition of the present crisis next year it has been deemed best to install a 15,000-kw. steam-turbine unit. This is being added to the Pacific Gas & Electric system at station A in San Francisco. The approval of the Fuel Administration has been secured for this unit and priority ratings of the equipment have also been given. The turbine is expected in San Francisco about the first of the year and will probably be ready for service about Feb. 1.

In working out an allotment of the available energy that would work the least hardship on war service and the public at large, large consumers were induced to rearrange their load so as to minimize demand during the peaks that occur during the summer from 8 a.m. to 11 a.m. and from 1 p.m. to 5 p.m. More recently orders have been issued by the Power Administrator curtailing the use of energy, first for such consumption as sign and display lighting, then for the less essential uses, such as breweries, quarries, rock crushers, etc. The breweries now get 50 per cent of the energy they were using when the order went into effect; cement, sand and gravel works are cut 33⅓ per cent, and economies in operation in many industries have been insisted upon. Further reductions are not expected to be serious, as the users of energy remaining undisturbed are either directly essential or closely related to the life and work of the community.

POWER CURTAILMENT PLANS FOR CALIFORNIA

Gold-Dredging Companies in the State Voluntarily Offer to Cut Their Power Demand One-Third

Anticipating government action in the restriction of power, California gold-dredging companies have voluntarily offered to do with one-third less than their present power demand. It is predicted that California Fuel Administrator Schwabacher and Power Commissioner Butler will request further power diminution in all "less essential activities."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Effect of Daylight Saving.—Authorizing the Warren Light & Power Company to increase rates, the Illinois Public Utilities Commission states in part in its review of conditions: "It is probable, however, that the conditions during the coming year will be somewhat different from those during the past year as regards electric consumption owing to the daylight saving plan inaugurated March 31, 1918, which will doubtless result in a decrease of the consumption of electricity for lighting purposes. Such decrease will, of course, not be fully reflected in the revenues received from service owing to the influence exerted upon these revenues by the minimum bills in effect."

Salaries and Economical Management.—Approving higher rates of the Momence Utilities Company, the Illinois Public Utilities Commission touches on the question of salaries as follows: "The engineering report indicates that certain revision has been made of salary items shown on the company's books. This report further calls attention to the fact that the company is operating its system very economically, that the system is in good condition and is in a position to fully meet the requirements of the consumers in Momence and Grant Park. The commission believes that under these circumstances the allowances for executive salaries should be of a character which will secure executive ability capable of attaining the operating results which are being secured for this property. The estimates of the engineering staff appear to take these facts into consideration. It is apparent that the cost of energy supplied to the consumers is materially less than would be the case if the property were not economically managed, and in determining upon a rate of return which is fairly applicable to this property this fact will be given consideration."

Emergency Increase Denied.—A decision dismissing the case in which the Queens Borough Gas & Electric Company sought higher electric rates has been rendered by the New York Public Service Commission, First District. An opinion of Commissioner Kracke, approved by the majority, says in part: "I fully share the view several times expressed by this commission that conditions caused by the war may necessitate rate readjustments in various instances, as a sheer matter of conserving and continuing absolutely essential public service of heat, light, transportation, power and communication. Each application for such a readjustment must, of course, be considered on its own separate and individual merits. When a change in rate is imperative, it is important that the means be available of making the readjustments as expeditiously and economically as the facts warrant, without in any way binding either the companies, the consumers or the commission as to the action which will be taken when conditions are again normal. . . . I am not of the opinion that this company has shown itself yet within the category of companies entitled to claim that conditions warrant changes in their rates on a basis less formal than a regular rate proceeding. Emergency increases are granted only to enable a company to meet a genuine emergency. A public utility company is not entitled immediately and almost automatically to raise its rates as fast and as far as operating costs go up, merely because costs have gone up, any more than the company voluntarily and automatically decreases its rates as fast and as far as costs go down. The level and trend of rates should follow and generally conform to the level and trend of prices —anything else is disadvantageous to the public, as well as to the company; but a company is not entitled to 'emergency relief,' to preserve a *quantum* of 'before-the-war' return, if that return has been or is excessive, or if the company's rates have been such as to permit it lately to accumulate surpluses or unwarranted reserves which may first be drawn upon before its services or finances can be said to be in danger. A company is not entitled, after having charged such rates in the past that its capital account, property or assets have been built by the taking of excessive sums from customers, to complain and seek emergency relief merely because its rates temporarily fail to continue its past rate of return, including a return on funds collected from consumers and accumulated in some guise of capital, property or reserves. Public utility companies, like other corporations and individuals, must to some extent 'take the lean (years) with the fat' and bear some loss of income in war time without flinching and without claim of right to the immediate restoration of a full return. . . . To determine with certainty and finality the adequacy of a gross return requires at least a substantial knowledge of the amount of the investment, and the company has avoided that basis of scrutiny. In the absence of even approximate investment figures, however, no unwarranted general assumption should be made in support of an increase in rates. The burden of proof that an increase in rates is necessary rests definitely on the company; no increase should be granted on an emergency basis unless it is shown to be both warranted and necessary, and persuasive proof has not been presented." Commissioner Kracke also questioned the propriety of the floating debt of the company and criticised the payment of dividends.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Jovian League.—The date for the meeting of the annual session of the Jovian Order has been changed from Oct. 14 to 16 inclusive, as previously announced in the ELECTRICAL WORLD, to Oct. 24 to 26 inclusive. It is to be held in Dallas, Tex.

Electric Club of Philadelphia.—Capt. Roswell C. Williams, Jr., was the guest of honor of the Electric Club of Philadelphia at a meeting on Thursday, Sept. 19. The meeting was addressed by H. H. Seabrook, chairman of the Electrical Group, Fourth Liberty Loan, who told about the ways and means of conducting the next loan.

Electrical League of Cleveland.—On Sept. 18 C. L. Collens, 2d, president of the Reliance Electric & Engineering Company, addressed the Electrical League of Cleveland regarding the activities of the War Service Committee of the Electrical Industry with the Priorities Committee of the War Industries Board at Washington. P. B. Zimmerman, publicity manager of the National Lamp Works at Nela Park, was chairman of the meeting. It has been announced that Ralph S. Mueller, president of the Mueller Electric Company, has been elected president of the league to succeed H. L. Schneider, who resigned because he was leaving Cleveland.

American Electrochemical Society.—A general meeting of the American Electrochemical Society will be held at Atlantic City, N. J., Sept. 30 to Oct. 1 and 2 inclusive. Motion pictures on the fixation of atmospheric nitrogen at Niagara Falls, on the Canadian Shawinigan Falls power development and on electrochemical industries and the triplex steel process at South Chicago will be shown. A symposium will be given on "Electrochemistry After the War." F. A. J. FitzGerald will discuss "The Electric Furnace After the War"; J. A. Mathews, "The Future of Electric Steel"; Robert Turnbull, "Electric Pig Iron After the War"; A. H. Hooker, "The Future of Electrolytic Chlorine"; Dr. Van R. Kokatnur, "Commercial Uses of Chlorine"; F. A. Lidbury, "The Government and the Technical Man After the War"; Grinnell Jones, "Tariff Problems in the Electrochemical Industries"; W. L. Landis, "The War and the Nitrogen Industry"; C. A. Winder, "The Power Situation After the War," and W. D. Bancroft, "Research After the War." An informal address will be given by Dr. E. F. Northrup of Princeton University on "The Oscillatory-Current Induction Furnace."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Yours for the Fourth Liberty Loan.—Thomas A. Edison has suggested that every letter written in the United States during the next few weeks shall close with the words "Yours for the fourth Liberty loan." The suggestion has been adopted by the Liberty loan committee.

Republic Company Passes Common Dividend.—The Republic Railway & Light Company has passed the quarterly dividend on the common stock and declared the regular quarterly dividend of 1½ per cent on the preferred stock. It was announced after the directors' meeting that the common dividend was omitted owing to the feeling that conditions now facing public utilities require conservative action. An initial common dividend of 1 per cent was paid on Jan. 15, 1917, and has been continued quarterly since that time.

Commercial Service Until 10 a. m. Discontinued at Pittsburgh.—To make available a greater supply of electric power for essential industries at Pittsburgh, the Fuel Administration has ordered the discontinuance of electric service to commercial business houses and residences between the hours of 7:30 a. m. and 10 a. m. each week day. The order covers the operation of elevators, lights and all items in connection with consumption of energy. The estimated power shortage for plants working on war contracts in this vicinity is about 10,000 kw., and it is anticipated that the new order will produce a saving of more than one-half of this amount.

Storage of Coal.—The United States Fuel Administration has announced a revision of the regulations governing the storage of coal by consumers listed on different preference schedules. The original announcement on this subject was published in the ELECTRICAL WORLD of Aug. 31, 1918, page 414. Consumers, including electric lighting and power companies, in class 2 of the preference schedules of the War Industries Board are permitted to accumulate reserve stocks of bituminous coals as follows: Maine, 120 days; Massachusetts, Vermont, New Hampshire, northern New York, 90 days; Connecticut, Rhode Island, southwestern New York, 75 days; southeastern New York and New Jersey, 50 days; Delaware, eastern Pennsylvania, Maryland, District of Columbia, Virginia, Florida, western Ohio, 40 days; western Pennsylvania, West Virginia, eastern Kentucky and eastern Ohio, 30 days; lower Michigan, 75 days.

Ordnance Department Establishes Industrial Education Section.—The Army Ordnance Department announces the establishment of an industrial education section for the purpose of increasing productive efforts in the plants engaged in the manufacture of ordnance material. The activities of the section are under the direction of Major F. L. Thompson and Capt. C. R. Dickinson and will be aimed to carry home to the individual worker, employer or employee, the fact that his own personal efforts will have a direct bearing on the winning of the war.

Surcharge for Electric Power Service Held Void.—The Edison Storage Battery Company, West Orange, N. J., has filed a notice with the Supreme Court covering its plea to have the order of the Board of Public Utility Commissioners permitting the Public Service Electric Company to impose a 25 per cent war surcharge for electrical energy set aside. The company holds that this order impaired the existing contract for power service with the electric company and therefore violated the constitution; also that the order was illegal, as its application to February service made it retroactive, and that the order was issued without proper hearing.

Wage Rate Clause in Electric Rate Schedule.—For the first time the Public Service Commission of Pennsylvania has been asked to approve a new rate schedule embodying a "wage clause," the company concerned being the Metropolitan Edison Company, Reading. The application of the company sets forth that owing to "increased prices of labor and materials" certain commercial lighting schedules are to be increased 15 per cent, and that for every cent per hour increase in the cost of labor the rates are to be advanced one-half of 1 cent, with similar provision for decrease in rates. In its application the company also makes provision for wire, etc., on consumers' properties to be paid for by conusmers, who are to agree also to maintain the company's equipment on the premises as required by insurance and municipal laws.

Men Needed for Submarines.—The United States Navy Gas Engine School, of which Lieut.-Commander Charles E. Lucke is director, at Columbia University, New York City, desires to obtain names and addresses of men willing to enroll for training for the position of chief engineer, warrant machinists and chief machinist mates on board the new submarines of the United States Navy. Such applicants must be men who have had extended experience in the operation of Diesel or other heavy oil engines. They must be fully capable of taking charge of Diesel engines and making ordinary repairs and be competent to foresee trouble and maintain the engines in efficient operation. Such applicants should be between the ages of twenty-one and thirty-five, but the applications of men up to forty will be considered.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Rate Agreement Binding.—A judgment entered by consent of the parties thereto fixing the rate to be charged for gas for a definite period ending Nov. 1, 1918, and until again fixed under and pursuant to an ordinance, is final and binding upon the parties, the Supreme Court of Minnesota held (168 N. W. 588).

Powers and Duties of Commission.—The Public Service Commission created by the Acts of 1913 is a legislative agency, assumed to be qualified by knowledge and experience to regulate public utilities with reasonable fairness not only to the public but to the utility as well, according to the Supreme Court of Indiana (120 S. E. 129).

Expense of Shifting Poles When Changing Grade.—A telegraph company maintaining poles in a post road crossed by a railroad at grade cannot enjoin township and county from changing grade of road because it would interfere temporarily with poles, or recover cost of changing location of poles and of restoring them to former location, its easement being subject to public rights in highway, the Court of Chancery of New Jersey held (104 A. 141). Where township and county had the right to change grade of post road at railroad crossing, under agreement with railroad having legislative sanction, the railroad, which did the work, was not liable to the telegraph company for cost of shifting poles temporarily, the railroad standing toward municipalities in relation of contractor and employee.

Limitation of an Action for Injury Caused by Falling Over Pole.—Where action was brought against a city for injury from falling over a telegraph pole lying in a gutter and the company owning the pole was subsequently made a co-defendant, the action as to the company was barred by limitation where it was not made defendant within one year from the date of the injury, according to the Supreme Court of Errors of Connecticut (104 A. 164). In action against city and telegraph company for injuries from pole lying in gutter a direction of verdict for company because action was barred by limitation does not preclude city, on recovery of judgment against it, from suing company for indemnity, plaintiff's cause of action against city being different from city's right of action against company, the court declared in the course of its decision.

J. G. Fisher, superintendent of the Drumright division of the Oklahoma Gas & Electric Company, has joined the United States Army and is now in training at Camp Pike, Ark.

George N. Rooker, manager of the Mountain States Power Company at Sandpoint, Idaho, has been appointed chairman of the Bonner County Liberty loan campaign committee for the fourth loan.

Arthur Seubert, formerly instructor in mechanical engineering, Polytechnic Institute of Brooklyn, Brooklyn, N. Y., has entered the service of the New York Edison Company, as assistant to the mechanical engineer.

Charles B. Yontz has resigned as general contract agent of the Illinois Northern Utilities Company at Dixon, Ill., to accept a position as manager of the Wisconsin-Minnesota Light & Power Company, La Crosse, Wis.

W. W. Henry, for fifteen years with the Georgia Railway & Power Company, Atlanta, Ga., and for some time special investigator of the engineering division of the electrical department, has been promoted to be assistant engineer, succeeding Alfred C. Wilson.

O. C. Baldwin, of Perth Amboy, N. J., connected with the Standard Underground Cable Company, has been appointed a member of a committee to investigate the proposed thirty-day coal-storage plan for bituminous coal in New Jersey and confer with the Fuel Administration.

J. O. Kammerman has been appointed associate professor in electrical engineering at the University of Oklahoma at Norman, Okla. For the last eight years Mr. Kammerman has been at the Pennsylvania State College and also has been engaged in consulting engineering work throughout the State of Pennsylvania.

Weare Parsons, who was formerly treasurer and manager of the Springfield (Ohio) Light & Power Company, has been made general manager of a group of properties covering the territory between Pomeroy and Middleport at one end and Nelsonville at the other end. Mr. Parson's headquarters are at Athens, Ohio.

C. J. De Bats, who for the past four years has been manager of the Walkerville (Ontario) Hydro-Electric System and recently manager of the Essex County System, has resigned his position with the Ontario Hydro-Electric Commission, which controls the others, to become manager of the Bay City (Mich.) municipal electric light plant.

Charles M. Rogers, who for several years has been engineer for the Southern properties of Henry L. Doherty & Company, has accepted an appointment for the duration of the war as engineer for the Gulf Coast Division, Bureau of Oil Conservation, Oil Division of the United States Fuel Administration, with headquarters in New Orleans, La.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Leonard L. Elden, the newly elected chairman of the Association of Edison Electric Illuminating Companies, is one of the best known electrical engineers in the central-station field. He has been employed by the Edison Electric Illuminating Company of Boston, Mass., and its predecessors for the past thirty-two years. His early work included service as chief operating engineer at the L Street station of the Boston Electric Light Company, which acquired the old Merchants' Electric & Power Company and was later made an integral part of the present Boston Edison system. Mr. Elden's work at Boston has embraced practically every phase of electrical service from the generating station through the transmission and distributing systems to the customer's installation, and it coincides at every point with the remarkable growth of the great Boston system from its small beginnings to the highly developed and comprehensive organization of to-day. As an expert witness he sustained the chief engineering burden for the Boston company in the recently concluded street-lighting rate case before the Massachusetts Gas and Electric Light Commission, in which nearly 10,000 pages of record were taken. Mr. Elden has been a pioneer in advocating the interconnection of central-station and hydroelectric power systems in New England in the interests of saving fuel, releasing additional capacity in plant and distribution systems and economizing in other operating matters, and he is chairman of the committee of central-station men which has this problem in hand for preliminary development. He has long been active in the National Electric Light Association and the American Institute of Electrical Engineers, having been chairman of the Boston branch of the latter. Since the outbreak of the war he has been closely identified with the problems of supplying energy to government and other war-service plants and has given much time to important advisory work of this character in eastern New England.

L. L. ELDEN

Keene Richards, formerly superintendent of Division L of the Public Service Company of Northern Illinois, has been promoted to be a major in the United States Signal Corps Reserve. He entered the service as a lieutenant and in a short time was made captain. Major Richards has acted recently as an instructor in this branch of army work.

A. H. Babcock, electrical engineer of the Southern Pacific Railway at San Francisco, has had his jurisdiction extended over the Western Pacific Railway and its branch lines. The announcement was made recently by W. R. Scott, federal manager of the Western Pacific-Southern Pacific lines, as part of the reorganization plans of the combined roads.

Samuel Insull, president of the Commonwealth Edison Company of Chicago and chairman of the State Council of Defense of Illinois, received a cablegram on Sept. 16 announcing the death of his father, Samuel Insull, Sr., at his home in London. Mr. Insull, Sr., on Sept. 10 reached his eighty-seventh birthday. Mrs. Emma Insull, mother of Samuel Insull, died on April 5 of this year.

Obituary

Charles O. Bancroft, a former president of the Cumberland County Light & Power Company, Portland, Me., died recently in Portland at the age of seventy-six. Mr. Bancroft was at one time president of the Portland Electric Light Company, predecessor of the Cumberland County company, and he was president of the Maine Savings Bank of Portland for nine years.

William Kent, a widely known consulting and mechanical engineer, died on Sept. 18 at his summer home at Gananoque, Ontario, at the age of sixty-eight years. Dr. Kent was probably most widely known through his "Mechanical Engineer's Pocket Book," written in 1895 and now in its ninth edition. He was for five years dean of the L. C. Smith College of Applied Science of Syracuse University and for four years editor of *Industrial Engineering*. Prior to going to Syracuse he was on the editorial staff of the *American Manufacturing and Iron World* and later for a considerable period with the *Engineering News*. He was a vice-president of the American Society of Mechanical Engineers from 1888 to 1890.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

WORLD PREPARATIONS FOR FOREIGN ELECTRICAL TRADE

England, Japan, Italy, Sweden and the United States Getting Ready for the Opening of This Market at the Conclusion of the War

Each week brings fresh evidence of the preparation that is being made by every industrial nation to enter the markets of the world in competition for the foreign trade that is expected on the conclusion of the war. Of German plans little information has reached the outside peoples. There has been, however, sufficient proof of Germany's intention to regain as much as possible of the foreign trade that she once held. German capital is finding its way into Scandinavian countries. Only recently a large German electrical corporation was started in Sweden. It was plainly evident that this company would provide a market for certain German goods that when fabricated could enter Russian and other Eastern markets without the stigma of "Made in Germany" attached to them.

In the international trade in electrical merchandise Germany stood number one, with England running second and the United States third. France and Belgium also shipped considerable quantities of electrical goods to other countries. When the war broke out, however, the foreign trade of the world in electrical goods fell off considerably. That of Germany and Belgium fell to nothing, with France not much better. England has only partly regained that which dropped off. For the first three months of the current year the exports of English electrical goods were but slightly more than $3,000,000, which is less than one month's figures for the United States have been for very many months.

Exports of electrical goods from the United States have increased by almost 100 per cent over the 1913 total in value, although the increase in volume is evidently considerably smaller.

The facts are, therefore, that a considerable volume of trade remains unsatisfied. For this trade and for those markets that have arisen as a result of the war's devastation manufacturers are beginning to make active preparations.

England and Japan are unusually active in so far as electrical goods are concerned. In the past four years the output of electrical goods in Japan has increased enormously. To some extent, of course, the Japanese output has been augmented by American electrical factories in Japan. The factories are under American guidance but use Japanese labor. Large factories are springing up all over Japan, and with efficient production methods and very cheap labor these goods will be able to reach foreign markets at a price which will be difficult for other countries to meet.

English manufacturers have apparently learned the advantage in foreign trade held by the German cartel. They are now forming groups, studying conditions and laying plans. Particularly is this true of the wire and cable manufacturers. One thing is evident, and that is that the English manufacturers are going to make every effort to monopolize colonial markets. For economic reasons, however, it is doubtful if much headway will be made in the Dominion of Canada.

Italian electrical manufacturers are organizing for foreign trade. The latest evidence is the formation of a trade association for this purpose by the wire manufacturers. Sweden and Norway are understood to be making similar preparations.

In the United States electrical manufacturers are very quietly making their plans. Some large corporations have been formed by the larger manufacturers for foreign trade, and agencies are being quickly established in the principal open markets. Smaller manufacturers are making connections with export houses.

Far more significant than the above, however, is the fact that the American electrical manufacturer is at last beginning to realize that goods meant for domestic consumption are not as a rule suited to foreign trade. In the past year a large number of wiring products and other kinds of electrical goods have been developed solely for use in foreign trade. Almost without exception these goods have been designed to meet low-price competition.

Lend to Me, Please—Uncle Sam

ADDITIONAL CAPITAL REQUIRED TO CARRY ON JOBBING BUSINESS

Necessity for Carrying Larger Stocks, Paying for Goods Before Delivery, Etc., Requires 25 to 30 per Cent More Capital

The electric supply jobber is essential. His stocks are being utilized by the government and industries connected intimately with the war to such an extent that jobbing houses in industrial regions are to-day more than 90 per cent on this class of business. The one thing that has made the jobber essential to the government has been his large stocks that enabled him to fill orders for immediate shipment. If these stocks had not been available, a considerable time would have elapsed in most cases before delivery could possibly have been had from the manufacturer.

To be of such value to the government, however, has been very costly to the jobber. He has had to double his stocks, provide extra warehouse space and put up additional capital. This latter item has been probably the greatest handicap, because this additional capital was not in a state that allowed a bigger business to be handled. Rather it was utilized in such a way as had not before been necessary.

Before transportation became so congested the jobber would have delivery long before the account was payable. The goods then would largely finance themselves. Now, however, payment must be made in many cases weeks before the goods arrive. Terms are generally thirty days from date of shipment, not date of delivery. To pay for these goods in advance, as it were, requires additional capital.

Furthermore, on a large number of orders, particularly the big ones, factory shipments were made. Now, however, stock must be on hand in the jobber's warehouse. This means the provision of additional capital for carrying the goods.

Besides, there are many other reasons why more capital has had to be employed by the jobber. A canvass recently made by the ELECTRICAL WORLD indicates that on an average from 25 to 30 per cent more capital is now required to do the same volume of business than under usual conditions.

THE WEEK IN TRADE

REPORTS from every section of the country indicate a continuation of the large volume of business, all however, of war character. More and more factories are using part of their facilities in making material strictly for war purposes. The gigantic upheaval in business is almost too large to talk about. Jobbers are turning down, because they can't fill them, orders for electrical material that four years ago would have been so large as to create talk. When the government places a single order for wire that runs into thousands of miles, some idea can be had of the immensity of the present-day business and of why nonessential work must give way.

The week brought forth a number of increases in price. Others have undoubtedly been held up pending the action of the government with regard to the official price of iron and steel, copper and cotton.

Rubber, which was left off the recent priorities list, has been placed on it and has received a rating.

NEW YORK

Business still keeps up, but it is, of course, practically entirely war work, or work intimately related to the war. Incoming supplies are not large and local stocks are spotty. Prices are advancing on staple commodities

Labor supply appears to be growing steadily less, and when the first call on the new draft class, which is to take place during October, is made a more general use of women is anticipated.

There is considerable government work under way or projected among the numerous camps in this region. These jobs and the housing contracts are drawing heavily on local stocks and frequently reducing them almost to nothing.

The government demand for small wire is beginning to be felt by those supply houses which were low. The manufacturers have not yet been able to turn out the quantity called for by the government. To do so would require an additional 3000 braiding machine alone.

SCHEDULE MATERIAL.—Sockets and receptacles were advanced recently. The brass supply is getting much shorter, especially after the recent order limiting the distribution of brass sheet. Schedules F and H have advanced recently around 10 per cent.

METAL REFLECTORS.—Manufacturers report good stocks and a steady demand. Deliveries to the local trade are good. Prices have advanced approximately 10 per cent.

LAMP GUARDS.—There has been an advance recently in the neighborhood of 10 per cent.

WIRE.—The week showed a stiffening in price by a couple of manufacturers. The others may wait for the announcement of the government price on copper to prevail after Nov. 1. A meeting is called of copper men for this purpose around the middle of October. Considerable difficulty is being had by the local jobbers in getting a supply of No. 14 duplex wire. The government has commandeered all No. 17 bridle telephone wire for supply houses and will take the entire output from manufacturers for the coming eight months. The telephone companies are now engaged in securing a substitute.

HEATING APPLIANCES.—The sharp days of last week have not called out many radiators. Heating pads, similarly, were quiet. There appears to be a good local stock of radiators. Flatiron stocks, however, are not so good, some lines being sold out entirely. One manufacturer recently advanced about half of his line, some items bearing a pretty stiff price. One producer has reduced the price on one grade of soldering irons from $13.50 to $11.50.

CONDUIT.—It is impossible to get any iron conduit locally without an A rating. Incoming stocks are infrequent.

LAMP CORD.—There has been no advance reported since early in September. The demand is very large and local jobbers' stocks are as a result exceedingly low. Cord is very hard to get.

DRY CELLS.—An advance on the 6-in. size is reported this week of 5 cents retail, 4 cents to the trade and 3 cents to the jobbers.

FLASHLAMPS.—The list price advanced this week by 20 per cent. This is the second advance that has ever taken place on this line. The first advance was from 20 to 25 per cent about two months ago.

PANELBOARDS.—The difficulty in obtaining board instruments is making it hard to obtain a supply of panelboards.

CHICAGO

Under the heading "Are Prices at the Top?" the National Bank of the Republic, Chicago, recently pointed out that owing to existing conditions it believed that prices of commodities, except where subject to extraordinary conditions, have reached an apex and that, therefore, it would seem the better part of wisdom on the part of wholesalers and merchants to avoid carrying too heavy a stock of goods, especially if purchased at present quotations. While it appears wise to keep always alert for the reversal of the price trend, it must be that the electrical industry is subject to the "extraordinary conditions" mentioned, because hard on the heels of the bank's statement came announcements of several price increases. Generally speaking, however, the statement should be seriously regarded. Investigation of priorities in steel shows that, while formerly only goods with an AA rate were given conisderation, priorities are now receiving attention which carry a rating of only A2, A3 and A4.

A contract for increasing Camp Grant to a capacity of 67,000 men has been awarded by the government to Henry Ericsson, Chicago. The amount of the contract was $7,419,000. The government ruling prohibiting the construction of buildings costing more than $2,500 without official permission has also gone into effect this week.

As evidence that some of the electrical manufacturers are preparing for after-the-war conditions, it may be stated that the General Electric Company is opening a warehouse and office at Havana, Cuba, where it has formerly been represented by an agent.

PLIERS.—All of the pliers in Chicago jobbers' stocks have been taken over by the government. There is little opportunity to replenish these stocks, as all of the manufacturers have more business than they can handle.

COPPER WIRE.—No. 14 copper wire is a very scarce commodity in Chicago, some jobbers being entirely out of stock. Prices of rubber-covered wire are increasing daily.

ELECTRIC CARS.—Electric passenger cars have been in considerable demand in Chicago since the gasolineless Sunday has been in effect. One dealer received in a single day more than thirty inquiries from persons with whom he had never before been in contact.

MOTORS.—An inquiry in a town of more than 100,000 population during the last week showed that there was not a single 1-hp. motor in the stock of any dealer. This situation is expected to become worse on all materials operated on the pledge system.

FARM-LIGHTING PLANT.—These units are commencing to move in the Central Western territory.

LIGHTING FIXTURES.—Electrical dealers are taking this opportunity to clean up their old stock. The high prices and the difficulty of getting certain types of fixtures are leading to the reassembly and sale of old fixtures which were heretofore considered practically good for nothing but junk. A particular effort is being made to salvage ¾-in. brass tubing, as it is impossible to get this. Moreover, its value is enhanced through the fact that the price of fixture chain has increased practically 100 per cent.

DRY BATTERIES.—An increase in dry batteries has gone into effect. It amounts to about 4 cents per battery.

ELECTRIC HEATERS.—Cool mornings and evenings, together with the desire on the part of the public to save coal, have speeded the sales of electric heaters. One manufacturer's salesman recently took back from a dealer what the dealer thought was an overstock on radiant heaters. The dealer was obliged to buy back the heaters at an increased price.

ELECTRIC RANGES. — One manufacturer reports that his business in electric ranges up to Sept. 1 was practically identical with the total electric range business for last year. The business in restaurant and heavier type equipment is 18 per cent ahead of last year. This is attributed to the difficult coal situation in the small towns. Thirty-five hotel-type ranges have been sold this year where practically none were sold last year. This does not indicate that the total range sales of the field have equaled last year's volume, since some of the manufacturers have treated their range business rather half-heartedly during the summer season. It is believed, however, that it can be taken to indicate that the electric range business still exists and can be secured by the more aggressive organizations.

BOSTON

Little change can be seen this week in the volume of trade, which is extremely heavy in industrial lines. Collections are holding up well despite the anticipated drain upon resources due to our increasingly powerful military activity. President Wilson's prompt rejection of the Austrian peace feeler and the finely organized and executed work of Pershing's First Army at St. Mihiel have combined to produce good feeling throughout New England industry. More and more utilities in this section are going upon a war basis, and probably at least 75 per cent of the output of the large central-station and power systems is now closely related to the war. A new high-voltage pole line has been authorized by the Massachusetts Gas and Electric Light Commission to interconnect the New England Power and Boston Edison systems at a cost of $620,000. This will add at least 15,000 kw. of off-peak capacity to war industries in the central Massachusetts area. Work is progressing rapidly on the army Quartermaster's Terminal at South Boston, where about $3,000,000 in electrical material is to be used. Jobbers' stocks are being maintained with increasing difficulty, due to labor shortage and the immediate demands of the government. Labor unrest is not so much in evidence at present, but the scarcity in all lines continues serious.

ELECTRIC RANGES.—A growing interest on the part of the trade is to be seen, but little active campaigning is under way. Prices are steady and stocks are equal to a fair demand. Any rush business, however, would soon exhaust the equipments on hand. There is a steady demand for electric cooking material which has undoubtedly been somewhat stimulated by the high percentage increases in New England gas rates lately declared. These have no counterpart in electric rate advances.

ELECTRIC RADIATORS.—Cooler weather has already begun to stimulate the movement of these devices, and it is a question if the market can be adequately supplied when sharper mornings appear. There appears to be a field for radiator service in the present influenza epidemic, especially in taking the chill off chambers and bathrooms prior to the lighting of the regular fires. Stocks are being built up, but are likely to disappear early in the cool season.

FANS.—The fan business has shrunk to nominal proportions in this between-season time, but dealers are expecting some improvement in sales late this fall in connection with more skillful house-heating arrangements. The scarcity and high price of coal justify a thorough study of the possibilities of supplementary heat distribution by fan service in the coming winter.

INDUSTRIAL ELECTRIC TRUCKS.—Business continues brisk. Quotations are confined largely to essential customers, and prices remain about as before the fall began. Some development work is being done by truck designers to meet the varied conditions of factory and terminal service. Deliveries are being well maintained at present.

FLASHLAMPS.—Trade is steady and prices are even. Not a little renewal business is being handled this month, following the vacation season.

LINE MATERIAL.—Business is quiet, apart from short industrial constructions. For many years there has not been so little new work on the central-station outside list. Extensions in connection with war work are being handled without much trouble.

LAMPS.—The growing merchant marine and constantly augmented navy of our country are absorbing an enormous output of lamps. Domestic requirements are well in hand, however. Far-sighted factory planning and extensions are vitally important factors in the good outlook for the winter on standard sizes.

MOTORS.—While the market is spotty with regard to motors of more than 25-hp. rating, conditions are reasonably satisfactory. The government is utilizing a large percentage of the new motor output. Stock deliveries in the smaller sizes are now quite common.

SECOND-HAND MACHINERY.—Dealers are very active and equipment commands high prices. Prompt delivery is an important factor in these sales. The motor market is moving well; there is a demand for generators which is difficult to meet, and transformers are far from a drug on the market.

ATLANTA

There has been very little change in the general character of the electrical business for the last week. All quarters report trade as being very steady. Owing to the continued drought, the hydroelectric customers of the Georgia Railway & Power Company remain under curtailment, and it is reported that the Central of Georgia Transmission Company and the Macon Railway & Light Company, Macon, Ga., have curtailed power consumption 65 per cent.

The order of the city of Atlanta secured by the citizens' committee, restraining the Georgia Railway & Power Company from increasing its rates, as handed down by the Railroad Commission of Georgia, is being argued this week.

Manufacturers report that municipal plants and small privately owned central stations have reduced their purchases to low levels, owing to the fact that the majority of them have not received any increase in rates to offset the high price of coal and materials for maintenance, and sales to central stations of this type are necessarily very small.

Recent hearings before the War Industries Board indicate that the price of iron ore will be increased 50 cents per ton and that pig iron may be advanced $5 a ton.

Many Southeastern developmental enterprises have been announced during the week. These cover mostly essential war plants, and coal-mining developments.

Negotiations are under way by the Woodward Iron Company, Birmingham, Ala., with the government with reference to the financing of additional construction to the extent of $25,000,000.

Contracts will soon be awarded for the construction of the new naval air station at Galveston, Tex., at approximately $3,000,000.

LAMPS.—Information from many sources indicates that the movement of lamps is very heavy. It is estimated that sales have increased approximately 20 per cent over the same period last month. Taking into consideration the lamps sold, the average wattage has increased from 40 to 60 during the last six months. War plants and essential industries are buying freely of the larger sizes up to 750 watts. Stocks are in good shape and may be safely estimated as being 25 per cent greater than in September a year ago.

Anticipating the possibility of delivery trouble this winter, Southeastern jobbers have placed substantial orders in advance. This, together with stocks that have accumulated during the slack season, will put the jobbers in splendid condition to handle the heavy demands this fall.

TRANSFORMERS.—Manufacturers report that the volume of business is sustained, the decrease in central-station requirements being offset by the abnormal demands for war and essential work. Present-days sales compare favorably with this time last year. This is accounted for by the fact that the call for the distributing type has been steady. Shipments are somewhat better than experienced earlier in the year.

SEATTLE—PORTLAND

The wholesale and retail trades report continuation of satisfactory activity with correspondingly easy collections. Sales were about the same as during the previous week, with the exception of power apparatus, which moved a shade faster. The shortage of material, particularly in the Seattle field, is growing more acute. All sales are necessarily for essential industries. Delays in shipments from the East continue harassing, with indications that the situation will become worse. Owing to the heavy traffic and grain movement empty cars are congested at large terminals, but efforts are being made to distribute them as speedily as possible before the coming of winter weather. In the Puget Sound cities particularly there is a large surplus of open gondola flat cars, for which the demand is light.

The advance guard of several thousand shipyard workers to be brought to Portland to relieve the serious labor shortage is arriving. In response to the city administration's appeal in Portland many men employed in non-essential industries are registering for war work. The shortage of labor in shipyards, which is acute, is confined mainly to common labor. Seattle's war industries, according to conservative estimate, demand 5000 additional workmen at once. There is also a heavy demand for men of the building trades to supply the local demand and for the government housing program at Bremerton. So acute has the housing situation become in shipbuilding cities, Seattle especially, that an effort is being made to have citizens not engaged in business activity give up homes to industrial workers. Embargoes reaching all exports through Seattle have been placed by the Railroad Administration until the accumulation of approximately 3000 carloads has been cleaned up.

Portland dealers report the sales of motors in the last week as very good. There were no large individual sales, but the volume was somewhat heavier than during the past few weeks. Sales of switchboards, generators and large transformers were light. Lamp stocks are in excellent shape, miniature lamps showing the only shortage, and these stocks are daily improving. Local jobbers are attempting to increase all stocks as a guarantee against possible freight embargo during the winter. Farm-lighting plants continue to show improvements.

Fixture demand is heavy owing to the large amount of residence building. Stocks are in fairly good shape but are expected to show a shortage if building continues in heavy volume. Prices are well sustained. Industrial demand for wire and cable continues heavy, and local jobbers are pressed to meet orders. Domestic appliance stocks are becoming shorter all the time, with a good demand for almost every line of labor-saving equipment.

SAN FRANCISCO

The volume of electrical business is large, but the greater part of it is devoted to government contracts. This state has been hit hard by the unprecedented rains during the second week of September. Reports which came from all sections indicate that the grape crop and a large part of the raisin industry have been ruined; that prunes, apricots and other drying fruits have been badly damaged, and the only compensation lies in the fact that other grain and orchard districts not so far along have been well watered when there was general fear of drought. On account of a shortage of power it would have been almost impossible for the power companies to relieve this situation. In anticipation of the certain increase of power requirements, the Northern California company has begun work on its Hamilton City-Colton line and the Pacific Gas & Electric Company intends to build from Knight's Landing to Colusa. The first of these projects will be ready early in November.

The construction projects listed during the past week include a three-hundred-thousand-dollar warehouse at the Liberty shipbiulding yards in Alameda, hospitals at the naval training stations at Balboa Park, near San Diego, and a three-hundred-thousand-dollar labor temple for the boilermakers and Iron Shipbuilders' Union in Oakland. This is an indication of the enormous number of men now working in such yards around the bay district. The labor situation is apparently quiet now, the main difficulty being successfully to house workers. A door-to-door canvass for apartments and lodgings is to be conducted.

SWITCHES.—Knife switches have enormously increased, averaging about 25 per cent. A big order for Detroit safety switches, together with more starting switches of a local make, was recently reported from Oakland.

FIXTURES.—Prices of semi-indirect lighting fixtures have increased about 25 per cent and deliveries are difficult because of scarcity of raw materials. The fixture business is better than previously announced on account of the completion and interior construction of factories.

FLOODLAMPS.—Government inspectors are authorizing purchase of floodlamps in considerable numbers to protect shipyards, following investigation and demonstrations. Immediate action is expected, for although such industries have not suffered from lawless crowds, as have certain California communities, such as Fresno, they are so important as to require the utmost insurance. This work is under the control of the Emergency Fleet Corporation.

BELLS.—Orders for thirty vessels will soon be placed. The conduit and wire, it is understood, will probably be brought from the factory.

METAL MARKET SITUATION

Meeting on Copper Price Called for Oct. 15—Licensing System for Tin

A meeting to discuss the official price of copper to prevail after Nov. 1 is called for Oct. 15. There has been little or no speculation in this connection, although it would not be surprising to see the producers get the price asked for last time—namely 27½ cents.

The War Industries Board has announced that it will take over control of the domestic tin situation by a licensing system.

Steel prices are unchanged for the last quarter. Spelter is a shade lower. The other metals show no change.

NEW YORK METAL MARKET PRICES

	Sept. 17	Sept. 24
Copper:	£ s d	£ s d
London, standard spot... ..	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake.	Govt. price 26 00	Govt. price 26.00
Electrolytic.	Govt. price 26 00	Govt. price 26.00
Casting.	Govt. price 26 00	Govt. price 26 00
Wire base.	29 25	29 25
Lead, trust price.	8 05	8 05
Antimony ..	13 87½	13 87½
Nickel, ingot. ..	40 00	40 00
Sheet zinc, f.o.b. smelter	15.00	15 00
Spelter, spot.	9 85	9 65
Tin, Chinese *..	No quotations	No quotations
Aluminum, 98 to 99 per cent.	Govt. price †33 10	Govt. price †33 10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire.	23.50 to 24 50	23 50 to 24 50
Brass, heavy.....	14 50 to 15 00	14 00 to 15 00
Brass, light ..	11.50 to 12 25	11 50 to 12 25
Lead, heavy.	7 50 to 7 75	7 50 to 7 75
Zinc, old scrap	6.50 to 6 75	6 50 to 6 75

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*No Straits offering. † In 50-ton lots or more; carload, 33 10 cents per lb.; 1-ton to 14-ton lots, 33 20 cents per lb.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List Per 1000 Ft.
No. 14 solid	$61 00
No. 12 solid	71 00
No. 10 solid	90 00
No. 8 solid	106.00
No. 6 solid	145.00
No 10 stranded	95 00
No 8 stranded	115 00
No. 6 stranded	160 00
No. 4 stranded	205 00
No. 2 stranded	266 00
No 1 stranded	315.00

Twin-Conductor

No. 14 solid	104 00
No. 12 solid	135 00
No 10 solid	185 00
No. 8 stranded	235 00
No. 6 stranded	370 00
No. 4 stranded	575 00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	12½%—57 25
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	12½%—66 75

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	12½%—97 75
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	12½%—126 80

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20% to List
Coil to 1000 ft	5% to 15%
	No. 12 Solid
Less than coil	+20% to List
Coil to 1000 ft	5% to 15%

Twin-Conductor

	No. 14 Solid
Less than coil	+5% to $100.00
Coil to 1000 ft	5% to 87.00
	No. 12 Solid
Less than coil	+20% to +5%
Coil to 1000 ft	5%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each
Standard packages from 100 to 250

DISCOUNT—NEW YORK

Less than 1/5 std pkg	12%
1/5 to std. pkg.	20%
Std pkg	44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+30% to 12½%
1/5 to std. pkg	+5% to 20%
Std pkg	18% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$ 40—$.44	$ 40—$.44
12 to 50	35— .39	.35— .39
50 to barrel	31— 35	32— .36
Barrel lots	28— 32	29— .33

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 40 to $0.44	$0.40 to $0.44
12 to 50	35 to .39	.35 to .39
50 to barrel	319 to .342	.329 to 37
Barrel lots	289 to .232	.299 to .342

CONDUIT, METALLIC FLEXIBLE

Size, In	Ft. per Coil	List per 100 Ft.
5/16	250	$5 00
⅜	250	7 50
½	100	10.00
¾	50	13 00
1	50	21 00
1¼	50	26 00
1½	25-50	35 00
2	25-50	45 00
2½	25-50	52 00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$63 75— 69.75
⅜-in. double strip	75.00— 82 50	72.00— 75.00
½-in. single strip	100.00	85.00— 93.00
½-in. double strip	100 00—110 00	96.00—100.00

NET PER 1000 FT. -CHICAGO

	Less Than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$63 75 to $64 25
⅜-in. double strip	78.25 to $78 75	71 25
½-in. single strip	100 00	75 00 to 85.00
½-in. double strip	105 00	93 00 to 95 00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In	List per Foot	Size, In.	List per Foot
7/32	$0 05½	1	$0.25
¼	06	1¼	.33
⅜	09	1½	40
½	12	1¾	.47
⅝	15	2	.55
¾	18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	35 00–55 00	24.45–32 00	21 50–29.00
¼-in.—	40 00–60 00	27 00–35.00	23 50–32.00

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$60 00	$30 00	$26.50
¼-in.—	65.00	33 50 to 32 50	29 00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
¼	$0 08½
⅜	08½
½	08½
¾	11½
1	17
1¼	.23
1½	.27½
2	37½
2½	58½
3	76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0 05	$0.19
⅜	.06	.19
½	07	.19
¾	10	.25
1	13	.37
1¼	.17	.45
1½	.21	.50
2	28	1.10
2½	40	1.80
3	60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	7% to 12%	9% to 14%
2500 to 5000 lb.	10% to 15%	12% to 17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb.	1.5% to 6.8%	3.5% to 8.8%
2500 to 5000 lb.	1.5% to 10.7%	3.5% to12.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5 00 to $6.00
Discount	30%

CHICAGO

List price	$6 00 to $7 00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp	100	$0.25
35-amp. to 60-amp	100	.35
65-amp. to 100-amp	50	.90
110-amp. to 200-amp	25	2.00
225-amp. to 400-amp	25	3 60
450-amp. to 600-amp	10	5 50
600-Volt		
3-amp. to 30-amp	100	$0.40
35-amp. to 60-amp	100	.60
65-amp. to 100-amp	50	1.50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30% to 31%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std pkg	$5 00 to $6.00
1/5 to std. pkg	4 50 to 5 25

Standard packages, 500. List, each $0 07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$7 00 to $8.00
1/5 to std. pkg.	5.75 to 7.00

Standard packages, 500. List, each, $0.07

LAMPS, MAZDA OR TUNGSTEN

105 to 125 Volts

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.30
60-watt—B	100	35
100-watt—B	24	70
75-watt—C	50	70
100-watt—C	24	1 10
200-watt—C	24	2 20
300-watt—C	24	3 25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25.	50	53
25-watt—G 25.	50	55
40-watt—G 25.	50	55
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30.	24	77
Round Bulbs, 4⅜-in., Frosted:		
100-watt—G 35.	24	1 10

DISCOUNT—NEW YORK

Less than std. pkg.	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg.	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$20 20—$35 90
Coil to 1000 ft	26 95— 27 18

CHICAGO

	Per 1000 Ft. Net.
Less than coil (250 ft.)	$35 00 to $38 00
Coil to 1000 ft.	26 00 to 28 00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24 00

CHICAGO

Net per 100	$21 75 to $30 00

OUTLET BOXES

Nos.	List, Per 100
101—A, A 1½, 4 S.C., 6200, 320.	$30 00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R.	20 00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25% to 33%	20% to 27%
$10 00 to $50.00 list	42%	37%

DISCOUNT—CHICAGO

	Black	Glavanized
Less than $10.00 list	30% to 40%	20% to 35%
$10 00 to $50 00 list	40% to 50%	30% to 45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	5% to 10%
1/5 to std. pkg.	15% to 20%
Std. pkg	25% to 30%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$21 00 to $38 00
1/5 to std. pkg.	17 85 to 19 00

Standard package, 2200 List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$16.80
1/5 to std. pkg.	15.80

Standard package, 2200. List per 1000. $20 00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net	Std. Pkg. 3500 5½ N.C.—Solid	Std. Pkg. 4000 Nail-it—N.C.
Less than 1/5 std. pkg.	$16 00 to $20.20	$32 00
1/5 to std. pkg.	13 60 to 15 60	27 20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid	Std. Pkg. 4000 Nail-it—N.C.
Less than 1/5 std. pkg.	$11 70 to $24 00	$33 85
1/5 to std. pkg.	10 15 to 20 00	26 60

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets.	500	$0 33
½-in. cap keyless socket	500	.30
½-in. cap pull socket.	250	60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+10% to 10%
1/5 to std. pkg.	5% to 8%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List
1/5 std. pkg.	10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0 80
60-amp. S. P. S. T	1 20
100-amp. S. P. S. T.	2 25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5 34
30-amp. D. P. S. T.	1 20
60-amp. D. P. S. T	1 78
100-amp. D. P. S. T	3 38
200-amp. D. P. S. T.	5 20
300-amp. D. P. S. T	8.00
30-amp. 3 P. S. T.	1 80
60-amp. 3 P. S. T	2 68
100-amp. 3 P. S. T	5 08
200-amp. 3 P. S. T	7 80
300-amp. 3 P. S. T.	12 00
Low Grade:	
30-amp. S. P. S. T	$0 42
60-amp. S. P. S. T	.74
100-amp. S. P. S. T	1.50
200-amp. S. P. S. T	2.70
30-amp. D. P. S. T	68
60-amp. D. P. S. T	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T	4.50
30-amp. 3 P. S. T	1.02
60-amp. 3 P. S. T.	1 84
100-amp. 3 P. S. T.	3 76
200-amp. 3 P. S. T	6 76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+5% to Net
$10 to $25 list	11% to 15%
$25 to $50 list	14% to 20%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16% to 25%
$15 to $50 list	24% to 28%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+15%
$10 to $25 list	List to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list.	+5%
$10 to $25 list	8%
$25 to $50 list	15% to 16%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0 28
5-amp. single-pole, ind	250	32
10-amp. single-pole	100	48
10-amp. single-pole, ind	100	54
5-amp. three-point	100	54
10-amp. three-point	50	76
10-amp., 250-volt, D. P	100	66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+10%
1/5 to std. pkg	5% to 8%
Std. pkg	23% to 25%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to 10%
1/5 to std. pkg	+5 to 16⅔%
Std. pkg	18%25 to 25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar	List Each
No. 155	$0 34
No. 160	60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list.	Net to 40%	Net to 30%
$2.00 to $10.00 list.	10% to 50%	5% to 40%
$10.00 to $50.00 list.	20% to 60%	10% to 52%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list.	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list.	25% to 64%	20% to 50%

TOASTERS, UPRIGHT

NEW YORK

List price	$6 00
Discount	30%

CHICAGO

List price	$6.35 to $7 00
Discount	25% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools.	$0 434—$0 51
No. 18, full spools.	384— 49

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	$0 65 to $0 72
No. 18, full spools	55 to 6 15

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14.	$15 00–$20 00	$13 00–$15 00	$11 25–$12.00
12.	21 29– 27 10	19 35– 23.20	$17 05– 17 42
10.	29 70– 37 80	27 00– 32 40	23 75– 24 30
8.	41 91– 53 35	38 10– 45 70	33 35– 34 29
6.	60 30– 84 40	54 27– 72 35	51 55– 53 05

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft	500 to 2500 Ft.	2500 to 5000 Ft.
14.	$22 00–$29 48	$16 50–$22 00	$14 75–$16 50
12.	29 46	29 46– 29 48	25 54–29 48
10.	41 10	41 10	34 62 35 62
8.	59 90	57 90– 59 90	50 18
6.	85 31– 91 58	85 31– 85 31	72 27– 79 37

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4 0 to 3 Inc

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$37 75 to $38 40
25 to 50 lb	36 40 to 37 75
50 to 100 lb	32 40 to 36 75

CHICAGO

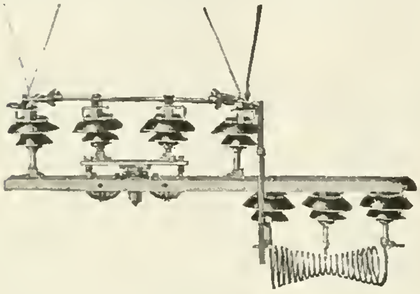
	Per 100 Lb. Net
Less than 25 lb.	$37 00 to $39.72
25 to 50 lb.	36 00 to 38.72
50 to 100 lb	35 00 to 37 72

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements
in Manufacturers' Products Used in
the Electrical Field

Choke Coil with Three-Point Support

To eliminate any difficulty occasioned by the sagging of choke coils, the Royal Electric Manufacturing Company, 606 East Fortieth Street, Chicago, has brought out a choke coil which is supported at the middle as well as at the ends. Two styles, one mounted above the insulators and the other suspended below, are being manufactured. Ratings from 100 amp. to 300 amp. and 6600 volts to 44,000 volts are considered standard, and units for higher voltages and currents are subject to special order. The three-pin type insulators which support the choke coils are mounted on a channel-iron base.



DEFORMATION AT SHORT CIRCUIT IS PREVENTED

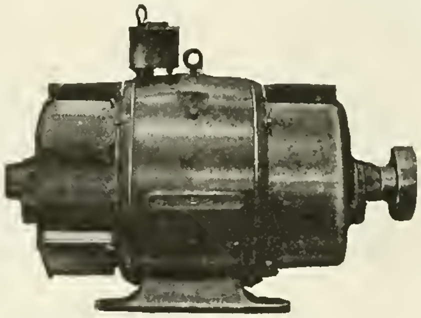
Fan-Ventilated Fire-Pump Motors

During the past year the Northwestern Manufacturing Company of Milwaukee, Wis., brought out a line of direct-current and alternating-current, high-speed fully inclosed motors for fire-pump service, ranging in sizes from 50 hp. to 100 hp. The design and construction comply in detail with the specifications of the Chicago Board of Underwriters.

The motors are fully inclosed to protect the operating parts from water. For the inspection of the commutators, the brushes or the slip-rings, openings are provided on the front-end brackets of the direct-current motors and on the frame of the alternating-current motors. These openings have metal covers closely fitted with rubber gaskets, held in place by four winged bolts.

The motors, being fully inclosed and of large output, must be provided with efficient ventilation for cooling purposes. A blower-type fan is used for this purpose, mounted directly on the shaft inside the motor. The cooling air is drawn from the outside into the motor through steel piping which is fitted to an opening on top of the rear-end bracket of the direct-current motors and then forced by the fan around the armature and the field coils. The hot air escapes through a corresponding opening in the top of the front-end bracket and is carried away by the piping. The method of ventilation in the alternating-current motor is similar to that in direct-current motors, except that the air enters and leaves the motor through openings on top of the frame.

The direct-current motors are compound-wound, equipped with interpoles, and are adjustable in speed from 1650 to 1800 r.p.m. The terminal leads are brought out through an inclosed cast-iron terminal box threaded for conduit connection. Alternating-current motors are of the slip-ring type. On top of the frame there is a large terminal box for the stator and rotor leads. These are carried away in separate conduits.

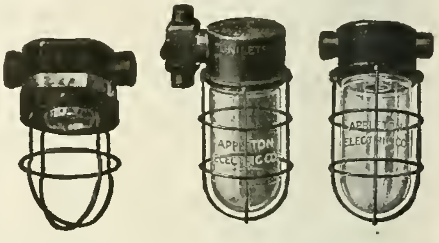


OPENINGS ARE PROVIDED TO ALLOW EASY INSPECTION

These motors are rated for continuous service with a temperature rise of not to exceed 40 deg. C. (124 deg. Fahr.) on the windings. Windings are especially impregnated against moisture. All motors are equipped with ring-oiling bronze bearings. The motors are designed only for direct connection to centrifugal pumps or blowers.

Vapor-proof and Weather-proof Fittings

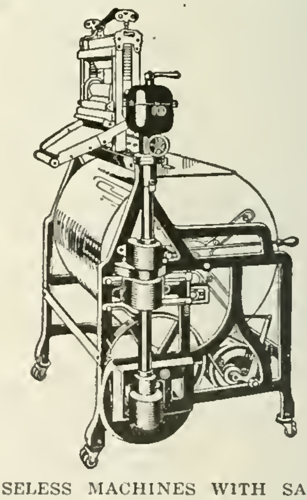
Vapor-proof fittings that have been designed to meet requirements for use in marine work, in breweries, refineries, flour mills, or wherever there is moisture, gas or fine dust, have been brought out by the Appleton Electric Company of Chicago. These fittings are so designed that they remain proof against vapor, gas and dust even though the globe may be broken or removed for renewal of lamps. The guards are of the screw type and do not require the use of a screwdriver. These fittings are furnished with receptacles, sealing plates, gaskets and all necessary screws and are made with or without globe and guards. A weather-proof fitting that offers a good protection for lamps and is suitable for use in freight sheds, steamships, garages and numerous places where a small, durable fitting is required is shown herewith. Brass guards are regularly furnished, but steel guards can be furnished if so specified. This type is not made to take vapor-proof globes.



FOR INDUSTRIAL AND WAR USES

Copper Electric Washer

With an electrical washing machine that is being manufactured by the Coffield Motor Washer Company, Dayton, Ohio, the operator has absolute control at all times over the machine because the wringer can be stopped, started or reversed at will and is provided with a safety relief for use in case of emergency. The washer can also be started or stopped as desired while the wringer is in operation. In



NOISELESS MACHINES WITH SAFETY FEATURES

addition, an electric switch is provided on the washer for stopping the entire machine when desired.

The tub made for this electrical washing machine, which is built of copper, polished on the outside and tinned on the inside, moves on centrally located bearings and is so designed that the oscillation of the tub forces the hot suds through the garments, dissolving and removing every particle of grease and dirt, according to the makers. The tub is provided with a special quick-opening drain faucet, placed conveniently on the end of the cylinder, and the faucet is provided with a threaded connection so that a hose can be attached if desired. Mounted on roller-bearing castors, the machine can easily be moved about in the laundry. The washing machine is driven by a motor rated at ¼ hp.

Vacuum Cleaner with Self-Locking Handle

The deeply embedded dirt, sand and grit that are steadily ground into carpets and rugs from constant walking can be readily removed by means of the Cadillac cleaner, according to its makers, the Clements Manufacturing Company, 601 Fulton Street, Chicago, Ill. This cleaner, driven by means of a 1/6-hp. motor housed in an aluminum casing, is very light in weight and can be readily carried up or down stairs. It has three rollers with the rear roller adjustable so as to permit the nozzle to be raised or lowered as desired by the operator for any length of carpet nap.

Many conveniences such as the pistol grip with the push-button switch, the self-locking handle and the movable cable hooks are incorporated in this device. A friction-driven brush in the nozzle will pick up lint and threads. The hose connection and the use of extra attachments and of a rear roller adjustment to elevate the nozzle to any position are some of the more important features of these cleaners, which have recently been re-examined and passed by the National Board of Fire Underwriters.

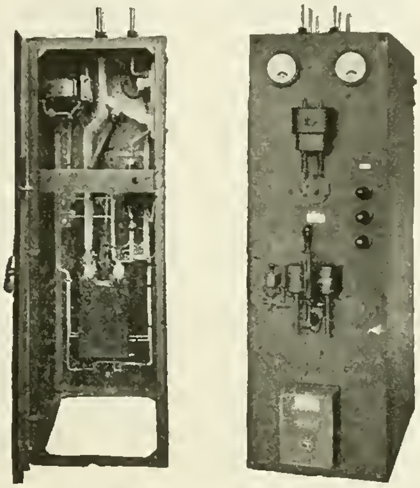
REAR ROLLER ADJUSTABLE TO PERMIT NOZZLE TO BE RAISED OR LOWERED

Series-Lamp Tester

A combination lamp tester and screw plug is being manufactured by the M. Propp Company, 108 Bowery, New York City, for use on Christmas tree sets. This tester consists of a wooden plug with a threaded ferrule on one end and a tester on the other. When the series lighting outfit fails to light, each lamp is removed in succession and the tester is inserted in the receptacle. When the set is relit by the insertion of the tester into a socket, it is seen which lamp is burned out. If a spare lamp is not available, the plug may be placed in the socket to complete the circuit.

Switch-Operating Mechanism

On present-day power systems with their high ratings an error in switching is likely to cause great damage. To eliminate this source of trouble, the General Devices & Fittings Company of Chicago perfected a disconnecting switch-operating mechanism.



SIX 2000-AMP. SWITCHES CAN BE OPERATED WITH ONE HANDLE

The fact that one man can operate six 2000-amp. switches with one handle makes possible the proper operation of all switches on both sides of an oil switch without the necessity of the operator identifying the different sets of switches, which is sometimes confusing owing to the general nature of the circuit layout.

In case of emergency there will, with this mechanism, be no delay in switch operation caused by the necessity of finding the hook stick, as is the case with individual switches. The operator in charge of the station will have a key on his person at all times and will be able to have complete supervision over the operation of the switches, as the lock is a Yale lock on which the keys can be limited as desired.

The mechanism permits of tagging all switches at one point and locking all "disconnects" in position without special switch locks. It also permits the operation of switches in positions that by nature of their location relative to the operator prohibit individual stick operation. Moreover, as there is no projection behind the switch compartments other than the operating handles, all switches can be permanently inclosed with housing work, to be removed only to make inspection.

It is usual to install auxiliary switches in connection with an operating handle that will give positive indication both at the compartment and at the switchboard of the position of the disconnecting switches.

Motor-Driven Gasoline Dispenser

The incidental losses in the vending of gasoline are said to be eliminated by the use of a visible-measure gasoline dispenser manufactured by the Visible Measure Dispenser Company, Louisville, Ky.

The pump is driven by a ¼-hp. motor, made by the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., which is inclosed in the base in accordance with the rules of the National Board of Fire Underwriters. When the wagon delivers gasoline to the garage the tank gage shows accurately the full quantity obtained. Every gallon drawn from the tank into the dispenser is shown on the tank register, which can be checked with the tank gage. Thus both the public and the garage owner are protected from loss. Furthermore, the oil companies are enabled to make more rapid deliveries with this dispenser than when measuring cans must be used.

Watertight Signaling Bells

For signaling purposes on ships and other places where watertight bells are needed, the Benjamin Electric Manufacturing Company, 806 West Washington Boulevard, Chicago, Ill., is manufacturing the bell shown in the accompanying illustration. These bells are furnished in either the vibrating or single-stroke type, the tapper rod being in a watertight stuffing box. The mechanism of the bells is entirely insulated from the case, but the binder plate-type connectors are easily accessible. The standard voltage for these bells is 120 volts direct current, but they may be made for lower voltages if so desired.

TAPPER ROD CONTAINED IN WATERTIGHT STUFFING BOX

Trade Notes

Government Contracts

Official notice has been given of the placing of the following orders for electrical equipment by the various departments of the United States government at Washington engaged in activities connected with the prosecution of the war:

QUARTERMASTER'S DEPARTMENT.—Aug. 26, Frank H. Stewart & Company, Philadelphia, electric fans.

BUREAU OF AIRCRAFT PRODUCTION.—Aug. 28, Willard Storage Battery Company, Cleveland, Ohio, batteries; Electric Storage Battery Company, Washington, batteries.

NAVY DEPARTMENT BUREAU OF SUPPLIES AND ACCOUNTS.—Aug. 23, Electric Storage Battery Company, Washington, spares for batteries. Aug. 26, General Electric Company, Schenectady, N. Y., single-conductor cable; Wellman, Seaver, Morgan Company, Cleveland, Ohio, electric capstans; Okonite Company, New York City, leaded cable; National Tube Company, Washington, pipe. Aug. 27, Wetmore, Savage Company, Boston, electric wire; J. A. Roebling's Sons Company, Trenton, N. J., electric wire. Aug. 28, Holophone Glass Company, Inc., New York City, reflectors; Macbeth Evans Glass Company, New York City, globes; Ivanhoe Regent Works of General Electric Company, Cleveland, globes; McKee Glass Company, Jeannette, Pa., globes. Aug. 29, Crouse-Hinds Company, Syracuse, N. Y., searchlamps. Aug. 30, United States Light & Heat Corporation, Niagara Falls, N. Y., batteries. Aug. 31, Walker Electric Company, Philadelphia, switchboards; Century Electric Company, St. Louis, Mo., adapters.

ORDNANCE DEPARTMENT.—American Car & Foundry Company, Barwick, Pa., power leads; W. A. Bonnell Company, Philadelphia, squeeze connectors for flexible conductor; Youngstown Sheet & Tube Company, Philadelphia, armored conductor; General Electric Company, Schenectady, N. Y., mobile repair shop equipment; Crocker-Wheeler Company, Ampere, N. J., controller covers; W. N. Matthews & Brother, Inc., New York City, electric repair equipment; Bryant Electric Company, Bridgeport, Conn., cartridge fuse contacts, electrical equipment; Novo Manufacturing Company, New York City, flashlamp batteries; Crouse-Hinds Company, Syracuse, N. Y., miscellaneous electric units; Electric Service Supplies Company, Philadelphia, magazine lighting equipment; Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., packing boxes; the Electric Storage Battery Company, Washington, D. C., "Exide" storage batteries; the Eiseman Magneto Company, Brooklyn, N. Y., magnetos; the Western Electric Company, New York City, friction tape; the Wisconsin Electric Company, Racine, Wis., adjusting tool.

GENERAL ORDER DEPOT.—Aug. 20, Irvington Varnish & Insulator Company, Irvington, N. J., varnish cambric; General Electric Company, Schenectady, N. Y., mountings for searchlights, motors; Sperry Gyroscope Company, Brooklyn, N. Y., high-intensity lamp mechanism; Westinghouse Electric & Manufacturing Company, Washington, spares for motors;; Albert & J. M. Anderson Manufacturing Company, Boston, electric equipment for Gantry cargo unloaders; George F. Cahill, New York City, floodlight projectors. Aug. 21, H. W. McCandles & Company, Washington, 6-volt lamps; Chicago Fuse Manufacturing Company, New York City, fuses and wire; Western Electric Company, New York City, portable microphone switching sets. Aug. 22, Doubleday-Hill Electric Company, Washington, dry cells; Western Electric Company, New York City, microphone switching sets; Crouse-Hinds Company, Syracuse, N. Y., condulets; Wheeler Reflector Company, Boston, copper reflectors. Aug. 24, Sperry Gyroscope Company, Brooklyn, N. Y., portable searchlights; General Electric Company, Schenectady, N. Y.; electrical supplies, teakettle searchlight; National Electrical Supply Company, Washington, cable; National Lamp Works, Cleveland, Ohio (Nela Park), foot-candle meters; Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., searchlight parts; Carlisle & Finch Company, Cincinnati, Ohio, searchlight base. Aug. 27, Ohio Brass Company, Mansfield, Ohio, insulators.

WESTINGHOUSE MANAGERS MEET.—During last week district managers for sixteen offices of the Westinghouse Electric & Manufacturing Company held a meeting in East Pittsburgh, Pa.

ACCEPTANCES.—The Webster & Atlas National Bank of Boston is distributing a booklet by the trade acceptance committee of the Massachusetts Bankers' Association entitled "Trade Acceptances."

"FULLER" SAFETY LAMPS APPROVED IN ENGLAND.—The English Home Secretary, according to the London *Electrical Review*, has issued an order approving of the Fuller miner safety electric lamp in all mines to which the coal mines act, 1911, applies subject to the conditions specified in the schedule of the order.

LARGE ITALIAN ELECTRICAL COMBINATION.—The British Consul at Milan states, according to the London *Electrical Review*, that a limited liability company has been formed with a capital of 64,000,000 lire (a lira is 19 cents), to be increased to 80,000,000, to absorb Franco Tosi of Legnano, the Officine Insubri (formerly Langen & Wolff), and the Societa Elettrotecnica Galileo Ferraris (formerly Thomson-Houston).

NO NEW YORK ELECTRICAL SHOW THIS YEAR.—George F. Parker, general manager of the New York Electrical Show Company, announced last week that "under present conditions it would be undesirable to attempt an Electrical Show this year. Many of our exhibitors are without articles to exhibit and would find themselves unable to replace sales, in view of the present shortage of labor and material. It also seems difficult, if not impossible, to secure adequate forces to represent these exhibits to the visiting public. With the conclusion of the war, we hope to build bigger, better and more effective shows than ever."

FORMATION OF ITALIAN CABLE MANUFACTURERS' ASSOCIATION.—On July 3, according to *Il Sole* of Milan, there was formed an association of manufacturers of rubber, cables, electric conductors, etc., between fourteen Italian firms, which employ about 20,000 workpeople and have an output of goods valued at several hundred millions of lire per annum (a lira is 19 cents). The president of the association is Senator G. B. Pirelli, and the vice-presidents Comm. Ing. V. Tedeschi of the S. A., Ing. B. Tedeschi of Turin, and Ing. Romola Pola of the Societa Piedmontese Industria Gomma e Affini of Moncalieri. The object of the association is the development of the rubber and electric wire and cable industries in Italy by the study of all questions affecting their expansion in Italy and abroad.

COMMERCIAL AND SHIPPING AGREEMENTS WITH DENMARK.—Danish-American commercial and shipping agreements which have been established for negotiating between the War Trade Board and a special Danish mission in Washington for some time past have been concluded successfully. Pursuant to the agreements, a number of vessels sufficient to carry the enumerated commodities to Denmark will be placed at the disposal of that country out of a tonnage which at present is employed in overseas trade. Under the general agreements are included a fixed quantity of electric lamps, in addition to various instruments for technical, scientific and other purposes and electrical machinery in quantities in accordance with actual Danish requirements for home consumption.

BRITISH STANDARDIZATION OF INCANDESCENT-LAMP VOLTAGES.—With regard to the proposed standardization of voltages, both for lighting and power circuits, the London *Electrical Review* reports that the Tungsten Lamp Association has formally indorsed the standards advocated by the British Electrical and Allied Manufacturers' Association and the British Engineering Standards Association, *i. e.*, 100, 110 and 115 volts for low voltage and 200, 220 and 230 volts for high voltage. The association, however, does not propose an immediate alteration to these limits, but for the present intends to adopt the following as the standard voltage range: Under 100 volts, 25, 50 and 55 volts; low voltage, 100, 105, 110, 115, 120 and 125 volts; high voltage, 200, 210, 220, 230, 240 and 250 volts. Lamps of these voltages will be supplied at standard prices, but an extra charge will be made for all lamps of intermediate and higher or lower voltages. These voltages are adopted as a start toward the standardizing movement recommended by other prominent associations and comprise a much larger number of voltages than it is intended ultimately to adopt.

WESTINGHOUSE MARINE EXPANSION.—So imperative have become the demands for marine propelling equipments for the Emergency Fleet Corporation that recently the new Essington plant, South Philadelphia, of the Westinghouse Electric & Manufacturing Company has been placed in operation for the exclusive production of this equipment. At present the Essington Works occupy a comparatively small part of the 500-acre tract which provides for ultimate expansion, and it contemplates an increase of three to four times its present capacity. The particular work at Essington at this time is the production of complete propelling equipment for merchant vessels which are being built for the Emergency Fleet Corporation. At the Essington plant there are 350 complete marine propulsion equipments on order or under construction. The significance of these orders can better be appreciated when it is considered that they include steam turbines, reduction gears, condensers, condenser pumps, small turbine generator equipment for lighting, stern tubes, propeller shafting and propeller shaft bearings. The largest equipment is 12,000 shaft hp., and none is less than 1500 shaft hp. The Essington Works were described in the Electrical World of April 20, 1918, pages 816 and 817.

PATRIOTIC MESSAGE FROM HYGRADE LAMP COMPANY.—To all the customers of the Hygrade Lamp Company, Salem, Mass., a letter was recently mailed from the factory emphasizing the importance of fuel conservation and analyzing the relative possibilities of coal saving in residence heating, cooking and illumination. The letter pointed out that economy in lighting as well as elsewhere contributes toward victory. It was shown that in order to equal the economy effected by saving one hod full of coal per day in the kitchen range, it would require the curtailment in the use of lighting of one 25-watt tungsten lamp for fifty-six days at five hours' service each. The average home requires for lighting about one-twenty-eighth of the total amount of coal used for heating and cooking, which is equivalent to saying in ordinary practice that if in the average residence the use of electric lighting were abandoned entirely, the saving in fuel effected would be equal to only that obtained by saving about one-half a ton in heating and cooking. The average domestic range consumes from six to ten tons a year if the fire is carried through the night. The Hygrade letter recommends a "balanced war economy," making the utmost effort to save where the greatest saving can be effected, viz., in the heating and cooking service of the home. It is pointed out that with a little care a 25 per cent saving can be effected in lighting, thereby conserving about one-eighth of a ton of coal per year per home, by using proper sizes of lamps, suitable reflectors and other lighting accessories, keeping bulbs, reflectors, shades, etc., clean and cutting off the use of unnecessary lamps.

THE ANDERSON ELECTRIC SPECIALTY COMPANY, 118 South Clinton Street, Chicago, has added a new department to its business for the manufacture of dental and laboratory appliances.

THE GENERAL ELECTRIC COMPANY has filed plans for improvements and alterations in the Bryan-Marsh Electric Works plant at Central Falls, R. I. The estimated cost is in the neighborhood of $50,000.

THE WITHERBEE STORAGE BATTERY COMPANY, 1904 Broadway, New York City, manufacturer of electric batteries, has increased its capital from $10,000 to $50,000, to provide for business extensions.

THE GOODYEAR RUBBER INSULATING COMPANY, 105 East 131st. Street, New York City, has finished plans for the construction of a new two-story addition to its plant. The structure is estimated to cost $9,000.

THE ORENSTEN-ARTHUR KOPPEL COMPANY'S plant has been sold by the Alien Property Custodian to a representative of the Pressed Steel Car Company. Among other things the plant makes electric industrial trucks.

THE ELECTRIC CONTROLLER & MANUFACTURING COMPANY of Cleveland, Ohio, has increased to such an extent that it has been found desirable to establish representatives on the Pacific Coast, as follows: O. E. Thomas, Washington Building, Los Angeles, for southern California; C. F. Henderson, Call Building, San Francisco, for central and northern California, and W. Montelius Price of Seattle, Wash., for the states of Oregon and Washington.

JOSEPH BRESLOVE, until recently sales engineer with the Allis-Chalmers Manufacturing Company, Pittsburgh, Pa., has opened an office in Pittsburgh and will engage in general consulting engineering, specializing in power-plant work.

A. B. VANDERCOOK has been appointed sales manager of the Western Electric Company at Los Angeles. Mr. Vandercook was first employed by this company in 1916 as a salesman and for the last six months has been a specialist at Los Angeles.

THE SHEPARD ELECTRIC CRANE & HOIST COMPANY, Montour Falls, N. Y., announces that it has appointed A. J. Barnes as export manager with headquarters at the main office. Mr. Barnes will also continue to be director of publicity.

THE KELLOGG SWITCHBOARD & SUPPLY COMPANY, 1066 Adams Street, Chicago, has taken over the business of the McLeod Manufacturing Company of Chicago. The McLeod company formerly manufactured the Sperry telephone brackets.

THE ROLLER-SMITH COMPANY, New York City, has appointed as its agent W. G. Merowit, 716 Ellicott Square, Buffalo, N. Y. Mr. Merowit will handle the company's lines of instruments, meters and circuit breakers in the western part of New York State.

THE NATIONAL CONDUIT & CABLE COMPANY, INC., and the National Brass & Copper Tube Company, Inc., have announced the appointment on Sept. 1 of A. G. Chapin as New England manager of both the companies, with headquarters at 200 Devonshire Street, Boston.

THE UNDER-FEED STOKER COMPANY of America has moved its Detroit headquarters from 42 Alger Avenue to 307 Majestic Building, where large accommodations have been obtained which have been necessary on account of the steadily increasing business of the company.

B. H. TRIPP, special representative of the Chicago Pneumatic Tool Company on the Pacific Coast, has succeeded M. W. Friseler as district manager of sales for the Pacific Coast territory. His headquarters are at 627 Howard Street, San Francisco. The Los Angeles branch of the company, at 521 Title Insurance Building, comes under Mr. Tripp's jurisdiction.

Trade Publications

INSULATING CEMENT.—Wilkins U. Greene, Ridgewood, N. J., has issued a circular telling of his "Porce-Lute" insulating cement.

POLISHERS.—The Minerallac Electric Company, Chicago, has issued a circular describing and illustrating its "Altman" desk and table polishers.

TOOL-ROOM SPECIALTIES.—A general catalog has been issued by the Taft-Peirce Manufacturing Company, Woonsocket, R. I., describing its tool-room specialties.

ELECTRIC WASHER.—The Coffield Motor Washer Company, Dayton, Ohio, has issued a circular describing its 1919 model electric washer with swinging wringer.

REFLECTORS.—Reflectors for inside or outside lighting are illustrated and listed in a four-page folder that is being distributed by the Reynolds Electric Company, 422 South Talman Avenue, Chicago.

DRAG SCRAPER.—The R. H. Beaumont Company, Drexel Building, Philadelphia, has issued catalog No. 38, describing and illustrating the Beaumont drag scraper system for the ground storage of coal.

DISCONNECTING HANGERS.—"Why Do Reflectors Wear Out?" is the title of a circular being distributed by the Thompson Electric Company, 5606 Euclid Avenue, Cleveland, Ohio, which discusses the effect of dirt on reflectors.

CIRCUIT BREAKERS.—Type FK-20 oil circuit breakers for industrial service up to 300 amp. and 2500 volts are discussed in a booklet, No. 47,433, distributed by the General Electric Company of Schenectady, N. Y. Features, mounting, construction, capacities and interrupting capacity, non-automatic breakers, automatic breakers, etc., are shown, with tables giving the ampere capacity of coils at different voltages and horsepowers. The magnetic locking device, with temperature rise and dielectric test, is discussed. Wiring for several types of circuit breakers is also described with line diagrams, in this bulletin.

FARM-LIGHTING UNIT.—The Western Electric Company, Inc., 195 Broadway, New York, has issued a bulletin describing and illustrating the features and parts of its directly connected type of farm-lighting set.

REDUCTION GEAR.—Mine fan drive is discussed in folder 203, dated August, 1918, distributed by the Poole Engineering & Machine Company, Baltimore, Md. This circular describes the uses of the "turbo-gear."

ELECTRICAL APPLIANCES.—"Universal Dealers' Sales Helps" is the title of a booklet that is being distributed by Landers, Frary & Clark, New Britain, Conn. This booklet gives suggestions for using newspaper electros and illustrates various advertising methods.

CONTROLLERS.—The General Electric Company of Schenectady, N. Y., is distributing a circular describing its drum-type controllers for cranes, hoists and similar service. Another circular describing the magnetic control for machine tools for direct-current motors shows the constant-speed equipment and adjustable-speed equipment with auxiliary devices.

TRANSFORMERS.—Type H circular-coil form KDD transformers, oil-insulated, self-cooled or water-cooled, are illustrated and described in circular No. 45,203 being distributed by the General Electric Company of Schenectady, N. Y. This circular describes the construction and equipment, cooling coils, bushing and leads. An outdoor substation is shown with these transformers.

SWITCHBOARD PANELS.—Standard-unit direct-current small-plant switchboard panels for two-wire general power and lighting service are described in bulletin No. 47,050A issued by the General Electric Company, Schenectady, N. Y. This bulletin discusses the application and details of construction of these switchboard panels. The equipment of panels is shown in line diagrams contained in the booklet. Wiring diagrams are also produced.

ELECTRIC WELDING.—The Indianapolis Switch & Frog Company, Springfield, Ohio, is distributing a treatise on electric welding for track and shop repairs and conservation of track and roadway for the prevention and cure of track disease. This bulletin discusses welding by electricity by three methods. Track joining and bonding is also discussed in this booklet, with directions on how to care for the welder. Instructions for applying welded joints and bonding plates are also given.

WATERWHEELS.—"Improvements in Waterwheel Efficiency" is the title of an interesting pamphlet being distributed by the Pelton Water Wheel Company, San Francisco, Cal. This pamphlet, fully illustrated with plant views and diagrams, is based on studies made by C. E. Hutchinson, chief engineer of the Pelton Water Wheel Company, and covers the changes made possible through improvements in waterwheel runners and water-economizing nozzles whereby the efficiency of an installation may be greatly increased by modification of its obsolete parts.

MOVING-COIL GALVANOMETERS.—Catalog No. 20, dated 1918, issued by the Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, gives a discussion of the moving-coil galvanometer and its uses. The theory and fundamental conditions of moving-coil galvanometers are given in full, and methods of expressing galvanometer sensitivity are discussed. In addition, the motion of the galvanometer system is shown mathematically, and the positions in which the outfit is to be set up are made clear. The lamp and scale of a galvanometer are also illustrated and described. The condition of motion of a galvanometer system is thoroughly worked out. Curves are given showing the action of the system under different conditions with small and moderate damping effects. The logarithmic decrement, damping constant and damping ratio are discussed, together with the critical damping and damped and undamped periods. A chapter is given on changing the working constants of a galvanometer. Under the heading "ballistic galvanometer," the time for the first throw, sensitivity for any circuit resistance, sensitivity of shunted ballistic galvanometer, change in torsion as affecting sensitivity and critical damping resistance, relation between sensitivity and field strength or turns of wire on coil and the effect of a prolonged impulse on the throw of ballistic galvanometer are treated in discussions and curves. Precautions for observation in using a moving-coil galvanometer are mentioned, and a discussion of the suspension material, thermal currents and temperature coefficient of the galvanometer is included. Fluxmeters are also discussed in detail. The different kinds of galvanometers made by this company, with their accessories, are described and illustrated in this booklet.

HEAT REGULATORS.—The Western Electric Company of New York City, has compiled a pamphlet entitled "Some Facts on How to Run a Furnace and Save Coal." This bulletin contains extracts from the Technical Paper No. 199 published by the Bureau of Mines, Department of the Interior, Washington, D. C.; also extracts from the bulletin published by the University of Illinois, Engineering Experimental Station, and extracts from the bulletin published by the University of Wisconsin, University Extension Division. The heat regulator for furnaces manufactured by this company is also described in this booklet.

SAND BLAST.—The principles and data of sand blast are contained in bulletin No. 50, now being distributed by the Pangborn Corporation of Hagerstown, Md. Descriptions of devices manufactured by this company are given in this booklet, and tables of the air flow in cubic feet of free air per minute through different sizes of nozzles at varying pressures, with the horsepower required to generate it in single-stage compressions, are given. Another table showing air-compressor characteristics and an approximate flow in pounds per hour of various abrasives through different nozzle openings is printed. Equipment, rooms, ventilation, dust arresters, etc., are illustrated.

New Incorporations

THE EVANS FUEL SAVINGS COMPANY of Birmingham, Ala., has been chartered with a capital stock of $25,000 by J. P. Evans and others.

THE DOMESTIC ELECTRIC COMPANY of Birmingham, Ala., has been incorporated with a capital stock of $1,000 by William C. Knopf and others.

THE BLACKSHEAR ELECTRIC CORPORATION of Brewton, Ala., has been incorporated with a capital stock of $20,000 by E. M. Blackshear, Ed. L. McMillan and others.

THE EASTERN KENTUCKY SERVICE COMPANY of Prestonburg, Ky., has been incorporated with a capital stock of $5,000. The incorporators are O. H. Stumbo, W. S. Wells and C. P. Stephens.

THE RUSCO ELECTRIC PRODUCTS COMPANY of Ladysmith Wis., has been incorporated with a capital stock of $10,000. The company proposes to generate electricity and manufacture electrical appliances.

THE BEAUMONT MANUFACTURING COMPANY of Camden, N. J., has been incorporated with a capital stock of $60,000 to manufacture electrical appliances. The incorporators are R. H. Beaumont, H. E. Birch and E. A. Thumlert of Camden.

THE ACCURATE ENGINEERING COMPANY of Plainfield, N. J., has been chartered with a capital stock of $35,000 to do a general electrical and mechanical engineering business. The incorporators are Charles P. Crouch, Anton Johanson and G. W. V. May.

THE DELAWARE COUNTY LIGHT & POWER COMPANY of Manchester, Iowa, has been incorporated with a capital stock of $25,000. The officers of the company are: Joseph Hutchinson, president; William Hockaday, vice-president; Harry Seeds, secretary and treasurer.

THE LUTHY STORAGE BATTERY COMPANY of Newark, N. J., has been incorporated by James A. Burke of Summit, N. J., F. A. P. Nelson and William Hughes of Newark. The company is capitalized at $700,000 and proposes to manufacture electric storage batteries and other electric equipment.

THE ELECTROPURE PROCESS COMPANY has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000 to engage in the business of purification of liquids by electricity. The incorporators are D. Buck, M. L. Horty and K. E. Longfield of Wilmington, Del.

THE STANDARD ELECTRODE COMPANY, Ward Building, Shreveport, La., has been organized to erect a plant and manufacture electrodes. The officers of the company are: James Kelly of New Orleans, president; J. E. Bailey, vice-president; T. E. Bird, treasurer, and W. F. Gradalph, secretary, all of Shreveport.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

CLAREMONT, N. H.—Plans are under consideration by the Town Council for extensions in the electric street-lighting system.

BOSTON, MASS.—The Board of Gas and Electric Light Commissioners has granted the petition of the Edison Electric Illuminating Company of Boston and the New England Power Company of Worcester for authority to make extensions and connections for the interchange of electrical power between the Edison station at Forest Hills and the stato's station at the Wachusett dam in Clinton. The Metropolitan Water and Sewerage Board has recently connected its power stations at the Clinton and Southboro dams by transmission lines. The New England Power Company buys the power generated at Clinton and the Edison company that generated at Southboro. A contract exists between them for interchange of excess power, but the Edison lines to Southboro are not sufficient to meet the present needs of the New England Company. It is proposed to build a new transmission line of 15,000 kw. capacity from the Edison station in South Boston to the Sudbury dam, running underground to Forest Hills and overhead on the railway location to Dedham and then overhead on private right-of-way to the Sudbury dam, connecting with the Metropolitan board's line and with the New England power system. The cost of the line is estimated at $650,000.

PEPPERELL, MASS.—Contract has been awarded by the Nashua River Paper Company for the construction of a new hydroelectric power plant at its works at East Donnerell to the L. H. Shattuck Company, Granite Street, Manchester.

WORCESTER, MASS.—The Economy Electric Company, 30 Foster Street, has secured the contract for the installation of a floodlighting system at the new plant of the Rockwood Sprinkler Company on Harlow Street. Fifty lamps will be installed at first. The Economy company has also been awarded the contract for wiring and equipping the Ipswich (Mass.) Hosiery Mills for electrical operation at $20,000. Peter A. Coghlin is president of the Economy company.

Middle Atlantic States

BUFFALO, N. Y.—Plans are being considered for the installation of electrically operated lifting machinery by the Department of Public Works in connection with the new bascule bridge to be erected across the Buffalo River on Abbott Road.

CORTLAND, N. Y.—Work has begun on the erection of the addition to the local exchange of the New York Telephone Company. The cost of the new building with improvements to the present exchange is estimated at about $25,000.

GALWAY, N. Y.—Contract has been awarded by the Board of Supervisors of Saratoga County to J. Tittmore of Galway for improvements to the county tuberculosis hospital, including an addition to the power plant at the institution. The cost of the entire work is estimated at $12,000.

HUDSON, N. Y.—Work has been nearly completed on the erection of the electric transmission line of the Hudson Power Corporation from Poughkeepsie to Athens, a distance of 37 miles. The corporation is a merger of the Albany Southern Railroad Company of Hudson, the Central Hudson Gas & Electric Company of Poughkeepsie and the American Electric Company. It is proposed to develop power in the Wallkill Valley and transmit it over this line throughout the region in which the three companies operate.

LONG ISLAND CITY, N. Y.—Plans have been completed for alterations and improvements to the boiler plant of the local Standard Oil Company at West and Mott Avenues, to cost about $8,000.

MASSENA, N. Y.—The St. Lawrence River Power Company is considering plans for the construction of an ice barrier in the St. Lawrence River to facilitate power operations.

MINEOLA, N. Y.—Work has begun on transforming Camp Mills from a tent city to a permanent cantonment to accommodate 50,000 replacement troops. The cost of transforming Camp Mills into a permanent cantonment is estimated at $13,353,000, and will include $2,458,000 for a base hospital accommodating 2000 patients, which is being erected in Mineola; a $50,000 Y. M. C. A. hut and a building for the Knights of Columbus, 500 barracks, post office and a recreation hall. Ten large warehouses have been completed. A refrigerating plant and a laundry capable of providing for the needs of the entire cantonment are nearly completed. A large power plant will also be erected at the camp.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, Municipal Building, borough of Manhattan, New York City, until Oct. 2 for installing an extra set of 2300-volt busbars and replacing the existing set; furnishing and installing additional panels, switches, bus work, etc., in connection with changes on the 2300-volt switchboard; rearranging regulators and connections thereto; furnishing and installing feeder regulator with all connections and appliances; also making all changes in gallery of the substation on Blackwell's Island. Blanks and further information may be obtained at the office of the contract clerk, tenth floor, Municipal Building. Bird S. Coler is commissioner.

OGDENSBURG, N. Y.—Plans have been prepared by the New York Central Railroad Company for the installation of a mechanical coaling plant at Ogdensburg for the St. Lawrence division. B. C. Martin, Union Station, is in charge of the work.

BLOOMFIELD, N. J.—Preliminary plans are being prepared for the construction of a boiler plant at the Sprague Electric Works, Bloomfield, owned by the General Electric Company, Schenectady, N. Y.

BORDENTOWN, N. J.—Contract has been awarded by the City Commission to the William R. Thropp & Sons Company of Trenton for the installation of two electrically operated centrifugal pumps with electric motors and automatic control at the municipal pumping plant. The Public Service Electric Company has been awarded contract for the erection of an electric transmission line to the municipal plant to supply energy to operate the pumps.

CAPE MAY, N. J.—Plans have been prepared by the Navy Department for the installation of a new electric distribution system at the local naval station (Specification 3386).

NEWARK, N. J.—Bids will be received by the Passaic Valley Sewerage Commissioners, Essex Building, 31 Clinton Street, Newark, until Oct. 8 for electrical work in connection with the installation of six sets of sewage screens at the Newark Bay pumping station. William Gavin Taylor is acting clerk.

ALTOONA, PA.—The Pennsylvania Railroad Company, it is reported, is contemplating the construction of a large central power station to furnish all electricity used by the company in Altoona and on extensions to the Juniata shops where new locomotives are built. The company now has four plants in Altoona, but three of them will be abandoned, save for heating the shops and running other machinery for which they furnish power, outside of electrical machinery, and one plant will be enlarged. Two 5000-kw. generators will be installed. An addition will be built to the Juniata erecting shop and another tower will be erected at the boiler shop to increase the output of Mallet locomotives.

PHILADELPHIA, PA.—Plans have been prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for a new electric shop (Specification 3420) at the local navy yard.

PHILADELPHIA, PA.—Plans have been filed by the Bennett & Aspden Company, Krams Avenue, for the erection of an addition to its power house, 15 ft. by 45 ft. Contract for the building has been awarded to the William Steele & Sons Company, 30 South Fifteenth Street.

PHILADELPHIA, PA.—Contract has been awarded by the Barrett Manufacturing Company to the O'Meary Construction Company, 253 South Quincy Street, for the construction of a new boiler house at its plant at Bermuda and Margaret Street, 75 ft. by 85 ft., to cost about $50,000.

PHILADELPHIA, PA.—The Public Service Commission has given its approval of the proposed agreement of the Philadelphia Rapid Transit Company with the United States Housing Commission, whereby the latter will loan the Transit company $1,740,000, to be used for extending its system for transporting workers in the local war industries. The fund will be used for the purchase of 90 new cars, extensions and improvements to electric substations and for extensions in electric feeder lines, etc.

PITTSBURGH, PA.—The United States government has decided to purchase 2500 to 3000 acres of land in Pittsburgh as a site for a new town to house the large number of men who will be employed at the large ordnance plant to be erected on Neville Island by the United States Steel Corporation for the government, at a cost of $150,000,000. The plans provide for the erection of between 4500 and 5000 dwelling houses. The cost of the project is estimated at $25,000,000.

WILMINGTON, DEL.—Plans have been prepared by the Diamond Ice & Coal Company, Pennsylvania Avenue and Union Street, for an ice factory and storage plant with capacity of 8000 tons, to cost about $250,000.

BLACKEY, VA.—The installation of an electric light plant in Blackey is under consideration. G. D. Ison and others are reported interested.

SALTVILLE, VA.—Preparations are being made by the War Department for the erection of a plant at Saltville for the manufacture of gas bombs, to cost about $250,000. The initial buildings will include a general manufacturing plant, gas-producer works, electric power plant, etc.

SPLASHDAM, VA.—The Sutherland Coal Company would like to receive prices on a new or second-hand drum for coal-tipple, electrical equipment and building material for houses.

WHEELING, W. VA.—Arrangements are being made to fit up the old city gas plant on Nineteenth Street for a receiving station to distribute energy from the Wheeling Electric Company. The city officials have decided to close down the municipal electric generating plant and purchase electricity from the Wheeling company.

YUKON, VA.—H. T. Heldreth, contractor of Yukon, would like to receive prices on electric wiring (conduit) for a store and office building. The cost of the building is estimated at about $60,000.

North Central States

DETROIT, MICH.—The Solvay Process Company of Syracuse, N. Y., is planning to erect an electric power plant, 72 ft. by 80 ft., at 1501 West Jefferson Avenue, to cost about $35,000.

DETROIT, MICH.—The purchase of a tract of 189 acres on Green Island,, near Albany, by the Ford Motor Company, on which it is proposed to erect a large plant for the manufacture of farm tractors, has been announced. It has not yet been decided whether construction of the plant will begin before the end of the war.

BELLEFONTAINE, OHIO.—An election will soon be held to submit to the voters the proposal to sell the municipal electric light and gas plants.

PIQUA, OHIO.—Negotiations have been closed between the Miami Conservancy District and the Dayton Power & Light Company whereby the latter will erect an electric transmission line to Piqua so as to reinforce the local plant.

WAYNESVILLE, OHIO.—The Public Utilities Commission has authorized the Dayton (Ohio) Power & Light Company to purchase the local municipal electric light plant, at $7,172. The Dayton company is reported to be contemplating the erection of an electric transmission line from Dayton to Waynesville, and has petitioned for permission to issue $30,000 in capital stock, the proceeds to be used for that purpose.

FORT WAYNE, IND.—The local power house of the Fort Wayne & Northern Indiana Traction Company was damaged by fire recently, causing a loss of about $80,000.

LAFAYETTE, IND.—A tentative agreement has been reached between the City Council and the Northern Indiana Gas & Electric Company relative to a new street lighting contract to replace the ten-year contract which expired on Sept. 1. The proposed contract is for a period of ten years, calling for 2500 hours of service for each lamp. The price will be $37.98 per lamp per year, the same as under the old contract. The city reserves the privilege to annul the contract at the end of three, four or five years.

NEW ALBANY, IND.—The United Gas & Electric Company is overhauling its electric plant at East Eighth and Water Streets, New Albany, and will put it in operation. For the past three years the New Albany plant has been used as a distributing center, energy being obtained from Louisville. Owing to the increase in demand for electrical service the company has been obliged to start the generating plant.

SELLERSBURG, IND.—Bids, it is reported, will be received by the Town Board at its November meeting for the installation of a municipal lighting system. The plans provide for the installation of thirty-three street lamps and for commercial lighting also. The cost is estimated at $6900.

BRADFORD, ILL.—The installation of a municipal electric light plant in Bradford, is under consideration.

CAIRO, ILL.—The Menominee Electric Manufacturing Company is erecting a new plant on the Upper Sycamore, to cost about $55,000.

CHICAGO, ILL.—Work has begun on the construction of the proposed new engine plant at the power station on Division Street of the People's Gas Light & Coke Company, to cost about $50,000.

CICERO, ILL.—The Kropp Forge Company is planning to erect a boiler house, to cost about $7,000.

DURAND, ILL.—Steps have been taken by the Citizens' Electric Company to establish an electric plant to supply electricity in the towns of Rock City, Dakota, Davis and Durand. The officers of the company are: W. E. Johnson of Durand, president; W. C. Smith of Dakota, vice-president; Walter Bliss of Durand, secretary, and J. M. Best of Durand, treasurer.

BARRON, WIS.—Plans have been prepared by J. C. Jacobson, engineer, First National-Soo Line Building, Minneapolis, Minn., for proposed dam to be erected by the city. The purchase of electrical equipment is also contemplated.

KAUKAUNA, WIS.—The Green Bay & Mississippi Canal Company is reported to have purchased the pulp mill on the lower water power of the Kaukauna, owned by Luther Lindauer. Plans have been prepared by the Green Bay & Mississippi Canal Company for the construction of a dam across the lower water power which will utilize the full flowage of the Fox River and which, it is estimated, will develop 6000 hp.

KEWAUNEE, WIS.—Arrangements have been completed by the Wisconsin Shipbuilding & Navigation Corporation of Milwaukee for the construction of a shipbuilding plant at Kewaunee. The proposed plant will be located at the mouth of Kewaunee River and will include drydock, machine shop and other buildings. The cost is estimated at $200,000.

LADYSMITH, WIS.—Plans have been prepared by J. C. Jacobson, engineer, First National-Soo Line Building, Minneapolis, Minn., for the installation of electrically operated machinery at the pulp mill of the Menasha Paper Company.

MILWAUKEE, WIS.—Work will soon begin on construction of a new power plant for the Wisconsin Gun Company, to cost about $180,000. H. J. Wiegand is general manager.

OCONTO, WIS.—Plans have been prepared for improvements to the power plant of the Oconto Service Company, including the installation of a water turbine, generator, switchboard, etc. Mead P. Seastone, State Street, Madison, is engineer.

MANCHESTER, IOWA.—The Delaware County Light & Power Company, recently incorporated, is reported to have purchased the Quaker Mill property, 2 miles from Manchester, and proposes to utilize the power developed to generate electricity for lamps and motors. Joseph Hutchinson is president.

HUME, MO.—The installation of a municipal electric light plant and ice factory in Hume is under consideration.

KANSAS CITY, MO.—An ordinance has been passed by the City Council providing for submitting to the voters at an election to be held Nov. 5 the proposal to issue $400,000 in bonds to establish a municipal ice factory. An ordinance has been introduced in the Council which contemplates abolishing 400 gas lamps and replacing them with 250-cp. tungsten lamps, one electric lamp for every three gas lamps discontinued. Curtis Hill is city engineer.

KANSAS CITY, MO.—The Southwestern Bell Telephone Company has awarded general contract for the construction of a telephone building at corner of Eleventh and Oak Streets to the Swenson Construction Company, Shubert Theater Building. Bids are now being taken on vacuum steam heating, electric wiring and plumbing above the first floor. The cost of the building is estimated at $800,000. Henrici-Lowry, Commerce Building, is the electrical engineer.

MILAN, MO.—The municipal electric light plant was recently destroyed by fire.

PUXICO, MO.—The local electric-light plant is reported to have been purchased by J. A. Bilbre of Clarence, Mo.

BUFFALO, KAN.—At an election held recently the proposal to issue $20,000 to rebuild the municipal electric light plant will be submitted to the voters. W. B. Rollins & Company, 209 Railway Exchange, Kansas City, Mo., are engineers.

DOWNS, KAN.—The Solomon Valley Light & Power Company, it is reported, is negotiating with the cities of Downs, Glen Elder, Cawker City, Gaylord, Portis and Kirwin, to enter into an agreement whereby they will raise $7,000 to put the plant in shape for business.

ELLIS, KAN.—Bids are being received by the city of Ellis for construction of smokestack, 100 ft. high by 5 ft. in diameter, for the municipal electric light plant. Black & Veatch, Inter-State Building, Kansas City, Mo., are engineers.

ELLIS, KAN.—Contract has been awarded by the city of Ellis for the construction of a new power house for the municipal electric light plant to Antone Jacobs of Hays. Proposals, it is understood, will soon be asked for machinery. Black & Veatch, Inter-State Building, Kansas City, Mo., are engineers.

Southern States

SHELBY, N. C.—The new knitting mill to be established by Charles A. Morrison in Shelby will be equipped with electrically driven machinery.

MOBILE, ALA.—Extensions and improvements are contemplated by the Mobile Electric Company involving an expenditure of about $50,000. The proposed work will include rebuilding line of heavy wire for additional power to be furnished various shipyards in the southern portion of the city, installing a centrifugal pump on waterfront and installing automatic stokers under boilers at power house to provide an additional horsepower.

TALLADEGA, ALA.—The Talladega Light & Water Company is reported to be in the market for a new or second-hand gas (artificial) engine of not less than 40 hp.

FORT SMITH, ARK.—Preparations are being made by the Glicks Dry Cleaning Company, which recently secured a contract with the War Department for cleaning all army uniforms at Camp Pike, for a large dry-cleaning plant which will require approximately 200 hp. in electric motors.

HELENA, ARK.—The Archer Lumber Company of Helena is planning improvements to its plant at South Helena, including dry kilns, dimension lumber plant and power plant, to cost about $250,000.

BRISTOW, OKLA.—The installation of new street lamps in Bristow is under consideration by the City Council.

EL RENO, OKLA.—A new high-tension transmission line will be erected from El Reno to Hennessey to serve Okarche and Dover. This line will also serve the purpose of connecting the Enid and El Reno divisions of the Oklahoma Gas & Electric Company, a line already being in operation between Enid and Hennessey.

HOWE, OKLA.—An election will be held Sept. 30 to vote on the proposal to issue $5000 to complete the municipal electric light plant.

MUSKOGEE, OKLA.—The Peabody Battery & Starter Company is planning to install additional machinery, to cost about $10,000.

STILLWATER, OKLA.—Contract has been awarded to the Merkle Machinery Company, Interstate Building, Kansas City, Mo., for machinery for the municipal electric plant.

AUSTIN, TEX.—Work has begun on the extension of the municipal water, light and power systems to the Radio School at Penn Field. The cost is estimated at about $30,000.

EASTLAND, TEX.—The local electric power plant has been taken over by the Texas Light & Power Company. Improvements, including the installation of new machinery and equipment, will be made to the plant. Electric transmission lines will probably be erected to various points in this oil-producing country.

EL PASO, TEX.—The power house at the Dudley & Orr rock quarry on Mount Franklin was recently damaged by fire, causing a loss of about $10,000.

SAN ANGELO, TEX.—The San Angelo Water, Light & Power Company is contemplating the installation of a filtration plant and other improvements, involving an expenditure of about $35,000.

Pacific and Mountain States

BREMERTON, WASH.—The City Council has adopted an ordinance providing for establishing a municipal electric light and power plant (to be built or purchased), to cost about $200,000.

DAVENPORT, WASH.—The Commissioners of Adams County have granted the Intermountain Power Company a franchise to erect an electric transmission line from Long Lake southward through Lincoln to a connection with the Milwaukee Railway in Adams County. The Washington Water Power Company of Spokane, from which the Intermountain company secures its power, has agreed to have its new unit at Long Lake ready by May 1.

RITZVILLE, WASH.—The Intermountain Power Company, a subsidiary of the Montana Power Company, has applied for a franchise on certain streets and alleys in the city. The proposed line is not for local service,, but to supply electricity to operate the trains of the St. Paul & Milwaukee Railroad over the mountains to Seattle.

SEATTLE, WASH.—H. K. Owens, consulting engineer of Seattle, has submitted a proposition to Mayor Hanson for the development of the Cedar River Power plant to twice its present capacity. This proposal is submitted as a possible means of getting more electric power in not to exceed a year and at a reasonable rate. Mr. Owens recommends utilizing the stored waters held in the lake by nature and states that a tunnel can be built that will draw off the water from the lake to a point 100 ft. below the surface, conduct it to a surge tank at a point on the hill directly above the present power station of the city, thence by short penstocks to additional turbines to be installed at the same station. This tunnel will be about 15,000 ft. long, but the penstocks are correspondingly shortened. The present penstocks are more than 16,000 ft. long, and those proposed will be about 1000 ft. long. This development will not interfere with the operation of the present plant and will not disturb natural conditions of the lake. The dam does not leak, and only a low dam of earth is required, similar to the small crib dam built by the city in 1900 and still in use. This use of the lake as a reservoir will afford sufficient storage to generate at least 20,000 hp. continuously at the city station. Mr. Owens states that the Skagit, the Cedar River or any other power project will cost 100 per cent more now than it will after the war, and by improving the city plant at Cedar Falls all requirements during the war period can be met at an expenditure of one-third of the cost contemplated on the Skagit and a saving of from $2,000,000 to $3,000,000 in the first cost on the Skagit River by waiting until after the war.

TACOMA, WASH.—An issue of $300,000 in bonds for the purpose of acquiring the Lake Cushman power site for the city of Tacoma has been approved by the United States government.

TACOMA, WASH.—The United States Shipping Board Emergency Fleet Corporation has loaned the city of Tacoma $237,000 to be used for double-tracking its car lines to the shipyards, the purchase of new street cars and the construction of a new loop line within the city.

BAY POINT, CAL.—The State Railroad Commission has granted the Bay Point Light & Power Company permission to issue 440 shares of capital stock having a par value of $100 per share, to be sold at not less than 80. Of the proceeds $6,454 is to be used to take up outstanding indebtedness and the remainder to be used for construction of substation, primary lines, transformers, secondary lines, meters, street-lighting, etc., amounting to $33,525.

GILROY, CAL.—The installation of a new electric generator at the firehouse is under consideration by the City Council.

LOS ANGELES, CAL.—Bids will be received by the Board of Public Service Commissioners, 1002 Knickerbocker Building, Los Angeles, until Oct. 8 for high-voltage transformers for the department in accordance with specifications No. O-181.

LOS ANGELES, CAL.—The Public Service Commission has awarded contract for the installation of a complete hydroelectric generating system to be installed in the power house, at Haiwee, on Owens River, to Archer & Baldwin, 114 Liberty Street, New York, N. Y., at $31,500.

SACRAMENTO, CAL.—Bids will be received by the City Commission until Oct. 1, for an electrically driven pumping unit to be installed at the city waterworks station. The cost is estimated at $25,000.

Record of Electrical Patents

Notes on United States Patents

14,505. (Reissue.) Safety Signal for Vehicles; William N. Best, Brooklyn, N. Y. App. filed July 25, 1916. Supplied with electricity, gas, etc.

1,275,961. Snap Binding Post; Nicholas Maynard, Sabetha, Kan. App. filed May 4, 1917. For firmly holding a wire and providing a contact surface therewith of relatively large area without the use of binding nuts, screws and other devices requiring tools for manipulation.

1,275,966. System of Control for Induction Motors; Friedrich W. Meyer, Pittsburgh, Pa. App. filed March 24, 1915. To provide circuits and apparatus whereby, in operating a motor from a single-phase supply circuit, a heavy starting torque may be obtained in a simple and efficient manner and whereby the motor may be subsequently operated over a wide speed range with little energy loss.

1,275,967. Frequency Changer; Friedrich W. Meyer, Pittsburgh, Pa. App. filed March 24, 1915. To provide circuits and apparatus whereby energy from one polyphase system may be supplied to another polyphase system of different frequency or of both different frequency and number of phases, without the use of heavy moving parts.

1,275,968. System of Distribution; Friedrich W. Meyer, Pittsburgh, Pa. App. filed March 24, 1915. To provide circuits and apparatus whereby a vehicle may be accelerated in a smooth and simple manner and whereby regeneration may be readily effected when coasting or accelerating.

1,275,969. System of Locomotive Control; Friedrich W. Meyer, Pittsburgh, Pa. App. filed March 24, 1915. To provide means whereby electric locomotives, especially those of the split-phase type, may be conveniently started and whereby the speed, power factor and load distribution in a plurality of motors may subsequently be regulated.

1,275,970. System of Locomotive Control; Friedrich W. Meyer, Pittsburgh, Pa. App. filed March 24, 1915. To provide means whereby electric locomotives, especially those of the split-phase type, may be conveniently started and whereby the speed and load distribution in a plurality of locomotives may subsequently be regulated.

1,276,030. Electric Welder; Spencer C. Cary, Brooklyn, N. Y. App. filed May 1, 1916. For the union of pieces of thin metal, such as sheet iron or steel.

1,276,031. Meter Box; Albert Casper, Vallejo, Cal. App. filed April 17, 1917. Easily assembled and weatherproof.

1,276,037. Automatic Ringing System; Hiram D. Currier and Michael B. Stazak, Chicago, Ill. App. filed Jan. 9, 1915. Applied ringing current is disconnected from a called line immediately upon the removal of the receiver.

1,276,043. Metering Panel; Edward F. Edgecombe, Jr., La Grange, Ill. App. filed Nov. 6, 1916. Ready connecting of different circuits in different grouping to different meters.

1,276,045. Transmission and Control for Motor Vehicles; Justus B. Entz, Cleveland, Ohio. App. filed June 22, 1914. A single dynamo-electric machine which functions as a variable-speed electric clutch between the engine and propeller shaft.

1,276,085. Combined Ignition and Lighting Generator; Leon J. Le Pontois, Lakewood, Ohio. App. filed June 28, 1915. Low-tension current and high-tension.

1,276,091. Day and Night Sign; Arthur E. Maiden and Carl Schindler, Oakland, Cal. App. filed Feb. 16, 1914. For displaying for any length of time a great variety of letters, words, sentences or pictures.

1,276,096. Sectional Electric Heating Element; Frederick W. Moffat, Weston, Ontario, Canada. App. filed April 2, 1918. Adapted for heavy duty in hotels and restaurants.

1,276,104. Electrically Operated Hammer; George M. Painter, Chicago, Ill. App. filed Jan. 2, 1917. Pneumatic hammer operated by an electric current.

1,276,110. Circuit Maker and Breaker; Christian Rasmussen, Cleveland, Ohio. App. filed Feb. 18, 1918. A rotary controller.

1,276,128. Trolley Head and Guard; Absalom D. Shaffer, Kittanning, Pa. App. filed Sept. 17, 1917. Pair of removable guards to prevent the trolley slipping off of the trolley wire.

1,276,129. Filtering Apparatus; Carolyn S. Smith, Brooklyn, N. Y. App. filed May 18, 1914. Sets up galvanic action.

1,276,130. Process of Treating Foul Solutions; Frank T. Smith, Jamaica Plain, Mass. App. filed April 2, 1915. Production of pure solutions of acid.

1,276,134. Purified Crystalline Alumina and Method of Making the Same; Frank J. Tone, Niagara Falls, N. Y. App. filed Jan. 5, 1918. For abrasive, refractory and other purposes.

1,276,150. Electric Heating Pad; Charles Wirt, Philadelphia, Pa. App. filed July 3, 1915. Cheap and flexible.

1,276,155. Automatic Railway-Crossing Signal; James W. Arney, Many, La. App. filed Sept. 4, 1916. May be used to protect a crossing without regard to any other block signal system.

1,276,158. Elevator Signal; August Andren, Brooklyn, N. Y. App. filed April 19, 1909. To provide means for closer coöperation between the "starter" and the several operators of the elevator cars.

1,276,196. X-Ray Tube; Francis J. Farrelly and Alfred Greiner, Hartford, Conn. App. filed Jan. 25, 1916. Breaking of the glass bulb at the point where the cathode neck joins the bulb is eliminated.

1,276,208. Conductor Bar; Julius H. Gillis, Anaconda, Mont. App. filed Aug. 6, 1917. For use in the electrolytic process for depositing metals.

1,276,216. Electrical Connection; Ellsworth A. Hawthorne, Bridgeport, Conn. App. filed May 20, 1915. For securely holding electric conducting wires to a plug or socket.

1,276,228. Line-Wire Connector; James C. Keenan and Michael H. Keenan, Toronto, Ontario, Canada. App. filed Sept. 11, 1917. Wire may be connected to an insulator without the use of any tool.

1,276,304. Armature Circuit-Testing Apparatus; Clyde Zeek, San Diego, Cal. App. filed Oct. 31, 1916. Automatically adjusts itself to different-sized commutators and is provided with means for producing an induced current.

1,276,317. Electric Incubator; Frank N. Blagen, Hoquiam, Wash. App. filed Feb. 16, 1917. Frequent removal of the mercury or cleaning is not required.

1,276,331. System of Electrical Distribution; William H. Cole, Walthan, Mass. App. filed Aug. 12, 1915. Employs a plurality of conductors arranged in parallel and extending between two receiving or distributing stations.

1,276,340. Electrical Coupling; William Gadke, Philadelphia, Pa. App. filed Sept. 2, 1915. For connecting the terminals of a timer for an internal-combustion engine, with the cables leading to the spark coil.

1,276,350. Apparatus for Sending and Receiving Information; Edwin V. Hagman, Boston, Mass. App. filed May 13, 1914. By electro-mechanical means.

1,276,378. Adjustable Support for Electric Switches; Edward H. Kruse, Fort Wayne, Ind. App. filed Feb. 18, 1916. Means for securing the base upon the bar in the desired location.

1,276,386. Apparatus for Separating Liquids; Charles W. McKinben, Houston, Tex. App. filed Nov. 24, 1917. For rapidly and effectually dehydrating petroleum-oil emulsions.

1,276,387. Method of Separating Associated Liquids; Charles W. McKibben, Houston, Tex. App. filed Jan. 22, 1918. For the treatment of liquids differing in specific gravity.

1,276,412. Telegraphic Sending Circuit; Edwin S. Pridham, San Francisco, Cal. App. filed Aug. 22, 1916. To prevent the sparking at the reciprocating contacts on the breaking of the circuit.

1,276,442. Telephone-Exchange System; Dawson M. Taggart, East Orange, N. J. App. filed Nov. 7, 1917. Central-energy type.

1,276,483. Trolley Head; William M. Brillhart, York, Pa. App. filed Sept. 7, 1916. Will serve to move snow and ice from the trolley wire.

1,276,491. Contact Bank; Henry P. Clausen, Mount Vernon, N. Y. App. filed Sept. 25, 1915. For automatic switches of the rotary type.

1,276,516. Electric-Lamp Socket; Frederick P. Gates, Hartford, Conn. App. filed March 20, 1917. Perfect adjustment of the socket switch.

1,276,521. Telephone System; Charles L. Goodrum, New York, N. Y. App. filed June 15, 1916. Arrangement for registering the number of telephone conversations.

1,276,522. Arc Lamp; Emile J. Guay, Lynn, Mass. App. filed Jan. 31, 1917. Feeding operating is induced by an electromagnet in a virtual or actual shunt around the arc, which is open before the arc is established.

1,276,549. Telephone-Exchange System; Alben E. Lundell, New York, N. Y. App. filed Dec. 26, 1916. Variably operable.

1,276,552. Brush Mounting for Dynamos and the Like; Charles Marcus, Far Rockaway, N. Y. App. filed June 4, 1915. Are readily accessible for inspection or removal.

1,276,557. Circuit Breaker; James H. Millspaugh, Guthrie, Okla. App. filed Sept. 10, 1917. The armature, coacting with the electromagnet, serves as one of the contact members.

1,276,558. Telemetric Signal; Robert R. Minton, Cleveland, Ohio. App. filed Jan. 15, 1917. For use in connection with lubricating systems.

1,276,563. Direction Signal for Vehicles; John F. O'Malley, Geneva, N. Y. App. filed May 8, 1917. Electromagnetically operated.

1,276,564. Trolley Replacer; Earl L. Pangborn and Henry W. Niermer, Indianapolis, Ind. App. filed May 7, 1917. Actuated by the displaced wire.

1,276,567. Protective Device; Charles S. Price, Rutherford, N. J. App. filed March 16, 1917. Comprises a fuse element for protection against abnormal currents.

1,276,568. Regulator for X-Ray Tubes; Joseph Regnier, Paris, France. App. filed Dec. 1, 1917. Reduced volume.

1,276,570. Registering and Recording Device; John G. Roberts, Dobbs Ferry, N. Y. App. filed March 7, 1914. Applicable to telephone-exchange systems.

1,276,574. Electrically Heated Radiator; James J. Rohan, St. Louis, Mo. App. filed March 23, 1918. Simple and positively acting means for automatically controlling the flow of electric current to the heater.

1,276,578. Electric Control for Generators; Herbert A. Scott, Saltsburg, Pa. App. filed Jan. 28, 1916. To augment the supply of current to the main line by an auxiliary source of supply which will become effective only when the load reaches a predetermined limit.

1,276,580. Synchronizing System; Charles E. Scribner, Jericho, Vt. App. filed May 19, 1915. For separated and independently driven rotatable bodies operatively interconnected by a transmission line.

1,276,581. Synchronizing System; Charles E. Scribner, Jericho, Vt. App. filed May 19, 1915. Separated rotatable bodies operatively interconnected by a transmission line.

1,276,589. Thermo-Regulator; Charles P. Steinmetz, Schenectady, N. Y. App. filed June 26, 1917. Control of heating device.

1,276,593. Battery Cover; Clarence W. Taube, Niagara Falls, N. Y. App. filed Jan. 2, 1918. Allows gases to escape.

1,276,594. Dynamo-Electric Machine; William A. Turbayne and Thomas R Du Bois, Niagara Falls, N. Y. App. filed May 19, 1915. Automobile starting and lighting system.

1,276,599. Process of and Apparatus for Etching; Joseph H. Weeks, Rutledge, Pa. App. filed April 1, 1916. For direct use in printing.

1,276,600. Electrical Etching Apparatus; Joseph H. Weeks, Rutledge, Pa. App. filed July 8, 1916. Brushes automatically keep the cathodes clean.

1,276,604. Electric Battery; David H. Wilson, New York, N. Y. App. filed Oct. 23, 1914. Long life, great reliability and cleanliness.

1,276,617. Morse Transmitter; James A. Breen, Washington, D. C. App. filed Dec. 6, 1917. Circuit closer may be actuated to make and break the circuit to make a plurality of "dots" by a single movement of the "dot" lever.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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The Situation Regarding Coal

COLD weather brings with it fuel problems. The position of public utilities as regards coal supplies is not so very serious as it was last year, thanks to the warnings of the Fuel Administration and the engineering press, yet it is nevertheless serious. Managers of public utilities have still a real cause for anxiety this coming winter, because we need more coal than ever and the mining and transportation questions are by no means settled. It therefore behooves all to practice more rigorous economy in the use of coal. We must get every heat unit out of it with a minimum expenditure of labor and make what we get go as far as possible. By using efficient equipment, improving load factors and power factors, stopping leaks and checking waste, we can help both the nation and ourselves. It is an excellent thing to have faith in ourselves and our industry and not to rely too much on other agencies. We may have a mild winter and we may not. Our transportation lines under government control may be equal to all emergencies and they may not. Anyway, it is better not to trust too much to them or to the weather. Works are what count, and right now every one should take a personal and patriotic interest in saving as much coal as possible. We can never become too efficient in the use of coal, and most of us are a long way from even the shadow of it.

We have gone into this war with clean hearts and hands. The cause is righteous and our men are fighting for it valiantly. Neither must suffer for lack of support. LEND!

Distributing Teachers of Radio

ACCORDING to reports received recently from the Division of Engineering, United States Employment Service, there is at present a great demand for teachers of radio-telegraphy. The need is particularly great in many important colleges now giving military courses to young men who are in the draft or are enlisted in some reserve corps. That such a demand exists and that it is not being adequately filled is regrettable, for instruction in this subject is highly important. It has been suggested that the whole demand may be easily filled if a suitable arrangement can be made with the army authorities. The army schools are regularly turning out men who have finished the regulation courses in radio-telegraphy and who are in many cases especially well qualified to teach it. If these men could be furloughed for a brief period and sent as instructors to the various universities and schools where military courses are being given, they could do a great deal of good in a direct way. With hundreds of men thoroughly trained in radio-telegraphy, it is regrettable to have universities begging in vain for one or two teachers.

There can be only two outcomes to the war—victory or defeat. The latter is unthinkable and victory cannot be effected without funds. Help us win by buying bonds.

Study of the Tariff Is Needed

STUDY of the tariff, systematic planning for the future, is necessary for the electrical manufacturer who hopes to maintain his position in after-the-war competition. Study and planning is not by any means all that the manufacturer needs to do, but it is the first step to assure sympathetic public and governmental recognition of his just requirements in this direction. Without preliminary and intensive study there cannot be a convincing presentation to the government of the grounds on which Congressional tariff action can logically be based. The electrical manufacturing industry as an industry, making its claims as a welded whole, has to-day an opportunity which, if neglected, may not be open for years again, may in truth never appear. We are at war, but we should not fail to look far enough ahead to avoid pitfalls, to see and follow the straight clear road toward greater volume of production. For many years the tariff has been the abused football of the two main political parties. Within the boundaries of high or low tariff, however, electrical manufacturers asserted occasionally their desire for equitable treatment.

No thinking man will deny that there has been entirely too much politics in the tariff in the past, too little real scientific consideration. Costs here as compared with costs abroad, markets, labor, raw materials, not carefully appraised in years gone by in their relation to the electric industry, are now awaiting the study of the men in the industry, who can render a service of permanent value to it. The United States Tariff Commission asks full revelation of the truth—in fact, urges it. Little understood by the general public or the law makers, dealing with a force mysterious to them, the electrical industry now at last has the official invitation to make its case plain to the commission, to make such an investigation as has not been made heretofore in the history of the country.

The international trade committee of the Associated Manufacturers of Electrical Supplies in its search for data to lay before the Washington authorities has undertaken a work which is of constructive and great importance. It is much handicapped by the war conditions and the additional pressure which the national demands put upon the staffs of the manufacturing companies. Nevertheless, its requests for data should be met and met promptly. Large results depend upon the success of its work; serious penalties will be paid if the United States adopts a tariff policy which fails to deal adequately with the electrical manufacturing industry. Certainly, the Tariff Commission, seeking a scientific basis of fact for its recommendations to Congress, has a right to expect the coöperation which it asks. Giving the coöperation, the manufacturers have every reason to urge with confident assurance that they shall have a separate classification in the new tariff schedule. The present powerful position of the industry warrants it, the hope and expectation of tremendous growth in coming years demand it. Other countries, far more deeply embedded in war than are we at this time, are proceeding to formulate programs for after-the-war foreign trade. We should not, to say the least, be behind them in outlining a positive course or, after it is outlined, in following it with zeal.

The blood of Americans is being shed abroad so that liberty and justice may prevail throughout the world. This sacrifice will be in vain unless the nation has the funds to finish what it has undertaken. Liberty bonds help.

An Important Interconnection System

A PLAN for exchange of power between the Boston Edison company and the New England Power Company is just now in process of execution. It unites the two biggest networks in New England to the benefit of both the participating companies and the public. This interconnection is a little out of the usual in that for the present it is a case of a steam plant coming to the rescue of an overburdened hydroelectric system, instead of the reverse. The Boston Edison company has a thoroughly efficient and well-organized plant on tidewater and covers between 400 and 500 square miles of territory with its right-of-way and pole lines. It is already heavily loaded at the peak, but like other plants doing a general electrical supply business has spare capacity for a part of the twenty-four hours.

The New England Power Company has a far-reaching network and does a business chiefly of wholesaling power in large blocks. It obtains electricity from the Connecticut and its confluents, the original plant being in South Vernon, Vt., close to the Massachusetts line. Now the Connecticut River is subject to periods of extremely low water, and despite the interconnections with steam plants of considerable reserve capacity, the company's business, now including a very large proportion of war industries, has grown to a point perilously near its feasible output. Under these circumstances a coöperative arrangement with the great steam plant in Boston was extremely desirable. The power thus made available for most of the day is a very valuable resource otherwise not immediately useful to any one. On the other hand, there are times of the day and year when the hydroelectric plant is able to return energy to its neighbor if needed. The vast extent of the whole system and its varied uses insure a considerable diversity factor and hence a better utilization of the aggregate of generating plant. The steam plant will, besides, definitely gain in the increase of load during hours off the peak, which will react favorably on generating costs. The whole situation is one in which the value of interconnection can be clearly demonstrated, and it is a matter for general congratulation that interconnection is to be at once provided.

The battle of Marengo was won by Napoleon because a drummer boy only knew how to beat a charge. If we only knew how to lend, there would be no doubt as to the outcome of this war.

More About Industrial Motors

SYDNEY FISHER'S paper on the equipment of industrial plants deals particularly with problems of motor rating. It is undoubtedly true that the average engineer plays for safety and is likely to overburden the plant with underloaded motors rather than to take any chances. The result is often a combination of low efficiency and low power factor which is a serious handicap. The ordinary induction motor is a remarkably efficient and reliable machine, all things considered, but it does not do its best on half load. Just now, when motor deliveries are poor, it is particularly undesirable to demand unnecessary capacity, to say nothing of paying for it in lowered efficiency. From this viewpoint Mr. Fisher has a fling at the limitations of individual drive. As our readers well know, the tendency of late has been strongly in the direction of machines directly motor-driven. There are obvious reasons for this in the added flexibility of the drive and, under favorable conditions, in the gain of efficiency by cutting out shafts and belting. Yet, as Mr. Fisher points out, a well-planned group drive may, through the diversity factor of its load, work at a rating giving considerably higher efficiency and power factor than with individual drives for the same machines.

Something here depends on the absolute as well as the relative size of the units. An induction motor of a single horsepower or a little more usually shows both rather low efficiency and rather low power factor even at full load, particularly if of moderate speed. The loss thus incurred may well be in the long run quite comparable to that from the well-planned shafting and belting of a group drive, to say nothing of the difference in the first cost. Hence each case should be carefully examined from the standpoint of economies, despite the familiar good points of the individual drive.

Mr. Fisher properly lays great stress on systematic experiments in the choice of motors and on rigorous upkeep. This implies sharp inspection not only of the motors themselves but of the controlling devices and of the whole drive. Of these three the two latter are likely to be the seat of the major part of the trouble. In case of a breakdown there should be a systematic scheme of trouble hunting planned to run down the difficulty in a thorough and orderly manner. One may sometimes see the cause at once or scent it by a sort of intuition, yet a regular program of examination will on the average save time—and time is money. With group drive immunity from breakdown may sometimes be had by using a pair of motors per group with an emergency belt connection and trusting to overload, which is no mean reliance in induction motors.

Motors in Paper and Pulp Mills

WITHIN the last twenty years there has been a very rapid increase in the applications of electric drive to paper and pulp manufacture. The general advantages of this are of much the same order as in other motor work—cheapness, convenience, simplicity and the like. Paper and pulp manufacture, however, requires some special adaptations of a somewhat unusual character and embodies as well a great diversity of conditions which make the choice of motors of unusual importance.

It therefore appears that a good bit of skill is necessary in picking out the motor equipment for the various items of the load. Here as elsewhere the induction motor is chiefly used, except for driving the calenders, where speed requirements interfere. A large part of the work in the general case can be accomplished with the ordinary squirrel-cage type of motor, which is cheap, efficient and rugged. There are, however, a good many machines in the pulp industry which demand special provisions for starting on account of the heavy loads dealt with at times. The squirrel-cage motor, when called upon to exert stiff starting torque, requires inconveniently high line currents, and where the starting load is exceptionally large the engineer is usually driven back upon the induction motor with a wound rotor and starting resistance. The familiar internal-resistance rotor here comes into play on account of its great starting powers, but it gives at bottom a constant-speed motor, since the resistances are intended merely for getting the necessary torque without too much current. In certain cases, particularly of group drive, when heavy machinery has to be started it is applicable with particular advantage; but there are, on the other hand, a good many cases in pulp mills where external starting resistances practically amounting to rheostatic control are necessary. Such instances are found where heavy torque is required, applied at will and in variable amount, to work the loaded machinery up to its speed. At this point it is necessary to note that such a motor has essentially the characteristics of a series-wound direct-current motor with rheostatic control. There are similar energy losses when running at reduced speed and similar tendencies for speed to vary under varying load for any particular setting of the rheostat.

For some few machines requiring rather large power even synchronous motors may be advantageously employed to do the work and improve the power factor at the same time. The voltage for large motors is sometimes the ordinary primary standard of 2300, more frequently 440 or 550 volts. In this connection it should be noted that in a paper or pulp mill motors and wiring are exposed in considerable degree to the general dampness, and proper caution in behalf of the employees would suggest that alternating currents as high as 440 volts are rather unsafe neighbors. Extra pains should be taken in the insulation of circuits and in getting both them and the motors as far out of the workmen's reach as is practicable. In certain cases, particularly with calenders, variable speed combined with constant speed under moderate variations of load is necessary. Certainly few classes of manufacture require so great variety of motors as the paper industry or demand more good engineering judgment.

To invest in the Fourth Liberty Loan is to perform a war service of the first magnitude. Financial support is as necessary to victory as military equipment. The two go hand in hand; therefore buy Liberty Bonds.

Extension of Outdoor Equipment

ANOTHER useful innovation in transmission service has come from the Pacific Coast, as so often happens. R. E. Cunningham's brief description of the application of automatic pole-top switches for transformer service gives a most useful hint to the engineers who in war-time stress have to find a way to keep up efficient service while keeping down cost. For general service it is easy enough to obtain the transformer equipment, but hitherto protective devices for small outdoor installations have been in a rather rudimentary state of development. High-voltage fuses have often proved disappointing, especially on three-phase circuits, where a single fuse might let go, throwing the motor on single-phase and very possibly burning it out.

To meet the needs of practical service there has been evolved for the Southern California Edison Company an automatic cut-out for pole-top use on circuits up to 10,000 volts. The switch is in a single tank and is fitted with three overload coils in series with the lines so that an overload on any one will disconnect the service. The cut-out can be reset by pull cables from the ground, so that a mere transient overload can quickly be dealt with. As some 200 of these switches are now giving satisfactory service, the apparatus has already passed the experimental stage, and it is in fact in regular use for transformers up to 100 kw. The cut-out can be placed on any convenient pole carrying the primary circuit to the service; thus there is no burdening of the poles with apparatus, and one hardly realizes that a real outdoor substation is in operation. The equipment is decidedly a move in the right direction—toward that simplicity in the distribution of energy at high voltage which brings good service at low cost.

We shall very probably see the same plan tried out at voltages considerably in excess of 10,000 with similar good results.

The Coming Issues

CONTINUING its discussion of electric service rates, the ELECTRICAL WORLD will present in an early issue opinions of several central-station executives on this subject. Features of a plant which was specially equipped to weather any probable contingencies that might arise as a result of the war will also be described shortly. In addition to the various problems mentioned in last week's issue, we will publish a report by Dr. Charles R. Mann on engineering education. In this report he does not propose a standard curriculum but a method by which engineering colleges can construct courses to meet present-day engineering demands. Every reader will find something in the ELECTRICAL WORLD that will apply to his own specific problems or will have some very close bearing thereon.

War Instruction at Massachusetts "Tech"

Instruction and Research Work Have Developed Rapidly Into Necessary Activities of Military, Naval and Aeronautical Character—Establishment of Unit of the Student Army Training Corps

The application of engineering educational resources to the national purpose in the war is illustrated most effectively by this account of the activities at the Massachusetts Institute of Technology.

SINCE the outbreak of the World War the instruction and research work carried on at the Massachusetts Institute of Technology, at Cambridge, one of the largest engineering schools in the world, have developed more and more into military, naval and aëronautical activities. The War Department has recently announced its intention of establishing a unit of the Student Army Training Corps at the institute, and since Oct. 1, 1918, the institute has been carrying on its work according to a program that will virtually make it continuous throughout the year for the duration of the war.

The war work of the institute has been outlined in a former issue of the ELECTRICAL WORLD, but comparatively little publicity has been given to the electrical laboratories in the plant at Cambridge, which was dedicated about two years ago and which is now thoroughly established in its new home. It is of interest at this time to touch upon some of the facilities which are now available.

The Cambridge buildings of the institute represent, with site, an investment of over $7,000,000. They face the Charles River Esplanade, and with the exception of an aperture of 354 ft. in that direction inclose a court area of about 5.5 acres. The units form a continuous building separated by fire walls into appropriate sections, three-story and four-story structures being used. In the center is an administration building and library, surmounted by a reinforced-concrete dome 72 ft. in diameter and rising to a height of 65 ft. above the top floor. The library is lighted by thirty-two 300-watt gas-filled lamps mounted in prismatic reflectors in the dome.

THE ELECTRICAL POWER PLANT

The electrical energy used at the institute is generated in a power plant containing three turbo-alternators of 187, 625 and 937.5 kva. rating respectively. The boiler installation is rated at about 1800 hp. The alternators supply the bulk of the power used and feed into 2300-volt, three-phase, 60-cycle buses. In addition to the above machines there is a turbine-driven 150-kw., 230-volt direct-current generator feeding into a 230-volt direct-current generator which feeds the 230-volt buses. This bus is also fed by two 150-kw. motor-generators run off the 2300-volt system.

Feeders from the 2300-volt buses in the generating plant are run to a distribution station in the basement of the central building directly under the dome. At this point transformers are installed to furnish the lower-voltage energy required in various parts of the institute for motor operation and alternating-current night and general lighting, laboratory outlets, etc. A special substation is provided for the electrical engineering department. A 2300-volt feeder is also run from the power plant to various laboratories where electric furnaces are used. From the 230-volt direct-current buses in the power station three main feeders run to the distributing station. These supply power to certain direct-current motors, fans, chemical and physical laboratories and electrical engineering laboratories. In order to enable sufficiently steady power to be delivered to the electrical engineering laboratory it was decided not to depend upon the 230-volt alternating and direct-current energy received from the plant of the institute through direct feeders, voltage variations and phase unbalancings due to other loads making the conditions unsatisfactory for experimental work. Hence a special substation was designed and installed for the electrical engineering department.

ELECTRICAL LABORATORY EQUIPMENT

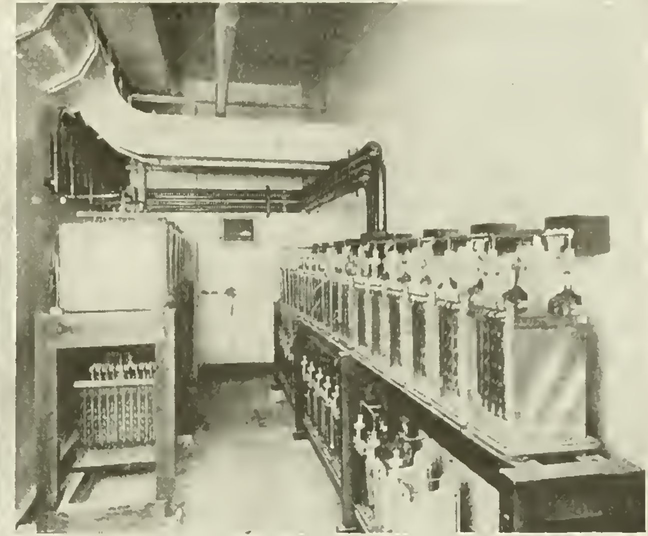
The electrical engineering laboratories are provided with unusually complete facilities for departmental control of energy for educational purposes. Primary three-phase, 60-cycle energy at 2300 volts is brought underground to the departmental switchboard. At this point is a local plant for the transformation of energy. The output at the switchboard at this plant is direct current at 110-220 volts, alternating current in all required combinations of two-phase and three-phase energy, 25-cycle and 60-cycle supply at 110-227 volts and 155-220 volts. Three motor-generator sets supply the electrical engineering laboratories with energy. These have a rated capacity of 500 kw., one being driven by an induction motor and the other two by synchronous motors. One machine is arranged to supply single-phase and two-phase energy to the laboratories. By using the third motor-generator set for single-phase supply the second set may be used exclusively for balanced three-phase loads. The motors of these sets are remotely controlled from the departmental switchboard. Tirrill regulators are installed to control the voltage of the generators in these sets. A storage battery is also installed for use in special tests where extreme constancy of voltage is needed.

The dynamo laboratory is arranged on an industrial model, with a main floor at the ground level and a central two-story crane well with a loading platform at each end and a balcony at the first-floor level. The main floor has an area of 8000 sq.ft. and is used for motors and generators above 2 kw. in rating. The balcony is reserved for the smaller dynamos and transformers. A 10-ton crane serves the laboratory. All the instruments used in laboratory testing are stored in an instrument room opening into the dynamo laboratory on the main floor. A dumbwaiter connects this room with the balcony, an electrical measurements laboratory and calibration room. A heavy-current laboratory is available on the ground floor for service up to 6000 amp., direct current.

The electrical measurements laboratory is supplied

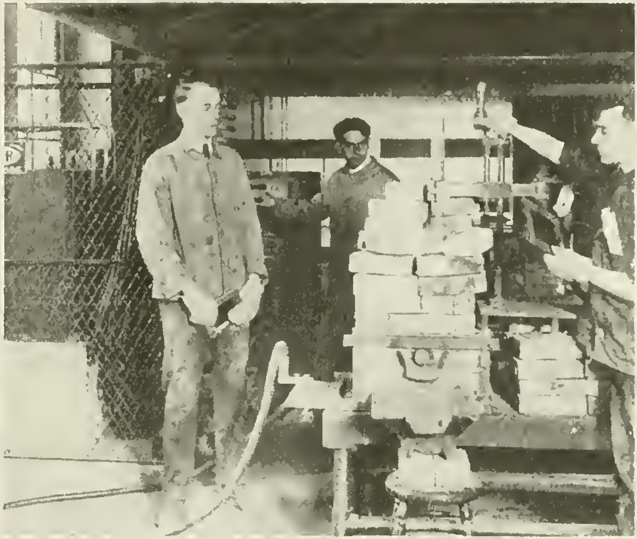
LABORATORIES IN MASSACHUSETTS "TECH" DEVOTED TO WAR WORK

Dynamo Laboratory

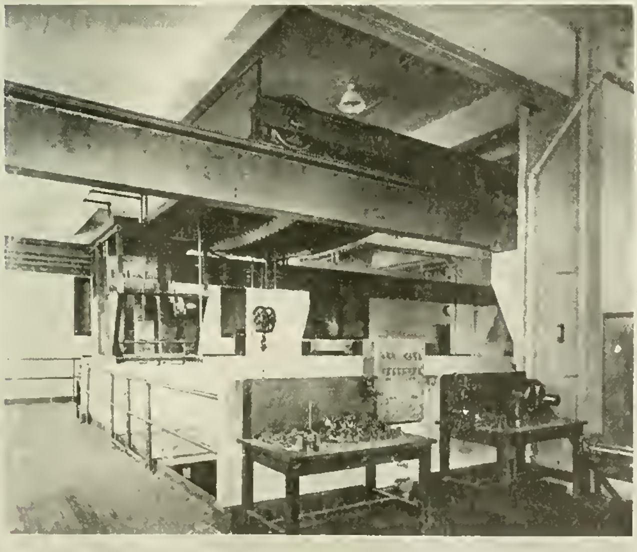


Typical Storage Battery Room

Chemical Laboratory



Electric Furnace Work



Balcony in Dynamo Laboratory

Dynamo Laboratory and Balcony

with energy by special feeders running directly from the departmental substation. By throw-over switches these feeders may be connected either to the motor-generator sets in the substation or to the power house supply. In the laboratory these feeders terminate at three main distributing panels equipped with switches, fuses and circuit breakers.

The following service is available at these panels: Direct current, 230-115 volts; direct current from storage battery, 240-120 volts; alternating current, three-phase, 60 cycles, 230-115 volts, four-wire; alternating current, two-phase, 60 cycles, 230-115 volts, five-wire; alternating current, three-phase, 24 cycles, 230 volts, three-wire. The main distributing panels connect with twenty-five supply panels at convenient points. Most of these panels are mounted around the walls, but four are on standards in the middle of the room for supplying the tables used in meter testing and similar work. Individual tables are provided for the experimental work, giving a flexible arrangement and freedom from jarring. The building construction is sufficiently massive to enable the galvanometers to be supported on the walls. To facilitate the setting up of galvanometers, hoods, lamps, etc., lengths of 2-in. by 4-in. (5-cm. by 10-cm.) studding, placed 21 in. (53.3 cm.) apart and fastened directly to the walls by bolts set in the concrete at the time of molding the concrete, were provided. The entire laboratory is provided with this studding. Between every two tables 115-volt wall outlets are provided, to which galvanometer lamps may be plugged. Central tables are provided for the heavier commercial instrument tests, with lamp banks and selective load switches conveniently placed.

At one table a special panel is installed which controls a phase-shifting motor-generator set consisting of a direct-current motor connected to two 1-kw., three-phase alternators. It is possible by means of a small motor provided with a remote-control arrangement to shift the stator of one alternator with respect to that of the other and thus obtain any desired power factor, lagging or leading. The range of frequency is from 18 cycles to 75 cycles. By means of specially designed field rheostats the voltage of these machines may be varied in small steps from zero to 300 volts.

WIDE VOLTAGE AND CURRENT RANGE PROVIDED

The laboratory is also equipped with a special low-voltage, high-current storage battery and a step-down transformer of high current rating, so that it is possible to obtain 2-volt storage battery currents up to 2000 amp. and 5-volt alternating current up to 5000 amp. By means of control equipment and series-parallel connections wide ranges of voltages and currents may be secured. A battery-charging motor-generator set is available for laboratory supply, in addition, for currents up to 150 amp. at 8 volts. Other rooms include a set-up room for preliminary investigations, which can be conducted without interfering with the regular work of the laboratory and independent of its apparatus arrangements; a calibrating room and a dark room used mainly in the development of oscillographic films and for printing.

A high-potential laboratory is adjacent to the laboratory of electrical measurements. This is equipped with a 15-kw., 230/100,000-volt transformer surrounded by a protective casing. Two high-potential busbars of iron pipe are suspended from the ceiling by suspension insulators of four units each. These buses run the length of the room and make it possible to distribute the high potential to other parts of the laboratory as desired. Another piece of equipment is a 15-kw., 50,000-volt transformer having voltmeter coils in its high-tension winding. These coils enable the high-tension voltage to be measured without recourse to multipliers or to potential transformers. The power used in this laboratory for testing service is derived from a 20-kva., three-phase alternator driven by a direct-current motor. The alternator is specially designed to give virtually a sine wave under all conditions of load. Beneath the floor an iron tank is provided for immersion tests, with water and steam supply for temperature regulation.

PHOTOMETRIC AND OTHER RESEARCH LABORATORIES

Other laboratories include photometric research and general research laboratories, a transmission laboratory with artificial lines for investigation purposes, all of which are wired for varied types of electrical service and equipped as pending researches demand. In general, the laboratories associated with the different institute departments are provided with an elaborate variety of service, electrical, steam, gas, air and hydraulic. Classrooms, lecture rooms and thesis rooms are also wired and piped for the most complete service, including in some cases control apparatus specially mounted according to the local needs, portable experimental tables run on wheels and tracks leading from preparation rooms to the lecture halls, pillars arranged to supply direct and alternating current, gas, air, etc., at diverse pressures, blackboard outlets and magnified instrumental installations. Motor-operated curtains are provided for darkening the main lecture room in the electrical engineering department, and a most complete provision of electric service outlets for the use of projector lamps is made.

Many machines in the various departments are driven by direct-connected motors, including hoists, cranes, lathes and tools for routine and instruction work. Electrical temperature control is provided for many laboratories. This is accomplished by a sensitive contact-making thermometer, a special relay of fine adjustment and an electrical heating element. The temperature control thus obtained is applied to various baths, ovens, insulated rooms, etc., and in some cases the temperature can be held within 0.002 deg. C. In the chemical laboratories a wide range of electrical service is available and many motor applications are in use, including fans for general and special ventilation, stirrers for mixtures, with electric furnace equipment, regulators and widely diversified outlets. A large variety of storage battery, motor-generator and outlet service is also provided for the department of physics.

Special rooms are equipped for low-temperature work, liquid air, vacuo, electric discharge and radio study, special electric heating applications, heat measurement equipment, optical study, metallurgical research and numerous other activities in which electrical service adds to the convenience, speed and reliability of the educational or experimental results.

Preventing Interruption of Production

Continuous Supply of Motive Power Imperative in These Times—What Can Be Done in Selecting and Inspecting Electrical Equipment to Assure Its Uninterrupted Maintenance

BY SYDNEY FISHER
Process Engineer, Bridgeport Brass Company

THE importance of an adequate uninterrupted supply of motive power is appreciated by all production engineers. In many cases, however, it is given comparatively little consideration in the press of routing, machine layout and other problems, because the latter are of relatively greater importance to the production engineer. The inevitable result is motor breakdown and consequent interrupted production when production problems are supposed to have been solved and the plant should be taking its full load. Many engineers play very safe and install more than enough motor-power equipment. This is particularly true in the case of munition plants where the supply of money is plentiful.

There are two objections to this overcautiousness, however. One is the fact that the available supply of motors is relatively low; hence the rating should approximate closely the actual requirements, as otherwise labor and equipment many have to wait for power. The other objection involves the operating difficulties that inevitably result from over-motoring, particularly where the equipment is of the alternating-current type and the reactive power is an important consideration. The writer has been called in on two cases where the reactive power demand has greatly exceeded the average power demand, hence causing a breakdown of transforming transmission equipment. The design of the motive-power equipment of the plant should be placed in the hands of a competent electrical engineer to whom all layouts of machinery requiring power should be submitted for the selection and location of the motor or motors and for any recommendations he may see fit to make.

The following suggestions on the selection, installation, operation and maintenance of motor equipment are based on experience at three munition plants. For group drive and individual drives requiring constant speed the three-phase, 60-cycle squirrel-cage induction motor is without question the most desirable type of motor for industrial work. It is of very simple design and very rugged, two factors which make for ease of construction, with resulting low cost and large supply and low maintenance respectively. This motor will take sudden load variations up to 200 per cent of its rated full-load torque with a comparatively small variation in speed and with small temperature rise. This type of motor is very satisfactory for drop-hammer, punch-press and upsetting-machine drives, the load on which is very variable.

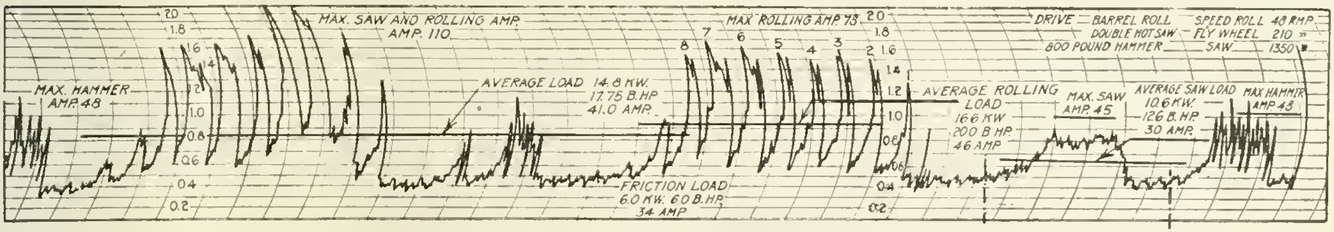


FIG. 1—LOAD VARIATIONS ON MOTOR DRIVING BARREL-ROLLING MILL

The motor is rated at 25 hp. and 244 volts, and it drives a hot roll, an 800-lb. drop hammer and a double hot saw 36 in. in diameter.

Fig. 1 gives the load variation on a 25-hp., three-phase, 60-cycle squirrel-cage motor driving barrel-rolling equipment consisting of a hot roll, an 800-lb. (362.9-kg.) drop hammer and double hot saw 36 in. (91.4 cm.) in diameter. This motor has operated for more than a year during three eight-hour shifts per day without breakdown.

Four hundred and forty volt motors are very satisfactory, the cost of wiring to serve them being much lower than that for 200-volt motors. As to speed, the 1200-r.p.m. motors are cheaper, but they give considerable bearing trouble, particularly with belt drive. Therefore 900-r.p.m. motors are more satisfactory.

The question of group versus individual drive is a very important one. Production engineers who have had the bitter experience of trying to get maximum production with a poorly designed, badly maintained motor equipment are apt to decide in favor of the individual drive. Instead of judging any type of drive hastily, however, it would be better to consider the relative merits of a well-designed group drive and an individual motor drive for the same group of machines. To illustrate how this can be done consider Fig. 3. The load curve shown is that of a drive which has operated without breakdown during the last eighteen months and may be considered a good design. An individual motor drive for the same group of machines might be determined from the data given on the curve as follows:

The peak-load 26.1 brake-hp. labeled "Work arrives, machines take load," is doubtless due to all twenty machines taking their maximum load simultaneously, hence the combined friction and cutting load per machine would be (26.1 — 5) ÷ 20 = 21.1/20 = 1.05 brake-hp., 5 hp. being the line and countershaft friction load. To make the equipment flexible enough to cover possible changes of spindle speed, rate of feed and depth of cut, it would be advisable to provide 25 per cent reserve capacity, hence twenty 1.25-hp. motors would be the equivalent of the group drive. It should be noted here that the diversity factor which exists with the group drive, but is absent in the individual drive, would cover small changes of spindle speed, rate of feed and depth of cut on about half the machines in the group.

Comparing the cost of the motor equipment in both cases, exclusive of cost of wiring, which would be considerably greater for the individual drive and take a greater length of time to install, one 20-hp. motor with compensator would cost $460, whereas twenty 1.25-hp. motors with starting switches at $102 would cost approximately $2,040. A small factory having forty such groups would require approximately forty 20-hp. motors for group drive and 800 1.25-hp. motors for individual drive. With the large order balances now carried by the large electrical companies, it is probable that a better delivery would be obtained on forty 20-hp. motors than on 800 1.25-hp. motors.

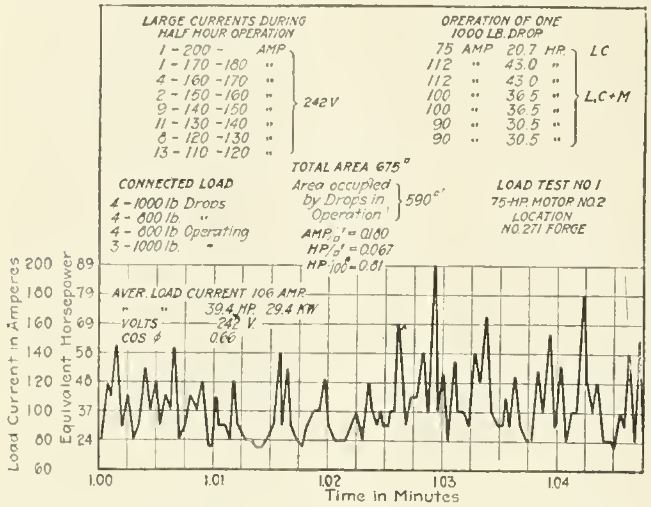


FIG. 2—LOAD FLUCTUATIONS ON A MOTOR DRIVING A GROUP OF DROP HAMMERS

Regarding the relative cost and time of delivery of shafting, hangers, pulleys, belting and counter-shafting required for the group drives and the change gears required for the individual drives, both involve steel and labor, two items which are at a premium at the present time.

Power Factor with Group and Individual Drive

The average power demand of the group drive is greater than that of the individual drive, owing to a continuous friction load required by shafting, belting, etc. The friction load varies from 25 to 35 per cent. On well-designed drives, however, the power factor is relatively high and the reactive power demand correspondingly low. For the individual drive the average load per motor is lower, there being no shafting, belting, counter-shafting, etc., and no diversity factor. This low average load coupled with the inherently low power factor for small motors results in a low total power factor.

In the case of large plants with a central power station where process steam and steam for heating are in great demand the additional power demand for friction is very desirable, while the high power factor makes for high turbine efficiency. Where an outside power supply is depended upon, the expense of power for friction is of course undesirable; on the other hand, additional expense is usually incurred by a low-power-factor load.

The relative ratings of transformers, cables and generators required for each type of drive might be compared as follows:

Kw._g — Group kw. (approximately 80 per cent power factor).

$\text{Kva.}_g = \text{kw.}_g \div 0.80 =$ group kva.

$\text{Kw.}_i = 0.75\ \text{kw.}_g$ (assuming 25 per cent friction load) $=$ kw. for individual drive (approximately 60 per cent power factor).

$\text{Kva.}_i = \text{kw.}_i \div 0.60 = 0.75\ \text{kw.}_g \div 0.60 = 1.25\ \text{kw.}_g$

$$\frac{\text{Kva.}_g}{\text{Kva.}_i} = 1.25 \div 1.25 = 1.$$

Inasmuch as the required capacity of generators, cables and transformers determined by the kva. load is practically the same in both cases the initial investment of this equipment and time of delivery do not differ. The maintenance of motor equipment is unquestionably higher with individual drives. This, of course, is inevitable with such a large number of units each operated by an employee whose chief consideration so far as the motor is concerned is to close and open the switch as required. Of course, breakdown of the motor involves only the shutdown of the machine which it drives, whereas shutdown of a group motor entails the shutdown of every machine in the group. Serious shutdown of a group motor should be a rare occurrence, however, if (1) the drive is carefully designed, if (2) adequate inspection of motor equipment is maintained, and if (3) an efficient maintenance force is available.

The common method of ascertaining the size of motor required is to add the power requirements of the machines driven, as given in the manufacturer's catalog, and apply what is commonly called a load factor. This more or less hit-and-miss method usually results in the selection of motors either too large or too small. A glance at the load curve in Fig. 3 will suffice to show that the power required to overcome machine friction is only about 25 per cent of the total power demands, the greater portion of the power being required for machining. In other words, power demand is determined by the class of work done on the machine. It is a function of (1) the spindle speed and rate of feed, (2) the depth and width of cut, and (3) the diversity factor, which depends on the length of cut and the number of machines per operator.

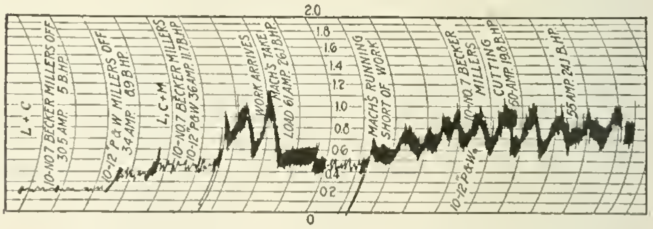


FIG. 3—LOAD FLUCTUATIONS IN RECEIVER MILLING

The motor is rated at 20 hp., 238 volts; the length of line shaft is 126 ft. Twenty-two belts are used, 50 per cent of which are crossed and 100 per cent are double. L.C. and M. per sq.ft. = 0.0102; L.C.M. and m. per sq.ft. = 0.0173; L. and C. per ft. of line = 0.04; L. and C./L.C. and M. = 0.43; L. and C./M. = 0.75; power machining ÷ power L.C. and M. = 0.70; maximum demand ÷ average demand = 1.22. L.C. is line and countershaft friction load, M. being machine friction.

Careful consideration of item 3 is of the utmost importance. For instance, even with the same conditions of operation as regards spindle speed, rate of feed and depth of cut, a larger motor is required for a cut 12 in. (30.5 cm.) long in the direction of feed than would be required for a cut 2 in. (5.1 cm.) long, because a larger number of machines would require power simultaneously. Similarly a one-machine-per-operator condition would require more power than a two-machine-per-operator condition, since the number of machines cutting at the same time would be greater. The effect of the diversity factor is illustrated in the curve shown in Fig. 3. The peak load occurred immediately after the arrival of the work and was evidently the result of all machines operating simultaneously, being considerably higher than the peaks during normal operation.

Two ammeters (0-50 and 0-150), the characteristic curves of stock sizes of motors (10, 15, 20 hp., etc.) and a few typical machine groups to experiment on should provide sufficient data for the motor layout design of most of the common machine-tool groups. Characteristic curves of a 50-hp. motor are shown below, also a synopsis of the method of calculation by which they were obtained.

MOTOR CHARACTERISTIC CURVES

1. Efficiency and power factor at half, three-quarters, full and one and a quarter times full-load output for standard sizes of 220-volt, three-phase, 60-cycle, 900-r.p.m., constant-speed induction motors. These data were obtained from the motor-manufacturing company's price book.
2. No-load input and no-load current values, obtained by test on standard motors.

Method of Procedure:

1. Input-output curves were plotted from above data, 1 and 2. Input = output ÷ efficiency.
2. Efficiency curves were plotted from input-output curve, which supplied values of efficiency below half full load.
3. Load-current curves were obtained by substitution in following relation:

$$P = (1.732 IE \cos\theta\ E) \div 746.$$

$$I = (746 \times P) \div (1.732 E \cos\theta\ E) = [746 \div (1.732 \times 240)] \times [P \div (\cos\theta \times E)] = 1.795 \times (P \div \cos\theta \times E).$$

I = load current.
E = line volts (240 volts).
$\mathrm{Cos}\theta$ = power factor given by manufacturer.
E = efficiency given by manufacturer.
P = power output (hp.).

Four points were obtained by calculation, using data No. 1 and a fifth point from data No. 2.

4. Power factor curves were plotted using four points from data No. 1. An additional point was obtained by substituting no-load current and no-load power input in $\cos\theta$ = watt input ÷ $\sqrt{3}EI$.

The use of the ammeters and the characteristic curves are demonstrated by the data given under Fig. 2. These data were obtained from a test on a 75-hp. motor driving a group of drop hammers and were subsequently used to design six similar drives.

Good judgment is a very valuable factor, of course. Accurate data obtained from a few careful experiments and applied with good judgment will result in economy of time and capital and will assure continuous and satisfactory operation. It is desirable from an economy and operating standpoint to design for an average load which is not less than 90 per cent of the rated load of the motor. Advantage should be taken of the overload capacity of the motor in every case. In this connection a chain drive should be used for the main drive, since the pulleys supplied by motor manufacturers apparently (from the experience of the writer) are not designed to transmit the overload which the motor is capable of carrying without slip.

INSPECTION AND MAINTENANCE SERVICE

Assuming that the motors have been carefully laid out, they should run without shutdown if given a reasonable amount of care. By care is meant adequate inspection to locate the cause of trouble before it reaches the danger point and immediate attention by an efficient maintenance force to correct the cause. It is the policy of many plants to expect machine operators and floor foremen to report the cause of breakdowns, but such practice does not bring satisfactory results since machine operators and foremen are responsible for production and that is the chief subject in which they are interested. They have neither the inclination nor the time, if they are attending to their work properly, to keep track of service equipment. It is eminently the function of the service department to see that its equipment is kept in proper shape to insure continuity of service, and this can only be done by an adequate inspection force. This does not necessarily mean an increase in the service force, as the work of an efficient inspection force will result in an elimination of trouble to such an extent that the maintenance force will have ample time for inspection work and may, therefore, ultimately replace the original inspection force.

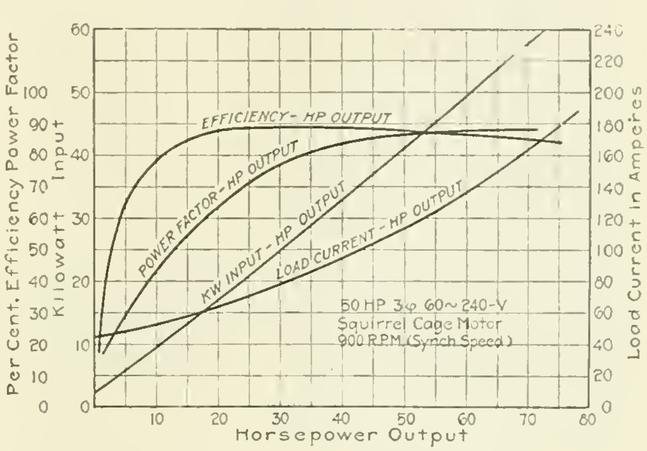


FIG. 4—CHARACTERISTICS OF 50-HP. MOTOR USED IN STUDY

Adequate inspection is maintained in one of the biggest munition plants in this country, and breakdowns, particularly of motor equipment, are very rare. This inspection work is carried on almost exclusively by maintenance men; hence, comparatively speaking, the cost of inspection in this case is almost negligible.

The inspection of motor equipment should include the observation of the following items:

Motor.

1. Oil supply.
2. Freedom of oil rings.
3. Application of gap gage to air gap.
4. Main-drive belt tension.
5. Slip-ring surface.
6. Speed test.
7. Motor temperature.
8. Observation of conditions in shop which would affect the operation of motor.

Control Apparatus.

1. Condition of make-and-break switches.
2. Condition of overload release on compensator.
3. Examination of compensator contacts, particularly on the running side.

4. Inspection of overload relays (timing, damping, etc.).
5. Oil supply in compensator.
6. Temperature of compensator—no-voltage-release coil.

A frequent cause of motor shutdown is defective starting and control apparatus. This is largely due to careless manipulation of the former and improper adjustment of the latter. It is essential, therefore, to provide comprehensive instructions covering the starting and stopping of motors, and to train one of the machine operators on each floor for this work. Most of the trouble is caused during noon hour when motors are "hobbed" in order to place the belts. "Hobbing" is prolific of more breakdowns than any other cause with the possible exception of seized bearings resulting from excessive belt tension or lack of oil. If a motor accelerates too rapidly to permit placing a belt safely, the compensator taps should be adjusted to cause a lower acceleration.

An efficient, enthusiastic maintenance force is one of the biggest assets that an industrial plant can have. The word enthusiastic is by no means misapplied as the conditions under which these men have to work and the rapidity with which they have to work are very trying. Properly directed, an enthusiastic force will correct a shutdown in jig time.

The training of an efficient maintenance force is largely a matter of personal contact of the chief electrician or electrical engineer with his men. An hour or two per week given to instruction of the men in the fundamental principles of electrical engineering and their practical application will accomplish wonderful results.

The electrical engineer should draw up a logical method of procedure to determine the cause of motor breakdown. This has been found to be a great time saver as compared with the usual hit-and-miss methods employed by the average electrician. Such a method of procedure might be framed as follows:

Suggested Procedure in Case of Breakdown

In case of motor shutdown the following method of procedure is to be followed unless the cause of shutdown is immediately apparent.

Test temperature of motor by hand.

1. If temperature of frame, including bearing, is uniform, examine fuses or relays; replace blown fuses and examine relay timing adjustment and damping device.

Start motor and stand by.

2. If temperature of bearing is abnormal, look in oil chamber. If full of oil, examine oil ring to see if it revolves freely. Reset relays or replace blown fuses. Jerk starting lever and observe motor shaft and chain or belt. If there is no motion, there is a seized motor bearing. Call for emergency motor.
3. If temperature of frame is uniform but abnormal, replace blown fuses or reset relays and start motor. Take speed of motor. If speed of motor is less than full-load speed, motor is overloaded. Inquire of floor foreman about changes in operation and look for seized shaft bearing. If either is the cause, notify chief electrician immediately.

Overheating of a three-phase motor is frequently caused by running single-phase, one phase being broken by a bad compensator contact on the running side; therefore examine compensator contacts on the running side and rectify if necessary.

The reason for the various steps should be carefully explained and every effort made to get the men to memorize the instructions.

The cost of delay in the event of breakdown can be substantially reduced by installing two motors per section and providing an auxiliary jack belt so that either section can be driven from the adjoining section. By doing this and providing extra cooling for the motor operated the writer has managed to keep a large portion of the machinery in similarly divided sections running until a new motor could be installed. A 20-hp. motor in one case carried 32 hp. for four hours, suitable additional ventilation having been provided as mentioned above.

In conclusion, decide on the best make of motor and install it throughout. This will substantially reduce the number of spares and spare parts to be kept on hand.

OUTDOOR DISTRIBUTION SUBSTATIONS IN WAR TIMES

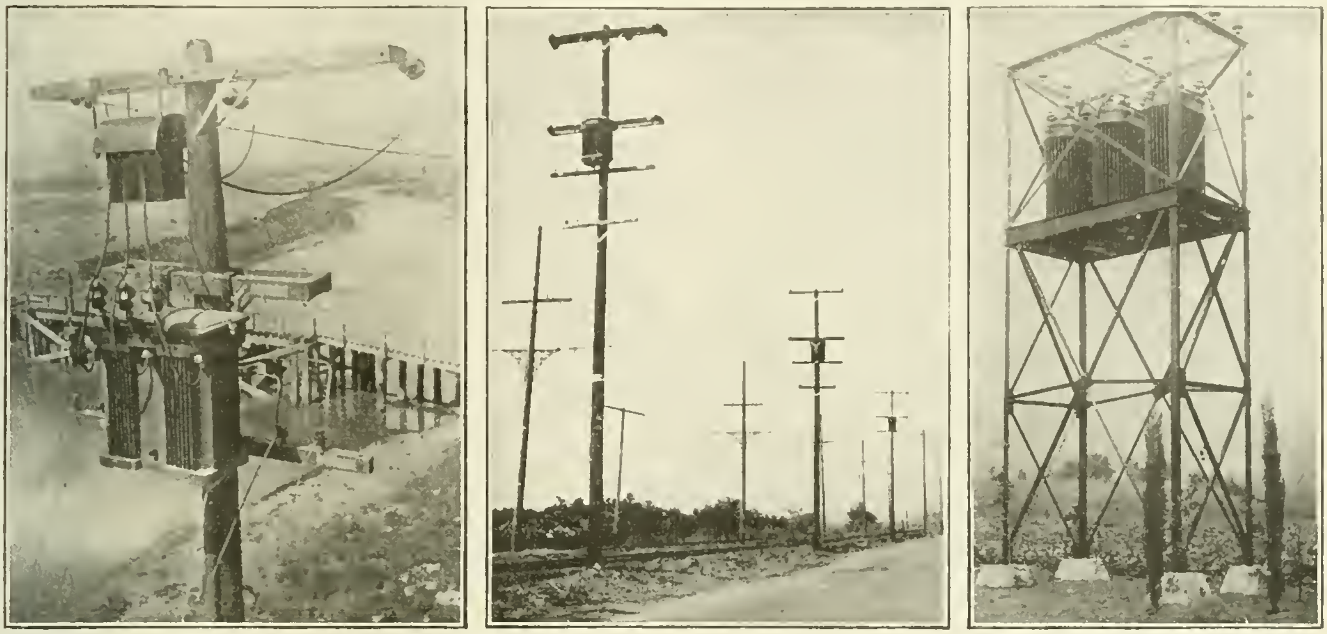
Three-Phase Transformers with Automatic Pole-Top Oil Switches in Primary—An Innovation Found Suitable Under Certain Conditions

BY R. E. CUNNINGHAM
Superintendent of Distribution, Southern California Edison Company

War-time conditions make it necessary for the power companies to use special care in order to obtain the greatest return for each dollar expended. The outdoor substation has proved to be the simplest and most economical means of serving large consumers, and the favorable climate of southern California makes its operation entirely reliable. Some of the 10,000-volt installations of the Southern California Edison Company are shown by the accompanying photographs. The features of interest in connection with these installations are their simplicity and general appearance.

Manufacturers have produced outdoor-type transformers which are entirely satisfactory for all moderate voltages. It has therefore only been left to the operating engineer to select switching and protective apparatus and properly arrange the equipment. Most distribution outdoor substations have been equipped with fused-type switches. Our experience with such switches has shown that they are not entirely reliable on account of the inherent weaknesses of high-potential fuses. Particularly on three-phase service we have trouble with one fuse failing, allowing the motors to operate single-phase and in many cases resulting in burn-out of the consumer's equipment.

In order to overcome this condition, a local manufacturer has made for us an automatic outdoor pole-top switch for service on 10,000 volts. We have more than 200 of these switches now in use, all of them having given satisfactory service. This is a single-tank switch, equipped with three series overload trip coils, so that an overload on any wire of a three-phase circuit will entirely disconnect the service. The switch is controlled by pull cables from the ground, and the consumer can immediately restore the service in case the switch has been kicked out by momentary overload. This saves the consumer a long interruption which would otherwise exist, with the use of fuse switches, since the company would have to send out a troubleman to replace the burned-out fuses.



FIGS. 1, 2 AND 3—AUTOMATIC OUTDOOR-TYPE SWITCH CONNECTED TO 10,000-VOLT LINE; TRANSFORMERS OF SAME BANK INSTALLED ON SEPARATE POLES TO IMPROVE APPEARANCE, AND TRANSFORMERS ON ELEVATED PLATFORMS

When extra heavy loads are to be started or fluctuating conditions are encountered, a simple time-limit device can be attached to the plunger of each overload relay, which prevents the switch kicking out except in cases of actual trouble or continued overloads. This switch also allows the consumer to disconnect his transformers when they are not in actual use, saving to the power company the energy lost in exciting the transformers and removing all hazard of energized wires on the consumer's property. With a switch of this type on the primary side of the transformers installed within 30 ft. (9 m.) of the entrance to the property, the local authorities have ruled that the main entrance switch on the secondaries is not required.

Outdoor Switches and Transformers

One of the automatic outdoor pole-top switches connected to a 10,000-volt line and protecting a 50-kw., three-phase transformer is shown in Fig. 1. Inexpensive-type disconnecting lugs are placed on the first pole away from the switch so that it is possible to entirely disconnect the line from the oil switch and inspect or readjust it when necessary. The switch-operating cables are attached to a pulley wheel mounted on the main operating shaft passing through the top of the switch tank. The pulley wheel is placed nearest the pole, and on the opposite end of the shaft, in plain view from the ground, is an indicating dial which definitely shows when the switch is open or closed. It can be easily seen that with this arrangement there is a minimum amount of labor and material in installing and connecting the apparatus, as the transformer has been designed with a very convenient arrangement of leads. Three-phase transformers up to 100 kw. are mounted in this manner.

An installation of three 50-kw., 10,000-2300-volt transformers is shown in Fig. 2. In this case it was necessary to provide 2300-volt three-phase service for a suburban town, and as our lines are installed along an important boulevard, the usual type of overhead racks on which to mount the transformers was objectionable. Hence each transformer is mounted on a line pole separated from the others by the usual length of spans, a protective pole-top switch being installed on the fourth pole. The installation is not noticeable to persons driving along the boulevard and at the same time entirely fulfills the requirements.

Three 100-kw. transformers furnishing 2300-volt service to serve kelp plants producing potash are shown in Fig. 3. In this case the high-tension lines could not be extended closer than about a mile from the plants on account of right-of-way difficulties and the impossibility of installing a high-tension line along a state highway. both sides of which were already occupied by important telephone lines. The steel frame was made up of extra parts of steel towers, which were redrilled for the purpose in our own shop, thus utilizing idle material. A protective switch has been placed on the high-tension side of the transformers on the next adjoining pole. The 2300-volt side of the transformers is connected directly to the line.

A century and a quarter ago it was deliberately ordained by those who were then responsible for the safety and defense of the nation that the duty of military service should rest upon all able-bodied men between the ages of eighteen and forty-five. We now accept and fulfill the obligation which they established, an obligation expressed in our national statutes from that time until now. We solemnly purpose a decisive victory of arms, and deliberately to devote the larger part of the military man power of the nation to the accomplishment of that purpose.—*President Wilson.*

Reconstruction of a Two-Phase Station—I

How Some Problems Made Necessary by Rapid Load Developments Were Handled by an Iowa Company—Description of the Furnace Equipment and the Efficiency Instruments Installed in the Plant

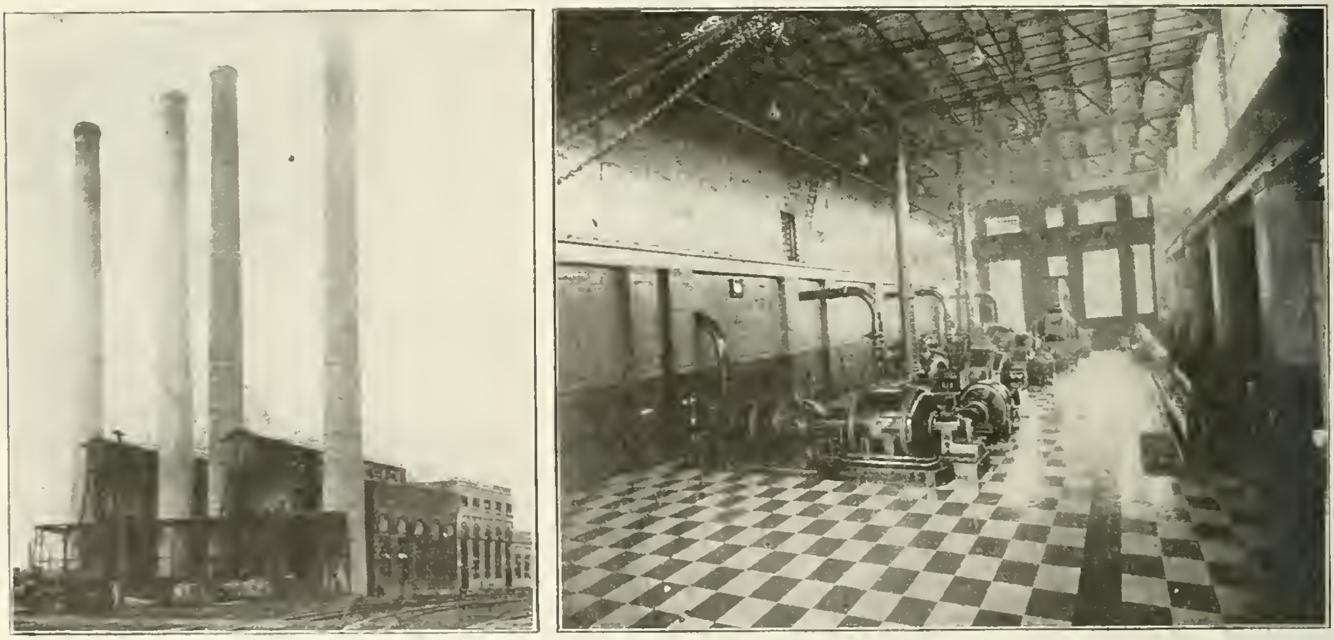
FROM a small non-condensing engine plant supplying electricity and a small amount of steam for district heating, the Iowa Railway & Light Company of Cedar Rapids has developed in a few short years into a modern electric transmission system serving a territory 200 miles (320 km.) long and 75 miles (120 km.) wide and, besides, is selling millions of pounds of superheated steam. Development had to keep step with this rapid growth in business, and as a result some unusual engineering problems were involved. How some of these have been worked out will be told in this article.

In analyzing this development several unusual factors which no doubt had influence on engineering decisions need to be kept in mind. First, the daily sale of 600,000 lb. (272,000 kg.) to 800,000 lb (363,000 kg.) of live steam at 200 lb. (14.1 kg. per sq.cm.) pressure and 100 deg. superheat to the Quaker Oats Company from a plant selling about 140,000 kw.-hr. of electrical energy per day demanded a comparatively large boiler plant; second, the early development of the two-phase system of distribution in Cedar Rapids built up a heavy investment in two-phase equipment not only in the power house but among the company's customers, and, third, the rapid growth of the company's electrical system not only in Cedar Rapids but also in distant outlying territory could best be reached by three-phase high-voltage transmission.

One of the first steps in the development consisted of taking over of the street-railway load. A 1500-kw. turbo-generator was added to the plant, and a little later two 3500-kw. turbine units of the bleeder type were installed to care for the increasing load and the heating system as well. Taking the heating steam at an average of 15 lb. (100 gm. per sq.cm.) from the turbines eliminated the trouble that had been experienced previously from oil and impurities throughout the system and reduced to a great extent the labor required for maintenance. From the operating standpoint there was another advantage. In case of boiler trouble or an insufficient supply of steam reducing the pressure, the turbines could be operated condensing at their full economy and the bleeder connections closed until the steam pressure was back to normal.

These large demands on the plant and the growth of the system throughout the state called for more capacity and made it necessary to remodel the plant. An addition was made to the boiler room, more than doubling its capacity, and the turbine room was entirely rebuilt. The steel work was put up inside the old walls, holes cut in the roof allowing it to pass through. The old roof was supported by this steelwork while the new walls and roof were being built and upon their completion was torn out.

Throughout the reconstruction service was maintained by the three turbo-generators. The engine units were removed, and in 1917 a new turbo-generator rated at 7500 kw. was installed, making the present capacity of the plant 16,000 kw. All of the units are two-phase, 60-cycle machines having a speed of 1800 r.p.m. and generating at 2300 volts. Before the remodeling of the plant a change from two-phase to three-phase generators was seriously considered, but the investment in motors that would have been required made the financial aspect rather unfavorable.



FIGS. 1 AND 2—EXTERIOR OF RECONSTRUCTED STATION, AND TURBINE ROOM OF IOWA RAILWAY & LIGHT COMPANY

The condensers are of the surface type. The one serving the 1500-kw. turbine has 3⅓ sq.ft. (about 300 sq.cm.) of surface per kilowatt of rating. It was installed years ago, and a liberal ratio was employed because of the fact that the air pumps were less efficient and the temperature of injection water high. An 8-in. by 16-in. by 20-in. (20-cm. by 40-cm. by 50-cm.) dry-vacuum pump is the only steam-driven auxiliary serving the unit. Both the circulating pump, having a capacity of 5000 gal. (about 19,000 l.) per minute, and the condensate pump are motor-driven.

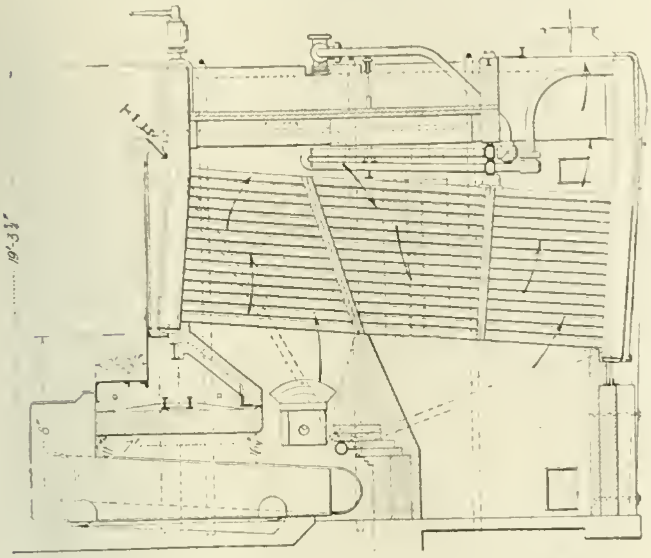


FIG. 3—OLD CHAIN-GRATE SETTING WITH CRAMPED COMBUSTION SPACE

The auxiliaries for the two bleeder turbines are duplicates, the condensers having about 3 sq.ft. (2800 sq.cm.) of surface per kilowatt. The pumps are partly steam-driven and partly motor-driven. The condenser serving the new unit has 1.73 sq.ft. (1600 sq.cm.) of surface per kilowatt, a ratio conforming with late practice. The circulating pump, having a capacity of 15,000 gal. (over 55,000 l.) per minute, is driven by a 100-hp. motor, while the combination air and condensate pump is turbine-driven. As a reserve there is also a "Radojet" air pump and a motor-driven auxiliary hot-well pump.

All of the circulating pumps are connected to a common header, so that any combination of the four pumps may be used to meet the requirements of the units in operation. At times the pumps belonging to the bleeder turbines will fulfill the demand. At other times the pump for the large unit, and perhaps the small pump, may be used, so that the arrangement is flexible and results in saving considerable power.

Natural cooling ponds for the condenser water are an advantage possessed by the plant. Through a concrete tunnel the water is drawn from the nearest pond, about 100 ft. (30 m.) distant, and is discharged to a second pond connected with the first, the water traveling nearly a mile before it is returned to the intake.

It may be seen that there is a fair division between electric and steam-driven auxiliaries, the latter being required to maintain the heat balance. In this connection two of the three exciter sets are steam-driven—one rated at 100 kw. by a high-speed engine, and a 150-kw. exciter by a turbine through reduction gearing. The third exciter is rated at 75 kw. and is motor-driven. All pumps are direct-acting or turbine-driven, and the forced-draft fans are engine-driven, as are the stokers which they serve. The chain-grate stokers installed in the older portion of the boiler room are driven by two 5-hp. motors, each serving four boilers, and in addition two auxiliary engines are provided as emergency-driven units.

From these various sources there is considerable exhaust steam available to heat the feed water, and during the heating season it is badly needed. To illustrate, 70,000,000 lb. (over 30,000,000 kg.) of steam was delivered to the heating system last January, and as none of the condensation was returned to the plant, the same amount of make-up had to be heated from an average temperature of 40 to 210 deg., without the assistance of an economizer. The total steam generated was 150,000,000 lb. (68,000,000 kg.), so that the percentage of making up was nearly 50 per cent. From the Quaker Oats plant the returns mixed with make-up water from the river are brought back to the boiler room at a temperature of about 100 deg.

The continued use of so much raw water, with its consequent deposits of scale and fouling of boiler tubes, is another disadvantage under which the plant must operate. In an ordinary plant a water softener would relieve the trouble, but in the present case, where both steam and electricity are sold in varying quantities, it was found that a water softener having normal treating capacity and feeding separately into the heater aggravated instead of relieving the trouble.

The amount of steam sold varied so much that when the water was treated to a certain degree of hardness for one proportion of condensation, this proportion would be so changed within an hour that the water would be too soft and priming and foaming would occur, carrying the impurities from the boiler over to the turbines. Settling basins of large capacity in which the condensation and treated water could be thoroughly mixed before entering the heater are being considered, as it is thought such a plan would relieve the situation.

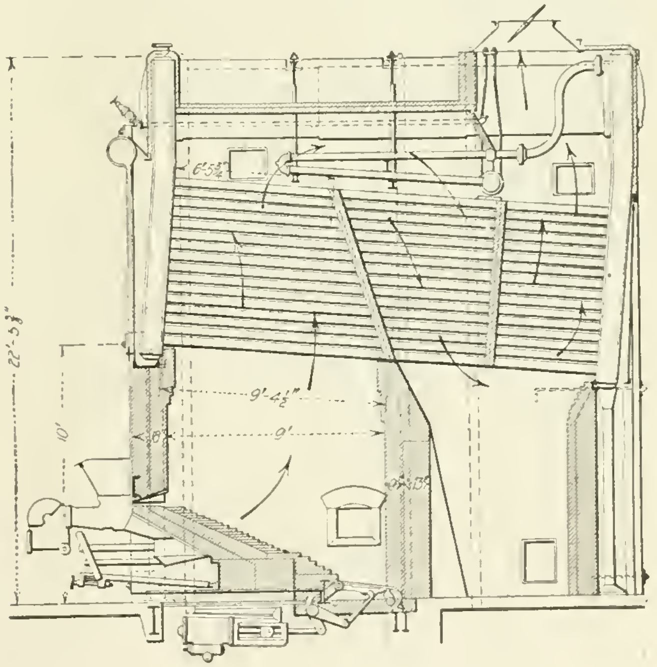
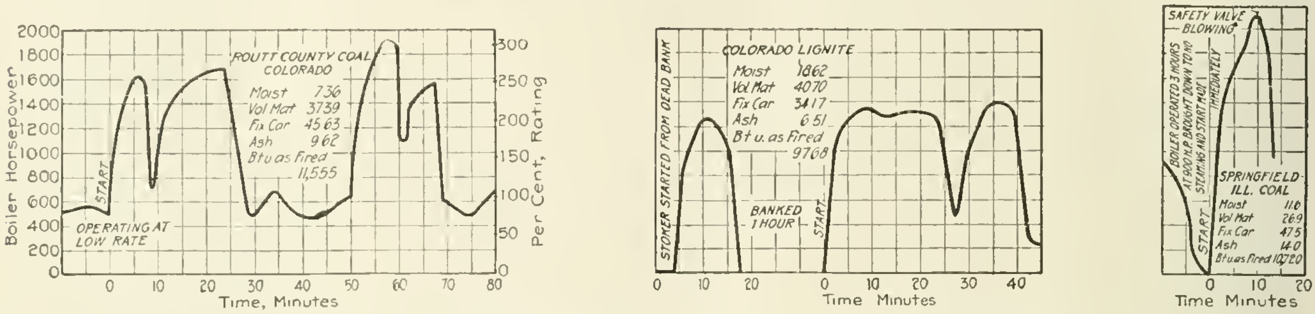


FIG. 4—SETTING ADOPTED WITH UNDERFEED STOKERS TO BURN HIGHLY VOLATILE FUEL

In the older section of the plant there were eight water-tube boilers arranged four on each side of a central firing aisle. Two of the boilers are rated at 400 hp. and the other six at 500 hp. They are served by chain-grate stokers having areas of 81 sq.ft. and 100 sq.ft. (7.5 sq.m. and 9.3 sq.m.) respectively. The two smaller boilers have Sewell baffling and the larger boilers are vertically baffled for three passes, the type of setting being shown in Fig. 3. To the bottom of the front header the head room is 8 ft. (2.5 m.), but a flat ignition arch extending well into the furnace reduces considerably the volume of the combustion chamber. At the stoker gate the head room is 11 in. (28 cm.) and at the rear of the arch 16 in. (40.8 cm.). Between the arch and a corbeled bridge wall there is a comparatively narrow throat to mix the gases, and beyond a large volume, expanding toward the tubes. With Kentucky and good grades of Illinois coal fair results were obtained from these settings, but with Iowa and certain Illinois coals, low in heat value and high in volatility, it proved difficult to maintain the boiler performance at 150 per cent of rating.



FIGS. 5, 6 AND 7—RESULTS OF TESTS WITH ROUTT COUNTY (COL.) LIGNITE AND SPRINGFIELD (ILL.) COAL

Fig. 5 shows results from Routt County (Col.) coal of the analysis given. With the stoker operating at nearly boiler rating, a sudden demand for steam occurs. The rating is increased as rapidly as possible, and thereafter high rates of steaming are required at intervals. In the test with Colorado lignite shown in Fig. 6 the stoker was started from a "dead bank." A high output is required for a short interval and the load goes off completely. The stoker is banked for an hour and is then called upon to meet a sudden and long-continued demand. Fig. 7 shows result from Springfield (Ill.) coal. With the stoker operating at 150 per cent of rating for three hours, the load was dropped to zero, then the maximum output was developed in the shortest possible time and the load was again dropped.

In making the addition to the boiler room, stokers that would respond to quick changes in load and would operate at considerable overload with Iowa coal were desired, and the choice was allotted to underfeed stokers with large power-operated dump plates. Seven-retort stokers were therefore used with water-tube boilers, which are rated at 627 hp. As shown in Fig. 4, the stoker is set flush with the boiler front, and with straight walls front and rear the combustion space is as large as the head room of 10 ft. (3 m.) will permit, the volume approximating 880 cu.ft. (25 cu.m.). In accordance with recent practice the first baffle slopes toward the boiler front to give contracting volumes in the first and second passes as the gases cool.

Operating at boiler rating, each stoker burns from 2500 lb. to 3000 lb. (1100 kg. to 1400 kg.) of coal per hour, depending somewhat upon the fuel used. On some occasions as high as 7400 lb. (3350 kg.) of coal per hour has been burned, or over 1000 lb (450 kg.) per retort. The furnace volume, on the basis of 3000 lb. and 7400 lb., reduces to 0.2933 cu.ft. and 0.119 cu.ft. (8300 cu.cm. and 3400 cu.cm.), per pound of coal burned per hour. An equivalent grate area of 94.5 sq.ft. (8.75 sq.m.) is credited to the stoker. The steam-making surface is about 66.4 times as large. Referring to the figures on fuel consumption previously given, 31.7 lb. and 78.3 lb. (340 kg. and 840 kg. per sq.m.) of coal respectively were burned per hour per square foot of grate.

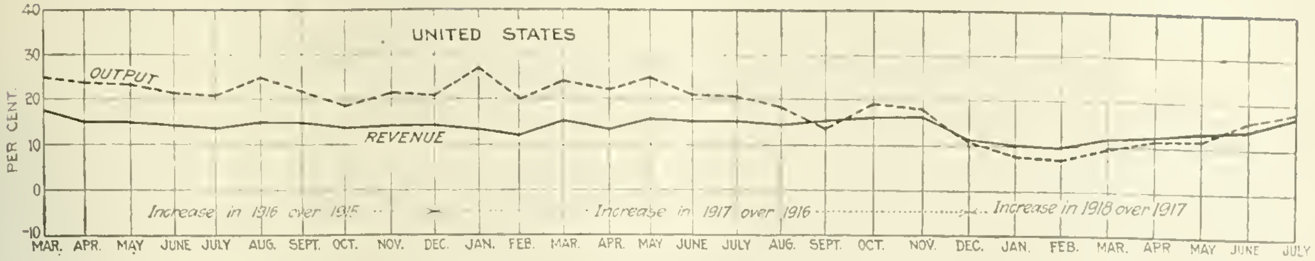
Some indication of the flexibility of operation is given by Figs. 5 to 7, which show results of tests made at the plant by the manufacturer of the stoker. Of numerous eight-hour tests conducted about the same time, one was made with Iowa slack coal from the Lakonta district. [The proximate analysis gave: Moisture, 9.7 per cent; volatile, 26.2 per cent; fixed carbon, 36.8 per cent; ash, 27.3 per cent; B.t.u. per pound of coal as fired, 9130 (105 cal. per kg.)]. Operating at an average rating of 168 per cent, 4875 lb. (2210 kg.) per hour of coal as fired was burned at a combined efficiency of 79.3 per cent. With Springfield (Ill.) slack of 9840 B.t.u. (110 cal. per kg.) as fired and 12 per cent moisture, 26 per cent volatile matter, 45.6 per cent fixed carbon and 16.4 per cent ash, 7400 lb. (3350 kg.) was burned per hour to maintain a load averaging 252.5 per cent of rating at a combined efficiency of 72.5 per cent.

From the foregoing it is quite evident that the stokers will care for quick changes in load and will carry heavy overloads at high efficiency when burning inferior coal. As to clinkers the boiler-room force reports no more trouble in proportion to the coal burned than with the chain-grate stokers.

Features of the boiler-room arrangement, methods of permitting flexible operation, use made of efficiency instruments and features of the electrical part of the station will be described in a later issue.

It is to be hoped that the paternalistic control of enterprise and industry, which is a necessary measure in war time, will not be permitted in our country to grow into a permanent feature of our governmental system, and that as soon as possible the fetters now placed upon private initiative and personal incentive will be removed and the genius of American individual enterprise set free again, with due regard, be it understood, for the welfare and opportunities of the masses of the people and for the duty of the state to protect those least able to protect themselves, and to prevent exploitation or oppression, undue privilege and unfair practices.—*Otto H. Kahn.*

Central Station July Operations



THE FIGURES OF GROWTH IN JULY ARE IMPRESSIVE

IT IS an old story to say that totals of central-station production of electrical energy continue to mount upward, but the figures of growth are so impressive that it would be illogical to fail to emphasize them. The July returns are particularly eloquent of the great volume of kilowatt-hour output which the properties are distributing to meet the needs of the nation's industries. Reports to the ELECTRICAL WORLD from 48 per cent of the industry show an increase in output, as compared with July, 1917, of 18.2 per cent and in revenue of 17.1 per cent. New England shows the striking gain of 30.2 per cent in kilowatt-hour output.

A fact of much significance in connection with the higher totals of current production is, as has been pointed out repeatedly, that the results of this year are added to a similar fine showing in the previous year. Thus, the increase of 18.2 per cent in July, 1918, over July, 1917, follows a gain in July, 1917, over July, 1916, of 20.8 per cent. That is to say, the returns indicate that July, 1918, was more than 42 per cent over the record of July, 1916. This conclusion, of course, is based on returns from varying proportions of the industry, but there is no reason to believe that the full figures, if they were obtainable, would cause substantial variation. The partial returns are an excellent barometer. Also it is important to consider that the scale of increase for the calendar year is still ascending rapidly as is shown by the improvement of each month over its predecessor since January, when the gain was but 6.3 per cent.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Industry Represented	Revenue from the Sale of Energy			Kw.-Hr. Output		
		1917	1916	Per Cent Increase	1917	1916	Per Cent Increase
Aug	63	$22,718,000	$19,972,000	13 8	1,451,928,000	1,223,373,000	18 7
Sept.	63	23,861,000	20,896,000	14 3	1,376,370,000	1,219,117,000	13 8
Oct	62	25,748,000	22,334,000	15 4	1,522,149,000	1,279,140,000	19 5
Nov.	62	26,665,000	23,183,000	17 0	1,485,370,000	1,292,113,000	15 7
Dec.	58	28,144,000	25,026,000	12 4	1,517,001,000	1,362,299,000	11 0
		1918	1917		1918	1917	
Jan.	62	27,035,000	24,977,000	8 2	1,508,353,000	1,422,121,000	6 3
Feb.	60	24,690,000	22,307,000	10 6	1,254,217,000	1,168,288,000	7 1
Mar.	60	25,396,000	22,702,000	12 3	1,418,222,000	1,294,561,000	9 4
Apr	60	25,864,000	22,966,000	12 6	1,450,221,000	1,297,843,000	11 5
May	62	25,365,000	22,426,000	13 1	1,537,527,000	1,372,935,000	11 9
June	56	23,470,000	20,577,000	14 0	1,407,585,000	1,212,870,000	16 0
July	48	18,076,000	15,437,000	17 1	1,134,170,000	959,273,000	18 2

Based on the returns from 48 per cent of the industry the ELECTRICAL WORLD estimate for July for the entire industry is: Revenue, $37,658,000; output, 2,362,800,000 kw.-hr.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

			New England States				Atlantic States				Central States				Pacific and Mountain States		
	Month	Percentage of Industry Represented	1917	1916	Per Cent Increase	Percentage of Industry Represented	1917	1916	Per Cent Increase	Percentage of Industry Represented	1917	1916	Per Cent Increase	Percentage of Industry Represented	1917	1916	Per Cent Increase
REVENUE	August	64	$2,352,000	$2,025,000	16 2	65	$9,021,000	$7,881,000	14 5	53	$6,910,000	$5,718,000	20 9	87	$4,819,000	$4,270,000	21 9
	Sept.	64	2,811,000	2,362,000	19 0	64	9,139,000	7,963,000	14 7	53	7,232,000	6,177,000	17 1	87	4,636,000	4,355,000	6.4
	Oct.	64	3,057,000	2,530,000	20 7	66	10,683,000	9,173,000	16 5	52	7,422,000	6,304,000	17 8	85	4,586,000	4,327,000	6 1
	Nov.	64	3,391,000	2,834,000	19.7	65	10,159,000	8,873,000	14 5	52	8,454,000	7,063,000	19 7	84	4,661,000	4,410,000	5 9
	Dec.	64	3,483,000	2,999,000	16.1	58	10,834,000	9,949,000	8 8	48	8,935,000	7,464,000	19 7	82	4,892,000	4,614,000	0 6
			1918	1917			1918	1917			1918	1917			1918	1917	
	Jan	63	3,393,000	2,990,000	13.8	64	9,677,000	9,517,000	1 6	53	8,862,000	7,639,000	16 8	86	5,113,000	4,831,000	5.8
	Feb.	62	2,995,000	2,272,000	8.0	57	9,473,000	8,658,000	8 6	53	7,779,000	6,746,000	15 3	84	4,443,000	4,131,000	9 5
	March	62	2,985,000	2,724,000	9.2	59	9,904,000	8,922,000	11 0	53	7,947,000	6,735,000	18 0	84	4,560,000	4,321,000	5 5
	April	62	2,890,000	2,578,000	12.1	59	10,054,000	8,946,000	12 4	53	8,431,000	7,103,000	18 7	84	4,489,000	4,339,000	3 5
	May	62	2,810,000	2,530,000	11 5	64	9,929,000	8,613,000	15.3	53	8,717,000	6,955,000	18 1	83	4,805,000	4,327,000	12 0
	June	58	2,664,000	2,340,000	13.8	53	7,992,000	7,141,000	1 9	48	7,8[illegible]0,000	6,571 000	19 1	84	4,966,000	4,425,000	12 2
	July	56	2,729,000	2,261,000	20 7	49	7,093,000	6,244,000	13 6	34	4,538.000	3,739,000	21 4	74	3,716,000	3,193,000	16.3
			1917	1916			1917	1916			1917	1916			1917	1916	
KW.-HR. OUTPUT	August	64	105,848,000	85,113,000	24 5	65	514,254,000	420,806,000	22 3	53	415,966,000	333,549,000	24 7	87	413,462,000	381,353,000	8 3
	Sept.	64	114,339 000	92,319,000	24 0	64	482,112,000	405,070,000	19 0	53	399,480,000	345,953,000	15 5	87	379,221,000	374,685,000	1 4
	Oct	64	121,666.000	94,853,000	28 5	66	589,242,000	472,619,000	24 5	52	417,018,000	351,713,000	17 0	85	394.223,000	359,955,000	9 6
	Nov.	64	130.311,000	108,561,000	20 0	65	532,301,000	445,537,000	19 6	52	443,374,000	384.480,000	15 2	84	379,384,000	357,535,000	6 1
	Dec	64	135,703,000	111,342,000	21 8	58	548,316,000	486,368,000	12 7	48	437,264,000	367,534,000	12 8	82	395,518,000	377,058,000	4 8
			1918	1917			1918	1917			1918	1917			1918	1917	
	Jan.	63	125,212,000	111,339,000	12 4	64	477,200,000	466,158,000	2 3	53	486,291,000	453,009,000	7 3	86	419,651,000	391,624,000	7 3
	Feb.	62	110,454,000	102,562,000	7 7	57	438,721,000	403,122,000	8 3	53	358,276,000	342,257.000	4 5	84	346,766,000	320,025,000	8 4
	March	62	121,518,000	111,576,000	8 9	59	501,320,000	452,250,000	10 8	53	398,166,000	356,860,000	11 5	84	397,218,000	373,875,000	6 2
	April	62	117,416,000	101,888,000	15 2	59	497,460,000	431,786,000	15 2	53	437,054,000	392,304,000	11 4	84	399,126,000	372,465,000	7 1
	May	62	121,751,000	105,601,000	15.3	64	512,202,000	455,977,000	12 3	53	441,202,000	403,560,000	9 0	63	462,372,000	406,797,000	13 6
	June	58	115,665,000	94,407,000	22.5	53	425,394,000	372,890,000	14 1	48	412,946,000	357,409,000	15 5	84	453,580,000	387,884,000	10 1
	July	56	123,569,000	94,913,000	30 2	49	409,729,000	348,227,000	17 6	34	233,181 000	198,133,000	17 6	74	367,691,000	318,000,000	15 6

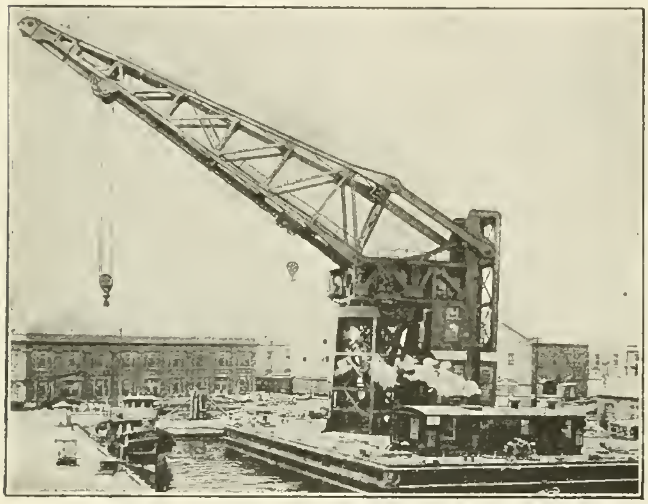
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

LARGE ELECTRIC CRANE USED BY AMERICAN NAVY

Mounted on a Huge Pontoon with Self-Contained Steam Power Plant—Made Safe by Means of Regenerative Braking

Operating on the principle of an ordinary derrick, the revolving giant crane shown herewith, which is used by the United States Navy, can easily lift a complete tugboat from the water. The whole structure is mounted on a flatboat or a floating pontoon which is so designed that it cannot turn over. The boat contains a complete boiler plant and an engine-driven generator which supplies the electric energy for operating the various motions of the crane. These motions are controlled from a small house mounted high above the deck.



HUGE NAVY CRANE CONTROLLED BY ELECTRICITY

The speed of the lifting can always be controlled by means of the electrical mechanism of the crane. When heavy loads are lowered the motors are used as generators, and thus the speed is controlled with great accuracy. In the case of an accidental interruption of electric energy, all of the crane's motions are automatically locked by means of brakes, thus making it impossible to drop the load. Safety and accuracy are essential, because the crane is used to handle large guns and turrets on battleships, and if through carelessness or inaccuracy these should be damaged it would entail a considerable loss.

The pontoon is 140 ft. long by 85 ft. wide by 15 ft. deep (42.6 m. by 25.9 m. by 4.6 m.). The generator is rated at 150 kw., and the crane has a main hoist consisting of two hooks of 75 tons and an auxiliary hoist of 25 tons capacity movable in a vertical plane. The crane rotates in a complete circle, the rotating being controlled by two 60-hp. Westinghouse motors. The boom luffs up and down from a practically vertical position to an angle of about 30 deg. from the horizontal in its lowest position. This luffing is accomplished by two 10-in. (25.5-cm.) screws operated by two 60-hp. Westinghouse motors, and the main hoists can operate separately or simultaneously as desired. When lifting the maximum load the crane is operated by two 60-hp. Westinghouse type MC motors. The auxiliary hoist has separate motors for hoisting and trolleying, each of which is 60 hp. The counterbalance at the rear end of the crane amounts to 200 tons, and the total weight of the pontoon crane (displacement) is 2500 tons. Four electrically driven capstans are placed at the four corners of the pontoon. The speed of the main hoist is about 6 ft. (1.8 m.) per minute, and that of the auxiliary hoist 30 ft. (9 m.) per minute.

Buy Bonds and Back the Guns

WATT-HOUR METERS TESTED AT DISTRICT REPAIR SHOPS

Central Station Covering Large Territory Places Repair Tables at Convenient Locations to Reduce Haulage and Breakage

BY C. W. WARD

In order to reduce as much as possible the transportation of meters from consumer's property to the main testing laboratory, with the consequent handling and breakage, the Duquesne Light Company of Pittsburgh, Pa., has installed test and repair tables at the center of certain districts of the city. The original idea in having meter test and repair tables at the various district headquarters and substations was that the meter tester working in any locality would repair and test such meters as were removed from service for any cause whatever in his district. In this way the meter tester could be provided with work inside the station on rainy days and at times when he might otherwise be idle. However, owing to the large reduction in the force of meter testers due to existing conditions, the original idea could not be carried out, and the test benches were utilized in three places in substations by teaching the substation operator to repair and test the meters.

At other headquarters, where the meters are accumulating and where the utilization of the idle hours of the substation attendant is not possible, it is intended to have women testers constantly go from one headquarters to another for the purpose of testing these meters. It has been found that only meters in reasonably good condition can be handled in this manner. Meters requiring new coils or new parts other than jewels or pivots are returned to the main laboratory in the usual manner.

The test tables are equipped with suitable switching devices, with a ground test for 1000 volts and a drawer for repair parts, and some are equipped with permanent loading devices. In other cases the portable load boxes of the tester are used. Permanent rotating standards mounted on each table especially for the purpose consist of a regular service-type meter wound with both 1-amp. and 20-amp. series coils and having graduated disks and revolution counter.

The average cost for repair and test of meters handled in this manner is somewhat less than the cost at the laboratory, but this is due principally to the fact that the laboratory receives only those meters in the worst condition.

The Bloody Kaiser Fears Liberty

ELECTROLYTIC PLANT FAVORS USE OF SMOOTH COMMUTATORS

Long Experience with Both Undercut and Smooth Type Shows that Best Service Can Be Obtained by Use of Latter

BY C. F. HUTCHINGS

General Manager North American Chemical Company

Because continuity of service in an electrolytic plant is one of the most important factors entering into the plant's success, the matter of having an adequate supply of electrical energy at all times is absolutely vital. This factor led a chemical company in the Middle West to study closely the varying conditions with both smooth and undercut commutators on its generators. It was found that although 100 per cent service continuity and load factor could be obtained when smooth commutators were used on generators and motors, no like results could be obtained with the undercut commutators.

This record was made possible by the use of an ordinary grade of domestic-made brush and by taking daily care of the commutator. Each morning two men sandpaper the commutators with the paper attached to a concave-shaped wood block. One man applies the block, the other holds a bunch of dry waste against the commutator directly behind the block to catch the copper dust. Each machine is thus treated for about thirty minutes. Then, without detaching any shunt wires, each brush is slipped from its holder and cleaned with sandpaper just enough to remove the particles of copper that may lodge on the wearing surface. The brush is then replaced and the machine will operate satisfactorily for another twenty-four hours. One would ordinarily suppose that sanding would rapidly reduce the commutator diameter, but this has not been the case. In twenty years the commutators have not lost more than 1½ in. (3.8 cm.) total diameter, and they seem to be good for many years more. In fact, a half hour's sanding barely removes the dirt and does not even remove entirely the brown gloss from the surface. The undercutting, however, shortened continuous operating periods down to six weeks and the machine would show distress at slight overloads. Different makes of brush and different modes of manipulation were used, but the trouble could not be eliminated without smoothing down the commutator. The reason that the undercut commutator is not very good is thought to be that the slot gets foul with carbon and copper dust and the tendency is to drag copper across the segments, making ideal short-circuit conditions. When an undercut commutator starts to give trouble there is no recourse but to shut down the machine, while on the other hand smooth machines under like conditions can always be brought back to good behavior by using sandpaper without reducing the load.

Another reason for the trouble with undercutting is that it is not mechanically correct to dig grooves across the wearing surface at right angles to the line of motion. It is thought that with a properly built and operated commutator high mica is non-existent. Soft mica, which is usually amber-colored, is the proper kind to use, and even the hard white mica will do if first split into thin sheets about the thickness of writing paper.

Knock Out the Potsdam Gang

SAFETY OF GROUNDED SECONDARY CONNECTION

Oscillograph Record Shows Effect of Contact Between Primary and Secondary Wires—Circuit Opened in Tenth of Second

The primary distribution system of the Madison (Wis.) Gas & Electric Company is three-phase, four-wire, 4000/2300-volts, with the neutral grounded. The neutral of the three-wire secondary is also grounded. The following experiment was conducted by George E. Wagner, superintendent of plant, and Prof. Edward Bennett at the University of Wisconsin to determine the effect of short-circuiting the primary through the secondary on such a system. The current was stepped up to 2200 volts from 110 volts by means of a 5-kw. transformer, and a 1-kw. transformer was used to represent the distribution transformer. The connections were made as shown in Fig. 1. The result of bringing the ungrounded side of the primary (*A*) in contact with one of the ungrounded legs (*C* or *E*) of the secondary is shown in the oscillograph record in Fig. 2. At the instant of short circuit the potential dropped to a low value and continued for about one-tenth of a second before the fuses blew. From this it was concluded that the grounding of the secondary protects it from excessive voltage.

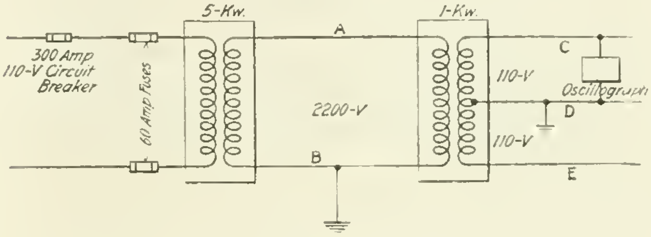


FIG. 1 -CONNECTIONS FOR TEST

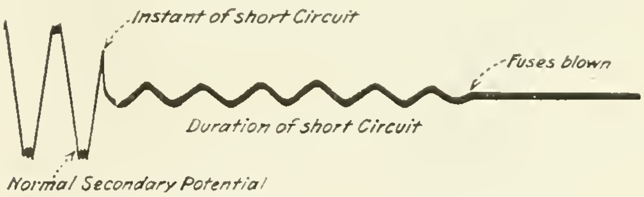


FIG. 2—VOLTAGE RECORD DURING SHORT-CIRCUIT TEST

Effect of a short circuit between a primary phase wire and a secondary line wire with the primary and secondary neutrals grounded.

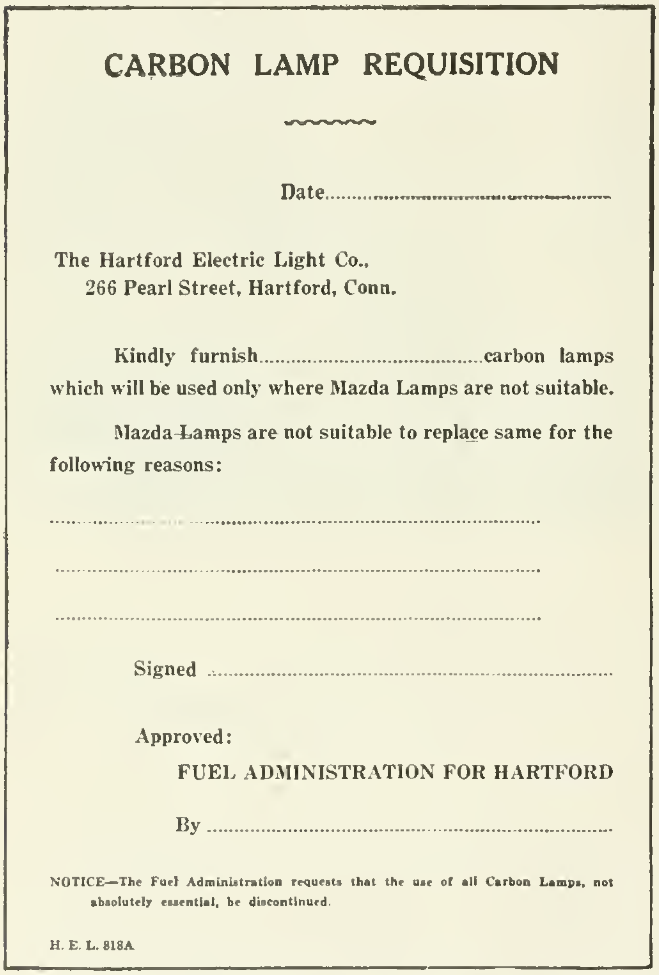
CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

STRICT CURTAILMENT OF CARBON-LAMP RENEWALS

Hartford (Conn.) Company Outlines Policy Adopted Which Enables It to Follow Out Fuel Administration's Recommendation

As a further step toward fuel conservation, the Hartford (Conn.) Electric Light Company has recently established a rule to the effect that it will neither renew free nor sell carbon incandescent lamps for replacement service without a written order from the Connecticut Fuel Administration, as reproduced. The Fuel Administration desires that the use of all carbon lamps not absolutely essential be discontinued.



CARBON LAMP REQUISITION

Date..

The Hartford Electric Light Co.,
266 Pearl Street, Hartford, Conn.

Kindly furnish..carbon lamps which will be used only where Mazda Lamps are not suitable.

Mazda Lamps are not suitable to replace same for the following reasons:

....

....

....

Signed ....

Approved:
FUEL ADMINISTRATION FOR HARTFORD

By ....

NOTICE—The Fuel Administration requests that the use of all Carbon Lamps, not absolutely essential, be discontinued.

H. E. L. 818A

A WRITTEN ORDER MUST BE PRESENTED BEFORE CARBON LAMPS WILL BE FURNISHED

The company's policy, which is in line with the Fuel Administration's recommendations (see ELECTRICAL WORLD, Sept. 7, page 457), now is to eliminate all round-bulb and ornamental carbon lamps and all 60-watt and 30-watt carbon lamps, replacing the latter by 50-watt and 20-watt tungsten lamps, which of course give a much better illumination besides economizing in the consumption of energy and fuel. In places where excessive vibration occurs, as on some classes of machine tools, the retention of carbon lamps is permitted, subject to the approval of the Fuel Administration. Hand lamps and stage lamps in theaters are allowed to be of carbon in order to obviate the excessive breakage that might take place if tungsten lamps were used. At Hartford, as elsewhere, carbon lamps are often improperly used in the following applications which are now subject to revision: Residences, by force of habit; on account of free renewals, in stores and residences; in sign and advertising lighting, in hall lighting, and in general factory illumination. The company is pointing out that the change to tungsten lamps is to the financial advantage of the customer.

Chase the Hun Home—Buy Bonds

NEW WORK OPENING UP TO THE COMMERCIAL MAN

How He Is Helping His Company to Get Capital, to Get Increased Revenue and to Deliver Its Power Where It Will Do Most National Good

Selling stock in the home territory and negotiating loans from prospective customers have become important war-time duties of some central-station commercial men. The former is a campaign activity not unlike in its general features any common pre-war new-business campaign. Into this work the commercial man fits naturally. Negotiating loans from prospective customers is a somewhat different problem. Formerly when a coal-mine owner asked the power salesman if he could buy central-station power the answer was an unqualified "Yes," and then there was cause for general jollification. But now the answer is "Yes, if you will loan us the money to make the necessary extension." Instead of a jollification, then there generally must follow an explanation of the central station's lack of capital and the underlying reasons for this deficiency. An agreement must be reached as to the terms on which the loan is to be accepted and refunded. If the operating ratio of the company is 75 per cent, it is a common practice to return the loan with interest at 6 per cent to the customer by rebating 25 per cent of each of his bills. This in effect permits the company to finance its extensions out of the earnings from them and to meet its bills for construction material promptly. In explaining this situation to prospective power customers and conducting the necessary contractual relations the commercial man is doing a new sort of work.

Another phase of his new job is getting more revenue for the company through increased rates. A manager of a large property recently remarked: "The commercial man who can figure out a method of increasing a rate is a whole lot more popular around the office than one who brings in a contract for a large piece of new business. With us," he concluded, "a dollar's worth of increased revenue is felt to be equal to about $20 worth of new business with its attendant capital requirements."

This means that the commercial man's new job requires him to study the method and manner of thinking of the regulatory body under which his company operates. He must know how its members feel not only on the question of amount of increased revenue but also on the topic of rate structures. This is necessary if the company is to expect prompt relief when its rate cases are filed.

While the above-named duties carry only indirectly war-time responsibilities, the commercial man engaged in power sales may have work to do in rationing power to the company's industrial customers which is of direct national importance. Upon his intimate knowledge of the importance and quantity of each respective customer's products largely depends the just and equitable distribution of the company's limited supply of power in times of shortage. The necessity for rationing power usually occurs on short notice, so the company in its preparedness for the emergency is prone to rely on the alert commercial department.

Money Means Munitions—Buy Bonds

FLAT-RATE CUSTOMERS CHANGED TO METER BASIS

New Orleans Investigation Shows that Customers, Besides Misusing Privilege, Pay Much Less for Energy Used than They Would at Regular Rates

Not only must strict economy be practiced to-day in every branch of utility operation but strict attention should be given to average rates for individual services to make sure that the income of the utility is as large as it ought to be. In this class falls the flat-rate customer. W. J. Aicklen, Jr., general manager of the Consumers' Electric Light & Power Company of New Orleans, La., has been checking up the income from flat-rate customers and has found that by changing over to meter service the average revenue for this class of customer can be considerably increased. These flat-rate customers are all connected through load-limiting devices.

A campaign for this class of business was started in the early part of 1913, and through wiring campaigns, etc., about 900 such customers were connected to the company's lines.

In the course of this campaign contracts were made with barber shops, saloons, pressing shops, residences, etc., all at the rate of 1 cent per connected watt, but after a little experience it was found that this did not pay, when compared with the regular rates. Consequently the rates for places of business were raised from 1½ cents per connected watt for pressing shops to 2 and 2½ cents per watt for saloons.

It was afterward found that even at these increased rates the company was often losing money, when compared with the retail lighting rates. These losses were not only due to the use of energy purchased by the customer for lighting with "mazda" lamps, but were also caused by the temptation that existed for the customer to use an electric fan without the knowledge of the company.

The company has had as many as twenty-five cases where the load limiter was practically destroyed through the customer using an electric iron or a toaster on a limiter with a capacity of only 100 watts. In fact, the average class of customer supplied on the flat-rate basis was found to be rather poor, and it was for this reason that there was so much of a tendency by customers to overstep the terms of their agreement with the company.

On tests made for this class of business, and in different localities, the company found that in a pressing shop paying $1.50 per month for 100 watts connected 34 kw.-hr. was used, which at the regular meter rate would amount to $2.24. At a grocery with a load of 200 watts and paying $2 per month it was found that 45 kw.-hr. was used in a month, which would amount to $2.90 per month at the regular rate. For a rooming house which was paying $4 per month for 400 watts connected a consumption of 76 kw.-hr. per month was found, which would amount to $4.50 per month at the regular retail rate. At another rooming house that was paying $2.60 per month for 260 watts connected was found a consumption of 49 kw.-hr. per month, which would amount to $3.10 at the regular rate.

It was such experiences as these that led the company to decide in 1915 that it would discontinue the installation of load-limiting devices for any new customers and that it would replace them with meters wherever there was an opportunity. For instance, if a customer moved from one address to another the company would refuse to move the limiter and would insist on a regular meter being installed. If the customer went out of business and was succeeded by another, the company refused to let the new customer have the excess indicator, insisting on installing a regular meter. This method reduced the number of load limiters to approximately 500 by the middle of 1918.

"As the load-limiter consumption has always been an uncertain quantity," Mr. Aicklen states, "and as it forms a large factor of uncertainty in the calculation of line losses, distribution losses, etc., the consideration of this, in addition to the facts that we had already learned regarding this class of business, caused us to decide to discontinue entirely all load limiters.

"As all these flat-rate contracts are written up on the yearly basis with a self-renewal clause, it was very easy to reclassify them into twelve monthly divisions, and to notify each division monthly of the expiration of their contracts, which were to be replaced on a meter basis or to be discontinued entirely.

"We have found that we have lost practically no business by this method, and even though we may not have so large a revenue on the meter basis, we will feel better in knowing that we are being paid for every kilowatt-hour sent out, and in creating so much larger a field for the exploitation of electrical appliances, as we have, of course, been restricted from selling any appliance to these flat-rate customers in the past."

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Boiler Equipment of the Auzberg Power Station.—P. KOCH.—It was made a condition that the grates should burn Bohemian brown coal economically, and it was found by trial that the Piedbœuf chain grate was most suitable for this fuel. Four Burkhardt vertical-tube boilers are used, each of 400 sq.m. heating surface and designed for 15 atmospheres working pressure with superheater and wrought-iron economizer. Induced draft is provided, and the total grate surface of each boiler is 17.2 sq.m. Flue ashes are caught in special spirals and removed below the boiler-house floor. The wrought-iron chimney is 29.5 m. high and of 1500 mm. internal diameter. Butterfly plates below the grate cut the air supply from part of the grate area at times of light load. Performance data are included.—*Science Abstracts, Section B*, July 31, 1918. (Abstracted from *Zeits. f. Elektrot.*, 11, "Maschinenbau," March 31, 1918.)

Calculation of Performance of Induction Motors Working in Conjunction with Flywheels and Slip Regulators.—HERBERT VICKERS.—The author deals with the subject mathematically, taking the two cases of continuous-slip regulator and intermittent-slip regulator; also the automatic-slip regulator and the Ward Leonard system. Numerical examples are given. It is the purpose of the article to consider the relative proportions of flywheels and motors.—London *Electrician*, July 19, 26 and Aug. 2, 1918.

Lamps and Lighting

Recommendations on Economy in Lighting.—A discussion on how to effect economies by ascertaining the past consumption, avoiding waste of light in selecting lamps, using properly designed shades, globes and reflectors, keeping lamps and illuminating accessories clean, noting where the illumination is excessive and burning only those lamps which are strictly necessary. In the appendixes of this paper recommendations for the adequate lighting of factories and workshops engaged on work of national importance are contained, with a table giving the minimum illumination on work and the consumption of electricity per thousand square feet of working area for different classes of work.—*Illuminating Engineer*, May, 1918

Properties and Characteristics of Wire Lamps.—A discussion of the different kinds of filament-type lamps in respect to where the material is obtained and how it is prepared for use in lamps is given for tungsten, tantalum and osmium.—London *Electricity*, June 14, 1918.

Generation, Transmission and Distribution

Localization of Faults on Broken Three-Phase Cables.—L. LEVIN.—The position of a fault in a three-phase cable may be determined, when one or more cores are broken, by comparison of the capacity of the individual cores, provided that none of them are earthed. But it often happens that at the moment of interruption of the second phase of a three-phase cable the arc set up melts the copper or chars the insulation so that one or more cores in each of the two portions may be earthed. Several cases are worked out mathematically, the position and size of the fault being calculated. If all the cores in one portion *BC* are earthed and none in the other half *AB*, then, as is known, the determination of the position of a fault is achieved by measurements of the capacity of an unearthed core in *AB* and comparison of the value obtained with the capacity per kilometer given on the test sheet of the cable. Since this value varies according to the number of cores earthed, it would be very useful if cable makers would state on their test sheets all three values of the capacity, *i.e.*, C_1 when no cores are earthed, C_2 when one core is earthed and C_3 when two cores are earthed.—*Science Abstracts, Section B*, July 31, 1918. (Abstracted from *Elektrot. u. Maschinenbau*, May 5, 1918.)

National Electricity Supply.—The linking up of power systems in south Wales and Monmouthshire, England, is discussed extensively, a map being given showing the problem involved.—*Electrical Times*, June 13, 1918.

Synchronizing of Alternators.—E. STYFF.—An abstract of an article in the *Elektrotechnische Zeitschrift* explains the mathematical theory of synchronizing and gives tables showing the phase displacement with relation to the deflection of instruments with lamps bright, dark and with mixed connection.—London *Electrician*, Aug. 2, 1918.

Use of Lignite, Bagasse and Wood Waste for Power Generation and Other Purposes.—JOHN B. C. KERSHAW.—Chemical and physical properties of lignite and power generation from air-dried lignite are discussed. Methods of briquetting are also outlined and the sectional elevations of boilers and fnrnaces for burning lignite are illustrated.—London *Engineer*, Aug. 9, 1918.

Wiring and Equipment for Radio Instruction.—W. HAYNES.—This article is written for the particular attention of Y. M. C. A. radio schools and for other agencies of instruction for radio work in the army. The difficulties of the present methods used are discussed, together with the improved system. This article is written in a simple manner and can be understood by non-technical men who wish to learn quickly the theory of wireless telegraphy.—*Journal of Electricity*, Aug. 15, 1918.

Use of High-Pressure and High-Temperature Steam.—J. H. SHAW.—The author considers the results of using high-pressure and high-temperature steam in power houses, and presents data showing the effect on efficiency and coal consumption for a wide range of conditions. Some modifications in boiler design resulting from such higher temperatures and pressures are discussed.—London *Electrician*, Aug. 16, 1918.

Installations, Systems and Appliances

Cable Section for Intermittent Load.—The problem attacked is the determination of cable cross-section required for intermittent operation, particularly in hoist service.—*Science Abstracts, Section B*, July 31, 1918. (Abstracted from *Brown-Boveri Mitteil.*, 4, No. 9, 1917.)

Electric Welding as Applied to Steel Ship Construction.—H. G. Knox and W. L. Merrill.—Various kinds of welds used in ship construction are described and fully illustrated. Arc welding, arc-welding tools, choice of current, distribution systems, holders, masks, spot welding and spot-welding tools are also considered. Other phases of this subject will be discussed in future issues of the journal.—*Journal of Engineers' Club of Philadelphia*, September, 1918.

Theory of the Static Frequency Doubler.—M. Osnos.—The action of the static frequency doubler is based upon the superposition of a steady field upon an alternating field. The apparatus is shown in its simplest form and the theory of operation is discussed in full. It was shown that for a constant sum of the alternating and continuous current ampere turns the secondary flux has its greatest value if the ratio of the maximum value of the alternating-current to the continuous-current ampere-turns is equal to two. In this article a graphical construction is given by which the maximum value of the primary and secondary fields may be determined. From this construction it is also possible to obtain the ratio between the primary and secondary voltages. This ratio is also obtained by calculation, and the results are confirmed by calculations from a special case, taking as a basis the saturation curve of a particular sort of transformer iron.—London *Electrician*, July 19, 1918. (Abstracted from *Electrot. Zeits.*)

Copper Economies in Austria.—F. Sabestsching.—A demand was made by the government for some of the copper and lead (11 tons of the former and 8 of the latter) used on an electric line, 13 km. long, between Bludenz and Sckruns in the Montatoner valley. This could be done either by raising the voltage, which was considered impossible owing to the existing motor equipment, or by altering the method of supplying the line with power. Hydroelectric power was supplied from a point about 800 m. from one end of the line, and it was found that the required saving could be effected, without detriment to the working, by transmitting this power to a point near the middle of the line, where a substation for transforming purposes has been erected.—*Science Abstracts, Section B*, July 31, 1918. (Abstracted from *Elektrot. u. Maschinenbau*, April 7, 1918.)

Electric Winding Engines and Mine Hoists.—H. H. Broughton.—In the first part of the article a convenient practical method of drawing the torque diagram is described. The method, which is used by the author for all cylindrical-drum winders, leads to the rapid determination of the cardinal points of the diagram. The distorting effect of heavy ropes is briefly considered, and diagrams are given for the unbalanced cylindrical-drum winder and for the balanced winder with tail rope.—London *Electrician*, Aug. 23, 1918.

Electrophysics and Magnetism

Contribution to the Quantum Theory of Paramagnetism.—F. Reiche.—A mathematical paper. The kinetic theory of paramagnetism of Langevin led to Curie's law that the molecular susceptibility is inversely proportional to the absolute temperature. Onnes and Oosterhuis, however, showed that this law did not hold at very low temperatures. The problem of setting up a theory of paramagnetism on the basis of the quantum hypothesis has been taken up by Oosterhuis and Keesom, Gans and Weyssenhoff. The theory of the last-mentioned author employs fixed axes of rotation; in the present paper an extension is made by the employment of free axes of rotation, *i.e.*, two degrees of freedom. Starting from the Jacobi-Hamilton equation, the quantum conditions are introduced and an expression is obtained for the molecular susceptibility. This is considered in the light of particular cases. Further, the calculated values of the susceptibility for various substances are compared with the experimental results of Onnes and Oosterhuis, good agreement being obtained.—*Science Abstracts*, July 31, 1918. (Abstracted from *Ann. d. Physik*, March 21, 1918.)

Potential Distribution in String Insulators.—H. Saegusa.—This is a mathematical discussion of the distribution of potential along a string of suspension insulators with capacity between one another and between each insulator and the earth.—*Science Abstracts, Section B*, July 31, 1918. (Abstracted from *Tohoku University Scientific Reports*, April, 1918.)

Electrochemistry and Batteries

Relation Between Specific Inductive Capacity of an Electrolyte and Electric Potential of a Metal Placed in It.—Dayton L. Ulrey.—The potential difference between electrodes of the same kind in a two-solution cell has been measured for a number of different percentage mixtures of two liquids for four different cases, and in each, after disturbing influences were removed, is shown to be strictly proportional to the difference in the specific inductive capacities of the two solutions. In the two cases investigated with copper electrodes, one with platinum and six with calomel electrodes, the direction of the electromotive force of the cell is in accordance with the theory that the loss of the ions from an electrode is dependent upon the specific inductive capacity of the electrolyte rather than upon the concentration of those ions in the electrolyte and a solution tension of the electrode.—*Physical Review*, July, 1918.

National Physical Laboratory (Great Britain) in 1917-18.—This paper consists of a report on the work in progress and the accomplishments of the National Physical Laboratory. Among the subjects of especial interest to electrical engineers are fundamental electrical units, magnetic disturbances of the laboratory, general electric measurements, electrotechnics, continuous-current resistance, buried cables, pyrometer tubes, thermal conductivity, electric hot plates and cold storage.—London *Engineering*, Aug. 2, 1918.

Units, Measurements and Instruments

Production of High Temperature and Its Measurement.—E. F. Northrup.—The author takes up the difficulties involved in the general problem and then describes apparatus developed by him in which the method of oscillatory current obtained from the discharge of condensers is employed. These oscillatory currents pass through an inductor coil of about fifty turns which surrounds the crucible, being sufficiently separated from it to permit of both electrical and heat insulation. It is thus a Tesla coil arrangement in which the voltage is lowered and the current raised. These furnaces have been made and tested in units up to 50 kw. and 60 kw. The writer also describes a pyrometer which depends for its indications upon the linear expansion of tin. The instrument is constructed on the general lines of a large mercury thermometer.—*Transactions* of the Faraday Society, June, 1918.

Chart for Oscillation Frequency and Wave-Length of Oscillatory Circuits.—P. LUCKEY.—(Similar article by A. S. M. Lorensen.) Gives a diagram from which the oscillation frequency and wave-length of an oscillatory circuit of given capacity and self-induction may be found. The chart is based on the logarithmic relation $\log \lambda - k = \frac{1}{2}(\log L + \log C)$.—*Science Abstracts, Section B*, July 31, 1918. (Abstracted from *Jahrb. d. Drahtl. Tele.*, April, 1918.)

Pyrometer Standardization.—EZER GRIFFITHS and F. H. SCHOFIELD.—In this paper the writers discuss the sources of error, limitations and calibrations of thermoelectric, resistance, radiation and optical pyrometers.—*Transactions* of the Faraday Society, June, 1918.

Automatic Control and Measurement of High Temperatures.—RICHARD P. BROWN.—In order to make action more positive than that obtained by merely making contact through the pointer of a millivoltmeter, the automatic control pyrometer described here operates in the following manner: A thermocouple formed of a nickel-chromium alloy, installed in the electric furnace the temperature of which is being controlled, actuates a high-resistance millivoltmeter. Below the pointer, and adjustable throughout the whole scale range, is a table carrying two contact pieces, separated by a thin piece of insulating material $\frac{1}{32}$ in. (0.8 mm.) thick. The depressor arm, which is driven by means of a small electric motor, or by a clock if that method be preferred, depresses the pointer at regular intervals, usually every ten seconds, and in doing so the pointer forces together the two contact pieces below.—*Transactions* of the Faraday Society, June, 1918.

Telegraphy, Telephony and Signals

Limit of the Increase in Transmission Range Obtained by Loading.—H. JORDAN.—By transformation of the expression for the attenuation constant the influence of the coil-loss angle and the dielectric-loss angle on the transmission is brought out. With given coils and dielectric the value of the self-induction for minimum attenuation is determined, giving the maximum speech range. The ratio between this and the range of the unloaded cable is the maximum improvement factor and is shown to be dependent only on the sum of the coil-loss and dielectric-loss angles, and independent of the resistance and capacity of the cable. In the case of the open line it is necessary to separate the added inductance from that inherent in the line. The dielectric-loss angle loses its physical significance, since the leakance is due to the insulators. The results for the open line are, however, similar to those for cable.—*Science Abstracts, Section B*, July 31, 1918. (Abstracted from *Elektrot. Zeits.*, Feb. 14, 1918.)

Constants of Radio-telegraphic Stations.—M. DIECKMANN.—At present there is a lack of simple characteristic constants to define the power of sending and receiving stations in wireless telegraphy. The usual method of defining the antenna of a sending station is by the number of watts calculated from the antenna current and antenna resistance. As this does not take any account of the radiating properties of the antenna, it does not lead to a means of calculating the range of the station. In the case of receiving stations only figures of the most general kind are generally given. The author proposes a system of constants that he has devised in a series of experiments with the help of Zeppelin airships.—*Science Abstracts, Section B*, July 31, 1918. (Abstracted from *Jahrb. d. Drahtl. Tele.*, 12, April, 1918.)

Miscellaneous

Tariffs for Interconnected Three-Phase Generating Stations.—H. BUSSMANN.—The satisfactory operation of several three-phase generating stations in supplying a common distribution network depends so closely on adjustment of the power factor that it is desirable to institute a system of payment to each station for the energy supplied from it in a manner that takes account of the wattless power. Such an arrangement, adopted by the Rhenish-Westphalian Electricity Works, is described.—*Science Abstracts, Section B*, July 31, 1918. (Abstracted from *Elektrot. Zeits.*, March 7 and 14, 1918.)

Aluminum Deposits and Production of Aluminium.—Although it is impossible at the present moment to forecast the effect of the war upon many industries, it is clear that the shortage of copper has greatly extended the use of aluminum, and that not merely temporarily. The production has in consequence increased and a number of important aluminum works have been and are being started in different countries. Under these circumstances a survey of bauxite deposits, and more especially the less known ones, and a description of the development and present state of the processes of production is here undertaken.—London *Engineering*, Aug. 16, 1918.

Electrical Reconstruction in Belgium.—A map produced in the article shows that as many as twenty-six important power stations were in existence in Belgium before the war. It is thought that generation of electricity should be concentrated at the ports of Ostend, Ghent and Antwerp and at the coal pits of Mons, Charleroi, Liège and Limburg. It is estimated that if the railway network were completely electrified the maximum demand for power would not exceed 250,000 kw. If all the industries were supplied with electrical energy for motive power, something like 500,000 kw. would be required. Therefore, providing for a future growth for five or ten years, about 1,250,000 kw. ought to be provided in the superstation system. Saving of coal is discussed and the effect of development of electricity shown. It is thought that instead of one big power house of 100,000 kw. to 300,000 kw. there should be many big power stations using surplus heat from blast furnaces and all kinds of plants, as far as possible linked up in the industrial district so as to concentrate in the one system of the industrial district all of the supplies of electrical energy that are available.—London *Electrical Review*, Aug. 2, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ELECTROCHEMICAL SOCIETY HOLDS GENERAL MEETING

Symposium of Papers and Discussions on Problems in the Electrochemical Industry That Will Demand Solution After the War

The thirty-fourth general meeting of the American Electrochemical Society, which had been scheduled to convene at Princeton University, was held at Atlantic City, N. J., Sept. 30 to Oct. 2, owing to the fact that the government was obliged to make use of all of the facilities at Princeton.

The American Electrochemical Society is the first of the national organizations to give consideration to post-war problems within the industry which it represents. A symposium on this subject was the feature of the meeting and occupied the program for an entire day. In general, the meeting was without social features being devoted entirely to the consideration of technical problems.

AFTER-THE-WAR PROBLEMS DISCUSSED

In the symposium on electrochemistry after the war a number of experts discussed the most obvious problems. Chief among these is the future of electrolytic chlorine, which has been produced in quantities far exceeding the normal demand. A. H. Hooker, who led the discussion, was of the opinion that new uses must be found for chlorine if the present plants are to be kept in operation. By way of emphasizing the possible uses of chlorine, Dr. Van R. Kokatnuf gave an exhaustive review of the commercial applications of the element. Apparently, the largest possible use of chlorine is in the treatment of ores. This would consume it in large tonnages.

Next to chlorine there is a large problem in the nitrogen industry after the war. W. L. Landis showed that the country has a capacity for nitrogen fixation which is beyond its apparent needs, but he was hopeful that the demand for fertilizer in more concentrated form would afford a market for the entire product.

The power situation after the war was discussed by C. A. Winder. He was rather skeptical about the so-called super-steam plant which has been proposed for the coal fields in capacities up to 500,000 hp. The quantity of water available for condensing purposes would be a limiting factor. Mr. Winder saw no such thing as surplus power and believed that there would be an ample market for all of the hydroelectric power in the country as fast as it could be developed. He was opposed to federal ownership of power plants, and in this was supported by all those who discussed the subject.

F. A. J. Fitzgerald discussed the electric furnace after the war and expressed the opinion that it would have more extensive use. J. A. Mathews expressed the opinion that electric steel would be produced in ever-increasing quantities and would make possible the wider use of better steel. Electric pig iron, in the opinion of Robert Turnbull, would not continue to be an important product after the war, when blast furnaces could supply the entire demand.

Col. W. D. Bancroft expressed some ideas on research work after the war. His subject was discussed by Dr. Mess. The gist of the discussion was to the effect that industry would profit by the establishment of coöperative research laboratories.

Tariff problems in the electrochemical industries were discussed by Dr. Grinnell Jones of the United States Tariff Commission, and the participation of technical men in government affairs was considered by F. A. Lidbury.

After the meeting the society visited the laboratory of the Pyrolectric Instrument Company at Trenton where a demonstration was made by Dr. Northrup of his high-frequency oscillatory current electric furnace.

Have You Bought Your Bonds Yet?

LIBERTY BONDS WILL KEEP THE LIGHT BURNING

War Convention of N. E. L. A. New England Section

Delegates Reaffirm at Springfield Meeting the Patriotic Pledge and Resolution of the National Association—Government Representatives and Members Discusss War Problems

MORE than 200 members and guests of the New England Section of the National Electric Light Association convened at Springfield, Mass., Sept. 27 and 28 to discuss war problems of the central-station industry. Mingled with the seriousness of the occasion was a sustained note of confidence in the rising tide of Allied victory and a consecrated determination to "go the limit" in supporting the cause of liberty.

The convention opened Friday morning at the Hotel Kimball with the singing of the national anthem, and the patriotic resolutions of the national association at the recent Atlantic City convention were unanimously reaffirmed and transmitted by telegraph to President Wilson. The convention was honored by the presence and addresses of representatives of the United States Fuel Administration and of the War Industries Board, and had there been no formal program of papers and discussions, these addresses and the opportunity the occasion afforded for personal interchange of ideas on questions of war import would have made the meeting memorable. Among the topics dealt with in papers and addresses were the government control of interconnected power systems, the use of women in the central-station industry, popularizing public utility securities, standardization of transformer ratings and designs, and coöperation of central stations and contractor-dealers for mutual advantage.

The President's Address

President Lisle's opening address was preceded by the reading of greeting telegrams, foremost of which was a message from President W. F. Wells of the national body pledging the organization to help in winning the war in every way within its power. With this as his keynote, President Lisle urged the membership to concentrate every energy and resource to this purpose, striving to coöperate to the utmost with the administration at Washington and to avoid looking at government policies and recommendations from any but the patriotic standpoint.

"Do not be afraid to ask Washington for help," said the speaker, "but be slow to ask industrial exemption for men not indispensable to the operation of plants. See if men with dependents cannot do the work nearly as well as those without them. Give until it hurts; go without something; lend your money to the government and then lend your credit! Read the electrical magazines. Take home their lessons and suggestions. Do not oppose daylight saving the year through, or the use of women and girls who want to do work which you thought was a man's. Put every effort into the cause and help win the war."

There are now 952 members of the New England Section, sixty-three having voluntarily joined this year, according to the report of the secretary, Miss O. A. Bursiel. The section headquarters has coöperated with Fuel Administrator Storrow of New England in many ways during the past year. In view of the demand for skilled labor a card file is now maintained at the Boston office, 149 Tremont Street, giving positions open and personnel available. The report of the treasurer, Bowen Tufts showed the finances to be in a healthy condition.

The program at the first session included papers on "Finances," by E. A. Barrows, president Narragansett Electric Lighting Company, Providence, R. I., and one on "The Financing of Extensions," by R. S. Hale, superintendent special research department, Edison Electric Illuminating Company of Boston. The papers of E. W. Lloyd, Chicago, and Alex Dow, Detroit, on "Line Extensions in War Time," prepared for the recent Atlantic City convention of the association, were also read.

In the absence of banking representatives President Lisle also conducted an informal discussion upon "Trade Acceptances" at this session.

Mr. Barrows emphasized the importance of rates adequate to cover the very real risks of the central-station business as well as to meet operating expenses and fixed charges. By the maintenance of a fair dividend rate local capital is encouraged to flow into utility development, and growth is an essential to the rendering of service. The Narragansett company has paid 8 per cent (issuing stock at par) for thirty years, and the city and Public Utilities Commission recognize this rate as fair. Seventy-five per cent of central-station power is now devoted to war essentials, and the industry needs far more than the $400,000,000 a year estimated as necessary for expansion by Frank A. Vanderlip not long since. The speaker commended the helpful and efficient work of the Capital Issues Committee in conserving capital for essential purposes.

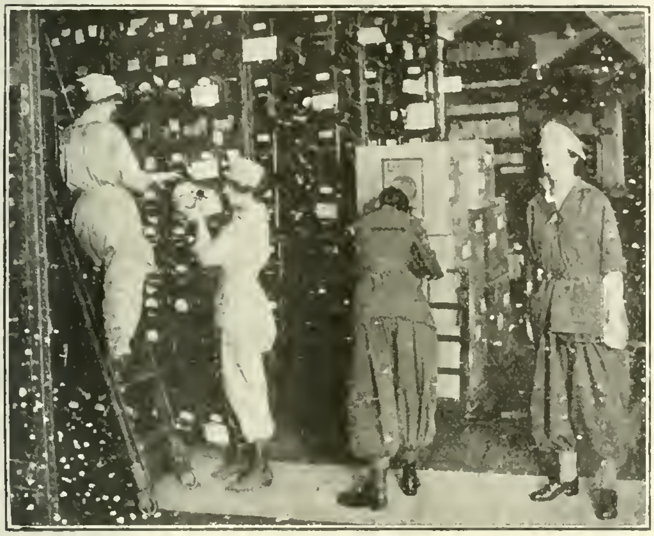
Government Control of Transmission Systems

That government control and even ownership of large interconnected power supply systems is imminent unless such systems are operated so efficiently and on the whole so extraordinarily well that there would be no advantage in the change from the public standpoint was declared by Philip Cabot of Boston, president of the Turners Falls Power & Electric Company, at the opening of the afternoon session.

As a leading public utility banker and executive, Mr. Cabot pointed out that little more than a beginning has as yet been made in the way of comprehensive power development and system interconnection in New England from the standpoint of ultimate economic tests. He maintained that electric power is of the most fundamental industrial importance, that the demands of economical operation will relatively soon force the electrification of New England railroads, adding at least 300,000 kw. to the present central-station load and that small and inefficient steam plants will be discarded. The industrial load to-day, combined with the railroad and central-station loads, must exceed 3,000,000 kw. in New England, of which less than one-fourth is handled by central stations.

After outlining the economic need of tidewater stations of large size as the mainstays of a comprehensive system of supply, Mr. Cabot developed the thought that the supply of electrical energy for power is a prime function of government and that the great expansion before the industry will require and produce extension of government control until it is complete. Upon his attitude toward this development depends the future of the young man in the central-station field.

There was no discussion of Mr. Cabot's paper, but Bowen Tufts of C. D. Parker & Company, Boston, in opening remarks upon the sale of securities to customers, referred to Washington's enunciation of the principle that the true function of government is to govern rather than to own. Mr. Tufts pointed out that the day of autocracy is quickly passing and said that in the public utility business to-day there are few properties owned by capitalists. About 40,000 Massachusetts men and women, for example, have put their savings into Massachusetts public utilities and should receive as much consideration as savings bank depositors. It is important, Mr. Tufts said, to show the public, at meetings bearing upon rate changes, who owns utility stocks and who holds company notes.


WOMEN AT WORK IN CENTRAL STATION

In a paper on "Raising Rates and Coal Clauses," R. S. Hale, Boston Edison company, outlined the limitations of coal clauses and war surcharges in the event of long-continued hostilities and corresponding price changes. Most of the companies during the first few months when costs rose went on the theory that the rise was temporary and that it should be taken care of through the reserves. Finally costs rose to a point where the reserves could not stand the strain and an increase in income became necessary. Coal clauses entered the rate structure, and these, combined with a war surcharge, temporarily care for central-station cost difficulties, particularly where the coal clause takes care also of other increasing operating expenses, collecting say 150 to 200 per cent of the increased fuel expense. In case the war is greatly protracted, a change in rates is likely to be required along the line of raising the prices for large power users to the increased cost of producing it in private plants under war conditions. Cooking business will probably thrive better without a raise in rates. Street lighting should be able to stand a raise unless political conditions interfere. Rates should not be raised to small customers until the limit has been gone with the large ones.

Success in selling public utility securities to the local public was described in a paper by Percy H. Whiting of the Central Maine Power Company. Sales were effected through vigorous newspaper advertising, especially in industrial towns handling intensive war work, shipbuilding, etc., and by selling to and through employees. Bowen Tufts also spoke briefly on this topic, stating that better results in selling such securities had been secured through the coöperation of local managers and subordinates than by experienced bond salesmen.

"The Employment of Women in Public Utilities" was the title of a paper by Charles H. Parker, superintendent of the generating department, Boston Edison company An illustrated article on this topic, based upon Boston experience, was published in the ELECTRICAL WORLD of Sept. 21. The author brought out as additional information the fact that there are now seventy-nine women in the department and that on Sept. 10, 1918, 81.6 per cent of the company's employees, or 1595 out of 1955, were men, whereas on April 3, 1917, 91.4 per cent were men. Nearly every department has increased its quota of women, and the movement is still progressing. Written contributions on this topic were also presented from J. W. Cowles, superintendent of the department of installations, and W. F. Stevens superintendent of the supply department, Boston.

The final paper in the afternoon session was on "Wholesale Power," by F. P. Royce of the Stone & Webster organization, Boston. The author reviewed the principles underlying the application of wholesale power rates and emphasized the importance of drawing large power contracts with extreme care.

FUEL SAVED MEANS DECREASED CASUALTIES

"In so far as we fall short in fuel saving it will be reflected in increased casualties," declared Howell Van Blarcom, assistant chief of the power and light section, United States Fuel Administration, Washington, in an address upon coal conservation at the evening session on Friday. The speaker contrasted the enormous consumption of munitions to-day with that of entire wars in the past and showed the close connection between savings in coal behind the lines and decreased casualties.

Mr. Van Blarcom said that the country faces a shortage of probably 50,000 000 tons of coal this year, the estimated total requirements being 673,000,000 tons. The demand for steel is the chief cause of the present enormous fuel consumption. In the entire Franco-Prussian War the Germans fired only 650,000 shells, whereas in the recent secondary engagement at the St. Mihiel salient 1,500,000 shells were used by the attacking armies. In the Flanders drive last spring the Huns fired more than half a million shells in seventy-eight minutes, and at the siege of Verdun the French used no less than 60,000,000 shells, which consumed 1,800,000 tons of steel and required 9,000,000 tons of coal in their making.

"To-day we have probably not over 650,000 miners at work in this country," said the speaker, "but the American miner produces more than twice as much coal as his British brother. Twenty-one million tons of steel is needed for the present quarter year, and 17,000,000 tons is the greatest production which we can hope for. We must conserve in every possible way. The central station is of inestimable value to the government in the conservation of fuel. New England is probably further ahead in this work than any other section.

"The Fuel Administration is about to embark upon a program of economy promotion which should be most effective. Ice-making plants not fully loaded are to be gradually closed down and the load transferred to installations which can be operated at maximum efficiency. Elevator service in apartments and hotels will be curtailed, and 'skip stops' will be applied to their maximum usefulness on electric railways. There must be a closer curtailment of lighting, and heat regulation must be run within sharper limits. Practically every boiler plant in the country is to be inspected by a representative of the Fuel Administration and rated upon the basis of data obtained. The best boiler rooms will be the last to feel the effects of fuel curtailment. It is estimated that 4,000,000 tons of coal can be saved per year by discontinuing the manufacture of carbon and metallized-filament lamps. Interconnection is being encouraged and inefficient isolated plants are being hunted down. Central stations are urged to take over isolated-plant loads in the summer season particularly, at least for the war period."

In closing, the speaker vigorously affirmed the coming of a victorious spring and urged the utmost conservation of fuel as a means of bringing the supply of munitions closer to the needs of General Pershing's forces and thereby increasing their power of advance with minimum losses of men. Much applause followed Mr. Van Blarcom's address.

Labor Must Be Gained Through Plant Conversion

Labor shortage and the problem of overcoming it were discussed by the next speaker, Leonard W. Cronkhite, head of the resources and conversion division, regional adviser's office, War Industries Board, Boston. Mr. Cronkhite outlined the need for men in the army and navy, in the shipbuilding and munitions plants and food supply of the nation. In this country there were about 33,000,000 male workers in 1917. Not less than 5,000,000 are needed for the fighting forces on land and in the air; the navy and shipping service require 750,000; shipbuilding, 750,000; munitions plants, 1 500,000, and food production, 11,000,000. All in all, about 7,000,000 are now left to do the work of 22,000,000. To-day twenty great war plants are short by 50,000 unskilled workers alone, and in the country as a whole 878,000 unskilled workers were needed on Oct. 1.

The speaker touched upon the importance of adequate appropriations for housing and on the possibility of increasing the productiveness of labor through supervision of unskilled by skilled workers, appeals to patriotism, the use of women, substitution and conversion of plants for work on war necessities, and labor dilution. Hundreds of conversions have been accomplished; thus, to cite a few, a stove plant is making locomotive parts; a terra-cotta factory, dummy drop bombs; a corset factory, medical and surgical belts; a shirtwaist factory, signal flags. The speaker closed with a powerful plea to heed the lessons of the war in future work.

The last speaker of the evening was W. H. Blood, Jr., assistant to the president of the American International Shipbuilding Corporation, who gave an illustrated talk on Hog Island shipbuilding activities which was received with great enthusiasm.

At the session of Saturday morning President Lisle called upon Executive Secretary T. C. Martin of the national association to address the convention. Mr. Martin referred briefly to the fuel conservation problem as affected by the exclusion of carbon and "gem" lamps from the general market, urging the coöperation of members in this and other conservation measures adopted on behalf of the country's war program. He touched upon the importance of paper conservation and instanced the reduction of the N. E. L. A. *Proceedings* from 2000 to 500 pages this year and of the *Bulletin* from 64 to 48 pages. He then introduced the resolution of loyalty adopted at the Atlantic City convention last spring, and it was reaffirmed unanimously for transmission to the President.

PRESIDENT-ELECT LELAND

Increases in wages, standardization of transformer ratings, the effect of daylight saving on central-station income, bonus systems and stimulating appliance sales were the topics of the morning session. The principal speakers were E. F. Lawton, Hartford, Conn.; F. H. Smith, Worcester, Mass.; W. R. Eaton, Cambridge, Mass.; M. O. Troy, Pittsfield, Mass.; Eugene Carpenter, Newton, Mass., and I. A. Honnewell, Lowell, Mass.

Special interest was aroused by the paper of Mr. Troy, which showed how the reduction of transformer types, sizes, etc., may be effected as an aid to economy in labor and material under war conditions. Quantity production and the concentration of designing and manufacturing effort to a limited range of activity are necessary for maximum efficiency in the use of material and labor to-day. More than a million designs were possible when the apparatus committee of the N. E. L. A. and the transformer committee of the Power Club completed the initial task of reduction summarized in the printed report now available, a task greatly aided by the engineering work of the standards committee of the A. I. E. E.

At the closing session on Saturday afternoon John J. Gibson, manager supply department, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., outlined a paper on "Making Quantity and Service the

Basis of Price" contributed to *Electrical Merchandising* by him recently. W. L. Goodwin addressed the convention on "Coöperation Between Different Branches of the Industry," urging that central stations conduct their retail sales departments on the same basis as the retail departments of contractor-dealers' organizations.

The officers elected for 1919 were: President, George B. Leland, Stamford, Conn.; vice-president, Clifton R. Hayes, Fitchburg, Mass.; treasurer, Bowen Tufts, Boston; executive committee, F. D. Gordon, F. A. Belden, H. L. Olds, W. L. Mulligan, R. C. Brooks, E. F. Lawton and A. B. Lisle. W. L. Mulligan, Springfield, was chairman of the convention committee.

President-Elect Leland

George B. Leland the president-elect, is general manager of the Stamford (Conn.) Gas & Electric Company, with which he has been associated for the last fourteen years. He was born in Johnson, Vt., and was educated in the local schools, working on his father's farm during the off-school periods until he became of age. Mr. Leland then was employed in a shop at Erving, Mass., and shortly afterward was appointed chief engineer and electrician in the Connecticut Industrial School for Girls, at Middletown. He entered the central-station field later as day engineer for the Middletown Electric Light Company and was soon promoted to the post of chief engineer. Here he had about seven years' experience in all branches of central-station work, including both inside and outside service. From Middletown Mr. Leland entered the field of construction in the employ of Sanderson & Porter. He was engaged in the erection of a generating plant at Far Rockaway, L. I., and upon its completion operated it as chief engineer for three years, leaving it to become superintendent of the Norwich (Conn.) Gas & Electric Company. Upon the municipalization of this system Mr. Leland became superintendent of the Stamford company, and early this year he was made general manager.

Mr. Leland is an associate member of the American Institute of Electrical Engineers, chairman of the Connecticut Electric Light Association, and is a member of the Connecticut Get-Together Club of the N. E. L. A., having served as chairman for one year. He is an inspector in the conservation division of the United States Fuel Administration under C. G. R. Corson of Hartford, Conn. He will take office as the head of the New England Section on Jan. 1.

Bonds Are as Necessary as Bombs

FORM THE STUDENTS' ARMY RESERVE CORPS

At More than 500 Universities and Colleges 150,000 Students Are Mustered Into the National Military Service

On Oct. 1 150,000 students at more than 500 colleges and universities in all sections of the country were mustered into the Students' Army Reserve Corps. They become a part of the military forces, pledged to the defence of the nation.

Special programs were arranged at the different institutions, and messages were read from President Wilson, Acting Secretary of War Crowell and General March, chief of staff.

EMERGENCY POWER ACT PASSED BY THE HOUSE

Representatives Approve Without a Dissenting Vote the Appropriation of $175,000,000 for War Power-Plant Construction

Without a dissenting vote the House of Representatives passed on Oct. 1 and sent to the Senate the government emergency power-plant act.

The bill as reported reduces the amount of the appropriation from $200,000,000, named in the original draft, to $175,000,000, "to be available during the time this act is in effect."

Chase 'em to the Rhine—Buy Bonds

PLANS FOR INTERCONNECTION OF POWER PLANTS AT SEATTLE

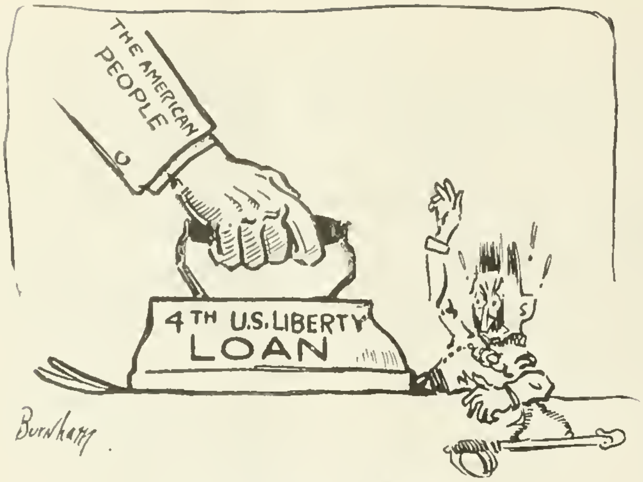
Estimated Cost of Tying Together the Company and Municipal Systems Is $60,000—Output of Combined Plants

J. D. Ross, superintendent of the Seattle city light department, and Councilmen R. H. Thomson and O. T. Erickson are conferring with officials of the Puget Sound Traction, Light & Power Company to work out a plan for interconnection of the traction company and municipal power plants. The estimated cost of the connection will be about $60,000.

One of the conditions on which the Capital Issues Committee authorized the city to issue $5,500,000 bonds to build the Skagit River power plant was the connection of the two power plants to reduce duplication of service and give a maximum efficiency for both plants. The War Industries Board has made a demand for quick action on the connection to insure uninterrupted power for Seattle war industries.

Superintendent Ross says that the combined traction and municipal plants will represent a capacity of about 140,000 kw. The city plant has a normal capacity of 30,000 kw., and the traction company plants in the Seattle district, including Tacoma, Kent, Auburn and Seattle, have a combined normal capacity of 110,000 kw. The traction company already has a connection with the Tacoma municipal power plant, with a rating of about 30,000 kw. The Seattle connection will unify the three plants in one system.

At a recent conference of Mayor Ole Hanson and the finance committee of the city of Seattle it was decided to place the first issue of Skagit River power bonds, aggregating $1,500,000, at once, if no objection is raised by the Capital Issues Committee. The quick action will be taken to issue the bonds before the proposed revenue tax is enforced. The only thing that now stands against the issuance of the securities is a "gentlemen's agreement" between Mayor Hanson and members of the Capital Issues Committee by which it was agreed that the issuance of the bonds would not be permitted to conflict with the fourth Liberty loan. Carstens & Earles, brokers, who have offered to take the Skagit first issue, have agreed to keep the bonds off the market until after the Liberty loan campaign is completed, and it is expected that this arrangement will meet with the approval of the Capital Issues Committee.



ELECTRIC-IRON HIM OUT

INDIVIDUAL PLANTS ON PREFERENCE LIST

Circular No. 20 of the Priorities Division of the War Industries Board Lists Plants by States

Circular No. 20 of the War Industries Board, Priorities Division, comprises preference list No. 2, issued Sept. 3, 1918, superseding preference list No. 1, issued April, 6, 1918, and all amendments and supplements thereto. It includes a classification of individual plants, listed alphabetically by states.

Buy and Keep the Liberty Bonds

CONSERVATION SCHEDULE FOR ELECTRIC HEATING APPLIANCES

Program of Elimination of War Industries Board to Conserve Materials and Labor, to Free Capital and to Simplify Production

B. M. Baruch, chairman of the War Industries Board, authorizes the following:

The Conservation Division of the War Industries Board, applying its program of eliminations to conserve essential materials and labor, to free capital tied up unnecessarily in manufacturers' and merchants' stocks and to simplify factory production, has issued a schedule for manufacturers of electrical heating appliances which calls for discontinuance of the manufacture of the following electrical utensils and appliances:

Carburetor heaters, hand-wheel heaters, intake heaters, manifold heaters, primer heaters, blankets, robes, cigar lighters, frying pans, plate warmers, curling irons, sauté pans, waffle irons, fluting irons, egg boilers, soup kettles, stew pans, corn poppers, hand dryers, hosiery forms, peanut roasters, transfer irons, vaporizers, varnish sprayers, entrée dishes, cigar lighters for automobiles, book-binding appliances, instantaneous water heaters, automobile foot warmers, fudge warmers, vegetable dishes and all Sheffield plated ware.

The schedule for domestic appliances (660 watts or less, except ranges) provides:

All appliances that are to be eliminated but which are now in the process of manufacture or are completed and in stock may be sold, but no more material for any of these appliances is to be purchased except to balance up stocks on hand, and their manufacture is to be discontinued entirely Dec. 31, 1918.

In no case is any manufacturer to add to the number of styles and sizes that he is now making.

Each manufacturer of the following appliances is to restrict his output to the number of styles and sizes specified:

	No. Styles	No. Sizes		No. Styles	No Sizes
Chafing dishes	3	1	Toasters	2	1
Percolators with faucets	3	2	Toaster stoves	1	1
Percolators without faucets	3	2	Convector heaters	1	1
Samovars	1	1	Disks Stoves	2	2
Nursery water heaters	1	2	Fireless cookers	1	2
Teapots	1	1	Flatirons, 7½ lb. or less	2	2
Hot-water kettles	1	1	Grills	2	1
Ovens	1	1	Heating pads	2	2
Reflector heaters	2	2	Hair dryers	2	1*

*One size in each style.

Ranges—Not more than six different ranges covering both styles and sizes to be made at any one factory, and none to be made at any factory that is not producing ranges at this date. Nickel plating and fancy ornamentation to be eliminated.

INDUSTRIAL APPLIANCES (OVER 660 WATTS)

	No. Styles	No. Sizes
Convection air heaters	3	7
Confectioners' appliances	2	2
Corset irons	1	1
Matrix dryers	1	1
Tailors' irons—12 lb. or over	2	4
Laundry irons — 7½ lb. to 10 lb.	1	2
Glue pots (no aluminum pots to be made)	1	3
Circulation water heaters	2	11
Immersion water heaters	1	8
Round-disk hot plates — open-coil type	1	4
Round-disk hot plates—solid top	1	3

Steam boilers—To be sold only where the electrical energy is generated from water power and there is a surplus of such energy available.

RESTAURANT EQUIPMENT

	No. Styles	No. Sizes		No. Styles	No. Sizes
Bake ovens	1	5	Toasters	2	2
Broilers	2	3	Hotel ranges	1	2
Grids	2	3			

In the appliances not discontinued the Conservation Division has cut out 691 different styles and sizes. For instance, in chafing dishes there were thirty-six styles and only three will be allowed: of electric teapots, twenty styles and one allowed; of toasters, ten styles and only two allowed. Manufacturers are to discontinue silver-plated and copper-finish appliances from the styles and sizes they will continue to make.

If You Like Liberty, Lend for It

RETAIL PRICE REGULATION BY WAR INDUSTRIES BOARD

Deeply Concerned Over the Whole Question, the Board Seeks Support of the Industries and Fair Deal for Public

B. M. Baruch, chairman of the War Industries Board, to make clear its position on retail price regulation, authorizes the following:

The board has treated matters of prices of raw materials, of manufactured products and of wholesale distribution. An effort is being made to adjust a fair scale of retail prices, based upon the cost of production, in coöperation with the various industries, which are attacking the problem under the guidance of the board in a spirit of coöperation and fairmindedness.

The board believes that this method will bring about beneficial results. No action ever has been or will be taken by this board affecting the interests of any industry except after consultation with representatives of that industry.

It should be said that the War Industries Board is deeply concerned over the whole question of retail prices and is intent upon gaining the support of the various industries.

MANUFACTURERS' PRIORITY FOR WASHING MACHINES

Regulation of Priorities Division of the War Industries Board Calls Attention to Fuel and Steel Needs

The Priorities Division of the War Industries Board, in Circular No. 12, signed by Edwin B. Parker and addressed to manufacturers of washing machines, sets forth the priority position of these manufacturers as follows:

The Priorities Division of the War Industries Board, in conference between your representatives and the undersigned with other representatives of the said board, has considered the claims of your industry for priorities in its fuel and steel requirements and has reached the conclusions following:

"*Fuel.*—The Priorities Division will receive and consider the application of any manufacturer in your industry for a place on the preference list for fuel, taking into consideration the fuel situation of such manufacturer and the nature of its product.

"Any manufacturer whose fuel requirements and whose output bear proper economical relationship to each other will be placed on the preference list for fuel; upon condition, however, that such manufacturer shall pledge its coöperation and shall observe its pledge and the rulings of the Priorities Board.

"*Steel.*—For the winning of the war steel is now the world's most precious metal. It is consumed, or used to some extent, every day by practically every civilized man in every civilized country and nowhere in such vast quantities per capita as in the United States. The present and constantly increasing steel requirements of this country and its allies for direct and indirect war needs, 100 per cent of which must under any and all circumstances be promptly supplied, are so enormous as well-nigh completely to absorb our constantly expanding producing capacity. The result is obvious. There will be comparatively little iron or steel left to distribute to those industries engaged in non-war work and to consumers for non-war uses. Every possible use of iron or steel or their products which can be deferred must be deferred until after the war. This duty is personal and cannot be avoided or delegated to your friends and neighbors. No consumption is so small as to be immaterial and no saving is insignificant.

All Orders Divided Into Five Classes

"Your careful attention is invited to Sections 1 to 11, inclusive, of Circular No. 4, issued by the Priorities Division of the War Industries Board under date of July 1, 1918, which sections describe five principal classes, with subdivisions thereof, into which all orders and work are divided and they also provide a basis for classifying all orders and work and of issuing priority certificates therefor.

"It will be noted that priority certificates are issued covering three classes, namely, Class AA, Class A and Class B. Class C comprises all orders and work not covered by priority certificates and not included in Class A or Class B automatic rating but which are embraced within the 'General Classification of Purposes Demanding Preference Treatment' appearing on page 17 of Circular No. 4, or which are placed by or are to be utilized in connection with an industry or plant appearing on Preference List No 1 prepared by the Priorities Board and appearing on pages 18 and 19 of Circular No. 4. In a majority of cases the application of the classification of purposes and of the preference list to orders received by manufacturers, jobbers or retailers can readily and accurately be made. Priority certificates are not issued for Class C orders and work. Class D comprises all orders and work not embraced in the higher classes and no certificates will be issued therefor. All orders for work or materials not covered by priority certificates or not taking automatic classification or not falling in Class C will fall with Class D.

"Preference List No. 1 referred to above is being revised from time to time by additions thereto and removals therefrom of individual plants and entire industries.

"In view of the nature of your industry, the amounts of iron and steel your manufacturers have now on hand, the economies in the consumption of iron and steel which will be brought about through the changes, eliminations and curtailments to which you have agreed, the industry requirements for its iron and steel for the remainder of 1918, not exceeding a certain agreed maximum, will be given a Class C priority rating; conditioned, however, that each manufacturer participating in the allotment shall pledge its coöperation and shall observe its pledge and the rulings of the Priorities Division.

"Such manufacturer's pledge of coöperation, as set out in this circular, shall cover its iron and steel already in its possession and its manufactured or partly manufactured washing machines in stock at the time its pledge is made as well as iron and steel hereafter acquired. In other words, the pledge will be construed as applying to all materials and all manufactured or partly manufactured washing machines and parts on hand when the pledge is given and to such as may afterward be acquired.

"The shortage of steel, present and prospective, is such that the Priorities Division does not undertake through this circular or through its priority certificates to guarantee to the industry or to any manufacturer its steel requirements. The success of the industry or of any particular manufacturer in obtaining its steel requirements will depend upon trade conditions and orders of higher priority.

"The pledge of coöperation to be given by the manufacturer will be in the form following:

Priorities Board, War Industries Board, Washington, D. C.:

The undersigned hereby pledges itself (1) to use only in the manufacture of washing machines or parts for washing machines the steel and iron and steel and iron parts suitable therefor which are now in its possession or which may hereafter come into its possession; (2) to devote the products of its manufacture as far as possible to essential uses only as that term has been or may be defined or applied from time to time by the Priorities Division of the War Industries Board; (3) to urge and procure so far as lies within its power all dealers in or users of its products to exercise all possible economy and conservation in such products by limiting sales and purchases, by intelligently repairing and by otherwise protecting and lengthening the life of such products; (4) to coöperate with the Conservation Division and the Electrical and Power Equipment Section of the War Industries Board; (5) not to furnish its products for resale to any leader unless such dealer shall give the undersigned a pledge in writing similar to this pledge nor if such dealer shall fail or refuse to carry out the letter and spirit of its pledge, and (6) not to acquire or own during the remainder of the year 1918 more iron or steel (including iron and steel already owned by the undersigned) than shall be equal to three-fourths of five-twelfths of its actual consumption of iron and steel during the calendar year 1917, and not to hoard any iron or steel.

"Any manufacturer who has already made application for place on the preference list should send in its pledge of coöperation in the foregoing form and mention the fact that application has previously been forwarded.

"The pledge to be given such manufacturer by any person to whom it has delivered or shall deliver a washing machine for resale shall be addressed to such manufacturer in the following form:

To ———, City of ———, State of ———.

The undersigned hereby pledges itself (1) to devote the products of your manufacture as far as possible to essential use only as that term has been or may be defined or applied from time to time by the Priorities Division of the War Industries Board; (2) to urge and procure so far as lies within its power all dealers in or users of your products to exercise all possible economy and conservation in such products by limiting sales and purchases, by intelligently repairing and by otherwise protecting and lengthening the life of such products; (3) to coöperate with the Conservation Division and the Electrical and Power Equipment Section of the War Industries Board; (4) not to furnish your products for resale to any dealer who shall fail or refuse to coöperate with you in carrying out the letter and spirit of this pledge.

"Each manufacturer will promptly file with the secretary of the War Service Committee of the Washing Machine Industry a detailed statement in writing, verified by an affidavit, setting forth:

(1) The kinds and quantities of iron and steel in stock, including parts and manufactured or partly manufactured stocks, but excluding completed machines.

(2) The kinds and quantities of iron and steel and iron and steel products required in addition to existing stocks to equal three-fourths of five-twelfths of its actual consumption of iron and steel during the calendar year 1917.

(3) Upon receipt of such statements the War Service Committee of the industry will tentatively make and submit for the approval of the War Industries Board an allocation of such iron and steel requirements of each manufacturer as it may be entitled to receive out of the maximum fixed for the industry, allocating to each manufacturer its just proportion of such maximum based upon its per cent of the total consumption by the industry of iron and steel for the year 1917.

"When these allocations shall have been made and orders placed by each manufacturer, the Priorities Division will by certificates in writing addressed to such sources of supply give to such orders a Class C rating."

Beat the Germans Back—Buy Bonds

BALL-BEARING AND STEEL-BALL INDUSTRIES ON PRIORITY LIST

Manufacturers Placed on Preference List by War Industries Board with Rating of Class B-3 Conditioned Upon Pledges

The Priorities Division of the War Industries Board, in Circular No. 19, dated Sept. 3, 1918, has placed manufacturers of ball bearings and steel balls on the preference list with a rating of "Class B-3," conditioned upon their executing and filing pledges of co-operation with an observance of the rules of the Priorities Division.

GAS PIPING IN HOUSES WHICH HAVE ELECTRICITY

Installation of Gas Piping Where Electricity Is Available for Lighting Purposes Not Permitted Except Under Conditions

Regulations adopted by the building materials section of the War Industries Board at a meeting with representatives of other departments affected and covering mainly pipe and water mains provide, among various restrictions, that the installation of gas piping in houses will not be permitted where electricity is available for lighting purposes. This will not prohibit the installation of gas piping for heating and cooking purposes where the extreme extension of the distribution mains to the houses is less than 1000 ft. (304 m.).

Buy Bonds—It's War Service Work

CONTROL OF SURFACE-TYPE CONDENSER-TUBE INDUSTRY

War Industries Board in Order to Conserve Brass Will Regulate Distribution of Condensers Essential to Ships

The War Industries Board authorizes a statement regarding its arrangements for practically taking control of the surface-type condenser-tube industry:

Following a conference of the brass manufacturers with B. M. Baruch, chairman of the War Industries Board, and other members and officials of the board, and representatives of the navy and the Emergency Fleet Corporation, and a later conference of the board with the war service committee of the surface-type condenser industry, it was decided in order to conserve brass to regulate distribution of these condensers, which are essential to ships.

There are about forty-five manufacturers affected by the decision of the War Industries Board. They are being notified to take no further orders and enter into no new contracts for sale or to sell or deliver to any purchaser, government or civilian, except on a permit issued by the War Industries Board. To get such a permit the proposed purchaser must show his need to the satisfaction of the board, and this need will be considered in connection with the needs of the government in the conduct of the war.

The manufacturers will be permitted to fill, where possible, existing orders with non-ferrous condenser tubes on contracts for shipment prior to Jan. 1, 1919. On contracts after Jan. 1, 1919, the manufacturers are urged to put steel tubes on condensers for land use and are directed to send immediately estimates for steel that is required for this purpose.

The navy and the Emergency Fleet Corporation are exempt from these orders and regulations of the War Industries Board as to condensers for ship usage, but not as to condensers for land stations.

Some months ago the government took over control of and distribution of the turbine-engine industry because of the shortage in the supply and their essential need in the navy and Emergency Fleet war program. The non-ferrous condenser is an essential integral part of the turbine, and shortage in its production caused the navy and Emergency Fleet Corporation officials to appeal for government regulations of production and distribution.

The effect of the taking over by the government of the surface-type condenser tube industry was considered carefully by the brass manufacturers with Mr. Baruch, Everett Morse, chief of the non-ferrous tubing section, and Walter Robbins, chief of the electrical and power equipment section. It is the purpose of the government to stimulate production to meet war needs first and supply civilian needs, if possible.

ATLANTA RATE RAISE IS UPHELD IN COURT

Petition of the City Authorities and So-Called Citizens' Committee for an Injunction Against Advance Is Denied

At the conclusion of the hearing in the Superior Court on Sept. 27 on the petition of the city of Atlanta and the so-called citizens' committee for an injunction to prevent the enforcement of the Railroad Commission's order authorizing rate increases, Judge G. A. Littlejohn handed down a ruling denying the restraining order.

In his order he held that the Railroad Commission had the right to authorize such increases and to change rates even where a contract existed. At the same time he instructed the Georgia Railway & Power Company to keep a strict audit of all increases in the event that his decision should be set aside in a higher court. It is expected that the city will appeal the case to the Supreme Court. The rates, as set out by the Railroad Commission as effective on Sept. 1, should go into effect on Sept. 27, the judge decided. The rate increase will average about 10 per cent. The company asked for 33 per cent.

Drive the Bayonet Home—Buy Bonds

PRIORITY FOR ATLANTA POWER DISTRIBUTION

"At This Time Personal Desires on the Part of Manufacturers Must Be Subservient to the General Good"

The Priorities Committee of the War Industries Board issued an order recently directing the priority to be observed by the Georgia Railway & Power Company, Atlanta, in the distribution of energy until increase in the water supply should increase the amount available. Through Charles K. Foster, vice-chairman, the committee wrote to the company in part as follows:

The figures represented show that after taking care of the municipal and public lighting, together with the power necessary to operate the street railways and waterworks pumps, you have remaining approximately 152,000 kw.-hr. per day. It is estimated that this is not sufficient to serve all the concerns that have government contracts, but that it is approximately enough power to serve the concerns that are working 100 per cent on war work by elimination of current to all other users.

In view of this condition, we urge you to proceed, while this condition exists, along the following lines:

1. That the Rome Railway & Light Company be instructed to start immediately its steam plant in operation and arrangements will be made with the Fuel Administrator to furnish it with coal for such operation. It is understood that if this is done the energy which you have been furnishing this company can be given to the Anchor Duck Mills for their consumption on government work.

2. It is suggested that you immediately get in touch with the Fuel Administrator and jointly with him for this committee determine the concerns working to approximately 100 per cent capacity on government work and furnish power to such concerns in accordance with the suggestions above. (The above suggestion, of course, means to the best of your ability.)

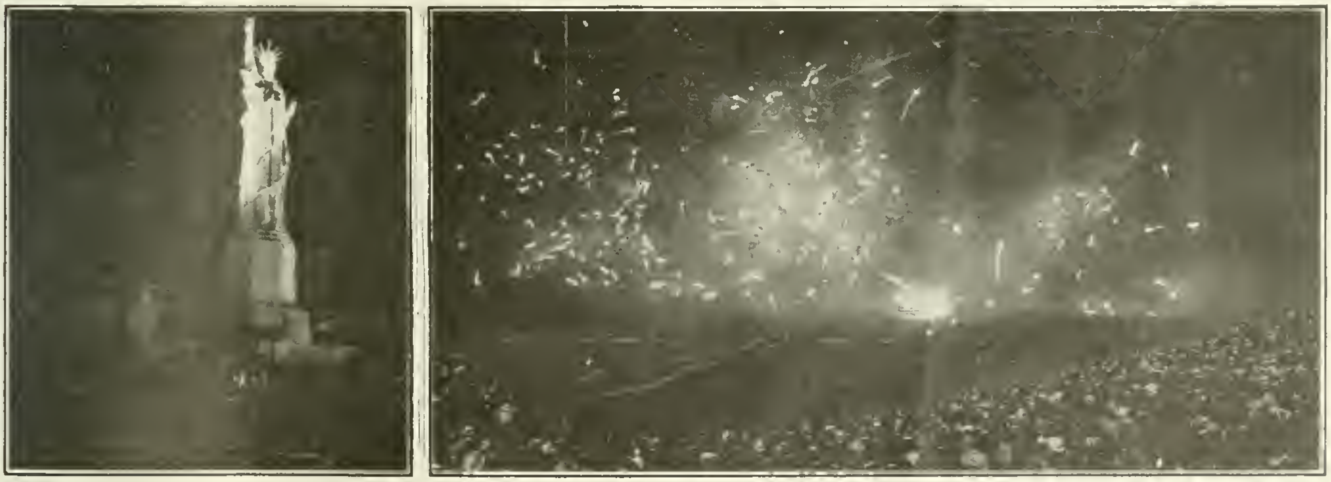
3. Where an individual steam plant can be operated at this time to advantage in the generating of power the Coal Administrator, to the best of his ability, should supply such concern having a steam plant with fuel during this crisis.

4. In order that a central control, which is necessary at this time, can be had of the situation, you are asked respectfully to refer all requests for power from whatever branch of the government they come to the Priorities Committee at Washington and not operate under any other instructions.

5. Relative to the injunction which has been granted the Bibb Manufacturing Company regarding its supply of power, we are of the opinion that if same operates to the detriment of the whole situation steps can be taken either to cancel their government contracts or to defer their production until such time as more power is available.

We might add that at this time all personal desires on the part of the manufacturers must be subservient to the general good, and we feel assured that when the matter is presented to the different concerns in this light we may expect their full-hearted co-operation to tide over this emergency.

Government War Exposition Draws Two Million Spectators



Fallen enemy airplanes, demolished anti-aircraft guns and heavier cannon, shells, Liberty motors, war trophies and three miles of actual trenches in which a sham battle was staged—all these were features of the United States Government War Exposition at Chicago, Sept. 1 to 15. In that time, 1,995,602 people, an average of 139,685 a day, visited the great war show. Samuel Insull, general chairman of the United States Government War Exposition, announced that the income from the show was over $500,000, which is sufficient to meet all expenses and leave the government a surplus. "Over the Top," as the battle was called, was the attraction which held and thrilled the crowds.

CHICAGO METHODS OF CONSERVING COAL SUPPLY

Conservation Bureau of the United States Fuel Administration Reports Results in Substitution of Electrical Energy and Water Power

Large coal saving, to supplement the war speeding up of production, is reported by the Conservation Bureau of the United States Fuel Administration. The bureau's administrative engineer for Illinois, Joseph Harrington, reports that in Chicago the power and light committee has induced the Chicago, Western & Indiana Railroad to close its pumping plant at Forty-eighth Street and the railroad tracks, substituting electric power. This change will reduce coal consumption at this plant 800 tons within the next two months.

The Sanitary District has been induced to enter into an agreement with the Commonwealth Edison Company by which through the substitution of water power an average of 150 tons of coal a day will be saved.

The city of Chicago will, by using the Sanitary District water power at its largest pumping station, be able to save 18,000 tons of coal a year.

Thus, in only three specific instances within the city of Chicago, the new conservation methods, so necessary at the present crisis, account for a coal saving of 73,550 tons annually.

Drive the Boche Back—Buy Bonds

FUEL ADMINISTRATION TO FIX HIGHER COAL-MINE POWER RATE

Too Low Rate for Electrical Energy to Operate Mines in Virginia Field Prevented Increased Development

A sidelight on the part the Fuel Administration is playing in helping the nation's great coal-producing machine accomplish its huge task with little friction and noise was revealed by an official statement of the settlement of a very difficult power situation in the Virginia field. Power companies furnishing electrical energy to run the Virginia mines were under contract at so low a price as to prevent increased development. Increased power facilities, however, became a necessity. The operators and the power companies met with the Fuel Administration. The following resolution was passed unanimously by all present:

> Resolved, that the committees from Harlan County, Kentucky, Bell County, Kentucky, and southwestern Virginia, representing the coal companies which are consumers of power from the above-mentioned fields, agree to submit the question of fixing the amount of increase necessary to provide the power companies the funds to serve the above consumers with satisfactory power to the price-fixing and engineers' committees of the United States Fuel Administration, and we hereby agree to abide by the recommendations of the said committees, and will so recommend to the respective coal operators of our fields.

Bomb the Enemy—Buy Liberty Bonds

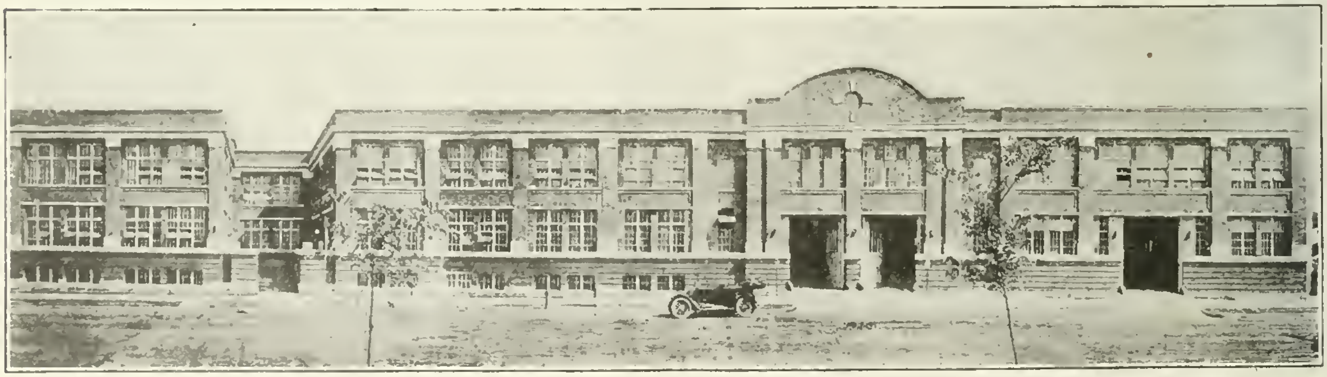
FUEL ADMINISTRATION PLAN IS SAVING COAL

Consolidation of Power Plants, Substitution of Hydroelectric Energy and Closing of Private Generating Stations Give Results

The United States Fuel Administration reports that a large saving of coal is indicated in power plants as a result of the campaign for economy. A bulletin on this subject says in part:

> Figures are now coming in showing very substantial savings of coal from the power changes already made. Consolidation of power plants at Richmond, Va.; Ludlow, Mass.; Wooster, Ohio; Charleston, W. Va.; Kirkwood, Mo., and at Clinton, Ind., reported to the Fuel Administration, will mean a yearly saving of 35,000 tons of coal.
>
> At Mammoth Springs, Mo., the Mammoth Springs Light & Power Company has effected new power contracts whereby excess water power is replacing power generated from coal. The saving will approximate 2000 tons of coal annually.
>
> In Keokuk, Iowa, the application of water power for power needs has replaced the supply formerly produced by steam in St. Louis, Mo. The saving here is about 110,000 tons each year.
>
> Power from more efficient stations having been substituted, eight private electric generating plants have closed down in Missouri, forty plants in New York City, twenty-five plants in Chicago.

Service Station Costing $1,500,000 Completed at Minneapolis



Here is evidence of evolution from the day when somebody's barn was good enough to serve as storehouse, meter department headquarters and in a variety of similar ways for the central-station company.

This huge structure, representing an investment of more than $1,500,000, is the service building of the Minneapolis General Electric Company. It houses the company's vehicles, its stocks of material, its meter department and the office force for handling all of these necessary adjuncts to electric service.

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 679 of this number.

Electrical Club of Detroit.—At the last meeting of the Electrical Club of Detroit, Sept. 20, C. T. Beck was elected president and George B. Clover secretary.

Electrical League of Cleveland.—At the regular Thursday meeting of the Electrical League of Cleveland held Sept. 26 Dr. J. G. Clutterbuck addressed the league on the subject "Why Germany Must Be Destroyed."

Institute of Radio Engineers.—Prof. Edward F. Northrup of Princeton University will address the next meeting of the Institute of Radio Engineers, Oct. 9, Engineering Societies Building, New York, at 8:15 p.m. The subject of his paper is "Special Heating Effects of Radio Frequency Currents."

San Francisco Electrical Development League.—At the Sept. 19 meeting Garnett Young, of the Garnett Young Company, was elected president. The speaker of the day was G. R. Geary of Yokohama, who has been Japanese representative of the General Electric Company for a period of about fifteen years.

A. I. E. E., Schenectady Section.—The 204th meeting of the Schenectady Section, A. I. E. E., was held at Edison Club Hall, Friday, Oct. 4. Representative George R. Lunn, a member of the House military affairs committee, spoke on "A Democracy at War," with special reference to the part which engineers are taking.

A. I. E. E., Toronto Section.—The Toronto Section of the American Institute of Electrical Engineers opened its sixteenth year on Sept. 20 with an address by Paul M. Lincoln on the subject of "Development of Electric Power Transmission." Mr. Lincoln's paper was particularly interesting to the audience in view of the possibility that the Hydroelectric Power Commission will transmit the energy to be developed at Queenston, Ontario, at 200,000 volts.

San Francisco Electrical Development League.—League meetings were resumed after the summer interval on Sept. 4. Albert E. Schwabacher, Fuel Administrator for California, was the main speaker of the day, addressing the members on the subject of "The How and Why of Fuel Conservation." H. G. Butler, Power Director for California, spoke on the subject of power conservation. A. H. Buckland, formerly of the famous "Princess Pat" regiment, addressed the meeting on Sept. 11 on "Thrilling Experiences at the Front."

British Columbia Association of Electrical Contractors and Dealers.—On Sept. 13 and 14 this association held its annual meeting at Victoria. There was a "get together" luncheon at which E. C. Hayward of Victoria was toastmaster. E. Brettell of Vancouver was elected president of the association. A long discussion of affiliation with the national association resulted in the decision to unite with this body on Oct. 1. R. F. Hayward made a forcible address on the progress and possibilities of electricity during and after the war. A feature of the attendance was the large representation from wholesale houses.

California Association of Electrical Contractors and Dealers.—The regular monthly meeting of the California Association of Contractors and Dealers was held at the Clark Hotel, Stockton, on Aug. 30. In the absence of President Reid, T. J. Bennett occupied the chair. A progress report of the work of the committee on the segregation of government electrical work was accepted and the committee was instructed to continue its efforts. The ethics committee submitted a code governing the conduct of members in all professional capacities. This was adopted. The next meeting will be on Oct. 12 at Modesto.

Jovian Order.—Two important questions stand out prominently before the Jovian Convention which will be held Oct. 24-26 at Dallas, Tex.—first, that of financing the organization; second, that of directing the greater part of the activities during the coming year in war work. The financial plan, according to those who have had it under consideration, if adopted, will to a great extent remove the burden of financing the order from the rank and file of membership by the reduction of the annual dues, while at the same time providing a source of revenue that will fully offset the depletion of income caused by the call of members for war service. Regarding war work several plans are under advisement, the prime object of all being to turn the forces of the organization to government uses.

National Association of Electrical Contractors and Dealers.—Final arrangements have been made for the meeting of the national executive committee of the National Association of Electrical Contractors and Dealers in Toronto on Oct. 14, 15 and 16. The meeting will be held at the King Edward Hotel and will be open to all branches of the industry. There will be a banquet on Tuesday evening at which the chair will be occupied by Senator Frederic Nicholls, president of the Canadian General Electric Company, Ltd. President James R. Strong will speak on organization and W. L. Goodwin on the Goodwin plan. The British government will have a trade commissioner present at this meeting, keeping in touch with the move that is attracting attention in other than electrical circles.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Discontinuance of Heating Service.—Acting on a petition of the Illinois Northern Utilities Company relative to the discontinuance of heating service at Belvidere, the Illinois Public Utilities Commission held that it would require a utility to continue rendering heating service, at a rate which would pay operating expenses, during the approaching season, where the evidence showed that the plant had neared the end of its useful life and the system had been operated at a loss, but conditions were such that to permit the company to discontinue service at once might leave many consumers without means of heating their premises.

Rate Relief Will Help Food Production.—The California Railroad Commission has authorized the Mount Whitney Power & Electric Company to make a temporary surcharge of 10 per cent on all bills for electric service. The new rates are effective on all readings for metered service after Sept. 15 and for flat-rate service after Sept. 1. The company must make a report each month to the commission of the results of its operation during the past month. The electric service supplied by the company is largely used for pumping water for irrigation, and the continuance and extension of this service are absolutely essential to the production of food so necessary at this time. The evidence shows that the company expended during 1917 over $300,000 in the extension and enlargement of its system to serve the territory more adequately, and that practically all of this was for extensions to serve necessary agricultural plants. The expenditures required in 1918 will equal or exceed this amount. More than 6000 hp. more of power motors, mostly for pumping water, will operate in 1918 than last year on the company's system. The addition of the 10 per cent surcharge would in six months increase the net return upon the investment to 5.8 per cent, and if effective for a full year, would result in an estimated net return of 6.61 per cent upon the total capital invested. "Considering the rate of interest which public utilities are required to pay to obtain money for extensions and betterments at this time," says the decision, "it is very apparent that it would not only be unfair to the utility but detrimental to the development of territory served by the company not to grant the relief requested, for it is obvious that the food production of the district would be curtailed and the prosperity of the territory as a whole decreased."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Powerful Radio Station at Annapolis.—The new naval radio station at Annapolis, Md., the most powerful in America, is now in operation. The Navy Department announced that the first messages sent were from Secretary Daniels to the First Lord of the British Admiralty, the French Minister of Marine and the Italian Minister of Marine. The station, which has an operating radius of 4000 miles, was completed in ten months and cost $1,500,000.

Milwaukee Gets Money for Street Lighting.—The Capital Issues Committee has granted the city of Milwaukee permission to sell $200,000 of securities to finance a portion of the street lighting which has been under way for some years. Before acting on this case the Capital Issues Committee received reports from two independent engineers and heard the arguments of the city's engineer, Francis A. Vaughn. As the result of these reports it appeared necessary to continue with that portion of the street lighting which will serve the industrial districts.

Eastern Power & Light Difficulties.—A note and bondholders' protective committee, also a stockholders' protective committee, have been formed by security holders of the Eastern Power & Light Corporation. President J. B. Taylor, New York, in a letter to security holders, gave notice that the $2,159,000 principal of collateral trust notes, due on Sept. 1, 1918, could not be paid at maturity, but that interest would be paid. He said in part: "The company and all of its subsidiaries could have continued to meet their charges and maturities in normal times, and the change in conditions is due directly to the war. In normal times they have been and would be able to meet all fixed charges and dividends, and with increasing revenues from enlarged power plants and systems to accumulate a surplus which would have facilitated under normal financial conditions the refunding of obligations of subsidiaries as they matured, through sale of securities. When the officers of the company asked its bondholders for the extension of its bonds for six months to Sept. 1, 1918, they expressed the hope that relief might be obtained from the War Finance Corporation. The directors, however, under the interpretation of the modified act by counsel for the government, have been precluded from granting relief in this and similar cases."

Praise for Patriotic Women in Central-Station Work.—The Sept. 7 issue of the *Women's Press* contains an article on the patriotic work of several hundred women employees of the Commonwealth Edison Company, Chicago. The article says in part: "The number of women employees has been greatly increased by reason of the fact that about 1200 of the male employees have entered the government service. There are now about 700 girls and women employed by the company. They have exhibited unfaltering patriotism, and the list of their accomplishments in war work shows achievements of genuine usefulness and much diversity. Nor has social recreation for the soldiers and sailors been neglected, Mrs. Samuel Insull's Saturday night dances in the Edison Building having become an established institution during the first half of this year."

Electric Vehicles in Spain.—A. Jackson Marshall, secretary Electric Vehicle Section, National Electric Light Association, reports that the demand for American-built electric vehicles by European countries continues to exceed the supply and available shipping facilities. Spain is the latest country to evidence a desire to utilize on a large scale electric vehicle transportation, not only for immediate use to help out in emergency conditions, but more particularly to form the basis of a systematic mobile transportation development to meet the conditions which will prevail with the return of peace. To this end several engineers, representing important Spanish interests, have been in the United States making careful investigations of electric vehicle developments here preliminary to effecting arrangements for the importation and manufacture of electric vehicles and parts.

United States Navy Steam Engineering School.—The United States Navy Department has perfected plans for the enrollment and training of considerable numbers of engineering officers. A school for this purpose, the United States Navy Steam Engineering School, has been established by the department at Hoboken, N. J. The school is open to men between the ages of twenty-one and forty, who meet the physical requirements of the navy, are of thorough ability and officer-like character and have completed the mechanical or electrical engineering course at certain recognized technical schools, or who possess an education and experience adjudged to be an equivalent thereof. The course consists of five months of training. The aim of the United States Navy Steam Engineering School is not simply to produce engineers but to produce naval engineering officers in the true sense of the word. Upon graduation the student is commissioned as an ensign in the United States Naval Reserve, with a salary of $1,700 per year, and is detailed for engineering duties on navy transports and cargo ships.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Regulation of Rates.—Where a power company contracted to furnish electricity to platted lands at a certain rate in return for certain easements, and lots were sold subject to such easements, the power company, while claiming the benefit of the property rights, easements and franchise so granted, cannot collect greater rates, although approved by Public Service Commission, according to the Supreme Court of New York in Village of Long Beach versus Long Beach Power Company (171 N. Y. S. 824). Where a power company contracted to furnish electricity to platted lands at a certain rate in return for certain easements, subject to which lots were sold, lot owners need not apply to Public Service Commission for redress where power company attempts to charge more than contract rate under a schedule approved by the Public Service Commission.

Competing Utility Allowed to Enter Town Under Certificate of Necessity and Convenience.—A contract of an electric company giving a city 100 kw.-hr. free monthly, worth about $40 per annum, will not be held to be a discrimination in favor of the city, where the value of electricity furnished the city for other lamps exceeded $2,000 per annum, the Supreme Court of Missouri held in Electric Company of Missouri versus Kinsor (204 S. W. 897). If an item in a franchise by a city to an electric company is invalid because discriminatory but the city and the light company are satisfied with the remainder of the franchise, a competing company cannot complain that the whole franchise is invalid. The statute empowers the Public Service Commission to issue a certificate of convenience and necessity to an electric light company or to refuse it, but does not empower it to adjudicate the question of the validity of franchises. Where one of two electric light companies can furnish electricity and make a reasonable profit at a certain rate, the other company has no right to any higher rates even though it cannot furnish it at the lower rate without a loss. In fixing rates for electricity protection of the public is the prime object, protection to the utility being incidental, and whether there should be regulated monopoly or competition depends on the particular facts in each case. The commission was held warranted in issuing a certificate of necessity and convenience to an electric light company, although another company was already furnishing electricity in the locality.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

D. M. Petty, president-elect of the Association of Iron and Steel Electrical Engineers, is superintendent of the electrical department of the Bethlehem Steel Company, South Bethlehem, Pa. Mr. Petty was born on March 2, 1885, at Archdale, N. C. He was graduated from Guilford College in 1907 with the degree of B. S. and two years later from Lehigh University with the degree of E. E. Since then he has been with the Bethlehem Steel Company and in 1913 was made superintendent of the electrical department. He has wide association connections and is president of the University Club of Bethlehem.

D. M. PETTY

S. B. Burrows, general lighting representative of the Public Service Electric Company, Newark, N. J., has gone to France with the Y. M. C. A. as an athletic director. Mr. Burrows started with the Public Service company in 1910 as electric sign specialist and shortly afterward was promoted to be general lighting representative. He was chairman of the store-lighting committee of the Commercial Section, National Electric Light Association, for the past four years.

F. W. Hausmann, connected with the Air Nitrates Corporation on the construction work of United States Nitrate Plant No. 2, as progress engineer for the equipment department, has been promoted to be head of the local planning division at Muscle Shoals. Previous to coming to Muscle Shoals he was for two years with the Aluminum Company of America as process control and efficiency engineer. Since graduation from the Georgia School of Technology in electrical engineering in 1910 he has been connected with Stone & Webster, the General Electric Company and the Henry L. Doherty Company. On the Panama Canal he made a study of the shops and electrical layout. As soon as the plant construction related to the war program is completed Mr. Hausmann intends to enter the field of invention in connection with the development of special equipment for industrial plants.

M. T. Maguire, Rosemont, Pa., formerly connected with the Bethlehem Steel Company, South Bethlehem, in charge of the power plant of the company, has resigned to become associated with the Symington Company, Chicago.

E. H. Jacobs, until recently chief engineer of the Electrical Engineers' Equipment Company, Chicago, has been appointed general manager, succeeding Frank H. Getts, who died recently. Mr. Jacobs was connected with the General Electric Company for eighteen years. He was made chief engineer of the Electrical Engineers' Equipment Company in the fall of 1916.

William F. Ham, who has been acting as president of the Washington (D. C.) Railway & Electric Company since the resignation of C. P. King in March of this year, was elected president of the company on Sept. 12. He first became connected with the Washington property in 1899 as controller. Later he became treasurer and in 1911 was elected first vice-president and a director of the company.

Obituary

Frank S. Mitchell, general superintendent of steam plants of the Southern Power Company, Charlotte, N. C., died on Sept. 8, from strangulation.

Lieut.-Colonel Morris N. Leibmann, vice-president of the Foote-Pierson Company, New York City, engineers and electrical manufacturers, was killed in France on Aug. 8 while leading his men in action.

Frank A. Harmon, secretary and manager of the Eastern Oregon Light & Power Company, Baker, Ore., died at his home on Sept. 12, aged sixty years. Prior to his going to Baker in 1908 Mr. Harrison was general manager of the Fremont Power Company, Sumpter, Ore., with which company he was associated for five years.

Joseph Parkin, electrical engineer, and for several years manager of the Puget Sound Traction, Light & Power Company's interests in Everett, Wash., died in Seattle on Sept. 15. Up to a year ago Mr. Parkin was one of the receivers of the old Seattle, Renton & Southern Railway Company, and prior to that period he had charge of the electrical property of the government at Fort Worden. Mr. Parkin was fifty-four years of age and had lived in Washington for thirty years.

Lieut. Henry Stone Bryant, aviation service, U. S. A., and previously assistant superintendent of the appliance department of the Boston Edison company, died of influenza Sept. 24 at his home in Cambridge, Mass. Lieut. Bryant was thirty years of age and was a graduate of Harvard College, class of 1910. He studied aviation at Kelly Field, Tex., and later became disbursing aëronautical officer at Boston. He was popular among the employees of the Edison company and was a member of the Harvard Club.

Samuel A. Freshney, district manager for Grand Rapids, Mich., of the Consumers' Power Company, died at his home on Sept. 16, after an illness of only a few hours, at the age of fifty-one years. Mr. Freshney, who had been engaged in the electrical industry for the last thirty-four years and was one of its pioneers in the Middle West, was born in London, England, in 1867. When still a boy he came to this country with his parents and received his early education in the schools of Cleveland, Ohio. He began his electrical career in 1884 with the Brush Electric Company of Cleveland, where he stayed for seven years. From then until 1900 he was manager of the Muskegon (Mich.) Electric Light & Power Company, when he became sales representative for the Fort Wayne (Ind.) Electric Works. He continued this work for two years, when he returned to Muskegon as general manager of the Muskegon Traction & Lighting Company. He was secretary and general manager of the Grand Rapids (Mich.) Board of Public Works from 1905 to 1912, and at the close of his term of office was employed for a few months by the Electric Bond & Share Company. In the fall of 1912 he became general manager of the Grand Rapids-Muskegon Power Company, and on the merger with the Consumers' Power Company he retained the managership of the Grand Rapids district. Mr. Freshney took considerable interest in national association activities and in 1915 was elected president of the Michigan Section, N. E. L. A.

S. A. FRESHNEY

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

WAR SUPPLY BUREAUS TO TAKE ADVANTAGE OF CASH DISCOUNT

Contractors Will Be Asked to State in Proposals Amount They Will Allow the Government to Insure Prompt Payment

Electrical supply jobbers and manufacturers have frequently called attention to the length of time their money has been tied up in government orders. This has caused considerable inconvenience at times. To a large extent this condition will probably be ameliorated by the recent action of the War Department authorizing all supply bureaus of the department, whenever possible, to take advantage of cash discounts for the prompt payment of bills. Instructions to do so have just been issued by the General Staff.

Contractors who have followed the custom of granting such cash discounts to the public will be required to state in their proposals the amounts they will tender the government for the prompt payment of their bills. In those cases where it has not been the custom to give fixed cash discounts for prompt payments the government will request the contractors to state how much they will give for prompt payment. These discounts will be taken into consideration by contracting officers when making awards. Arrangements have been made to allow the government discounts on "materials and supplies on which a fixed or maximum price has been set" whenever these discounts have not been included in the differential between prices made for the government and for the public.

That the government may be sure of such discounts in the future, it is provided in the instructions that all materials and supplies shall, in so far as possible, be inspected and accepted by the government at the point of manufacture or origin. The inspecting officer is ordered to see that the proper vouchers are sent through promptly to the contracting officer, with the government bill of lading attached, so that the bill may be paid within the specified time during which discounts will be allowed.

Money Builds Tanks—Buy Bonds

INCREASE IN THE PRICE OF "MAZDA B" LAMPS

New Contract Forms Provide for an Advance of Not More than 15 per Cent During the Coming Year

Effective Oct. 1, large "Mazda" lamps (excepting gas-filled lamps) were increased in price roughly 15 per cent. The lamps for standard lighting service, 10-watt to 50-watt sizes, increased from 30 to 35 cents for clear bulbs and 33 to 38 cents for frosted; the 60-watt size was 35 cents clear and 39 cents frosted and is now 40 and 45 cents for clear and frosted respectively. The 100-watt size, which was listed at 70 cents clear and 77 cents frosted, is now listed at 85 cents clear and 92 cents frosted.

This is the second increase in the history of "Mazda" incandescent lamps, the first, of roughly 10 per cent, occurring Jan. 1 of this year.

According to the contract forms of last November, the manufacturers reserved the privilege to increase the price of lamps during the life of contract (one year) by not more than 10 per cent on any one lamp to consumers who hold these contracts. The new contract forms, which are just out, are similar to these others except that a provision is made that the price during the life of the contract shall not advance more than 15 per cent over the prices in effect at the time the contract started. The new list prices on "Mazda B" or vacuum types follow:

			List Price	
Volts	Watts	Bulb	Clear	Frosted
SCHEDULE 1				
110-125	10-15	S-17	$0.35	$0.38
110-125	25-40-50	S-19	0.35	0.38
110-125	60	S-21	0.40	0.45
110-125	100	S-30	0.85	0.92
SCHEDULE 2				
220-250	25-50	S-19	0.40	0.43
220-250	100	S-30	1.00	1.07
220-250	150	S-35	1.50	1.60
220-250	250	S-40	2.50	2.65
SCHEDULE 3				
110-125	15-25-40	G-25	0.55	0.60
110-125	60	G-30	0.75	0.82
110-125	100	G-35	1.05	1.15
220-250	25-50	G-25	0.65	0.70
110-125	25	T-10	0.60	0.65
110-125	25-40	T-8	1.20	1.30
SCHEDULE 4				
11-12½	2½-5	S-14	0.32	0.35
55-65	5	S-14	0.35	0.38
110-125	10	S-14	0.35	0.38
SCHEDULE 5				
525-650	23-36	S-19	0.35	0.38
525-650	56	S-21	0.40	0.45
525-650	94	S-24½	0.85	0.92
SCHEDULE 7				
30-34, 60-65	10-15-20-25	S-17	0.35	0.38
30-34, 60-65	50	S-19	0.35	0.38
30-34, 60-65	85-125-175-250	G-18½	0.50	0.53
30-34, 60-65	500	G-30	0.75	0.82
SCHEDULE 8				
28-32	5	S-14	0.35	0.38
28-32	10-20	S-17	0.35	0.38
28-32	40	S-19	0.35	0.38

Note.—On bulb types the following notation is used: S = straight sides, G = round, and T = tubular.

Schedule 1 is for standard lighting, 110 volts to 125 volts; schedule 2, the same for 220 volts to 250 volts; schedule 3 for ornamental lighting, schedule 4 for sign lighting, schedule 5 for electric street railways, schedule 7 for train lighting, schedule 8 for use with country home-lighting outfits. Schedules 6, 9 and 10 pertain only to gas-filled lamps, on which the price has not been changed.

Bonds Buy Bayonets for Liberty

CHARGE VIOLATIONS OF "HELP WANTED" RULE

United States Employment Service Cites Infringements of "Special Inducement" and "Wages" Clauses of Regulations

Violations of the rule of the United States Employment Service relative to "help wanted" advertisements have come to the attention of the authorities, and in such cases the offenders have been notified. The most frequent violation is the offering in the advertisement of special inducements.

Inasmuch as a large number of electrical manufacturing concerns have been pioneers in employer welfare work, much of which would probably come under the head of "special inducements," the citation of a few of the infringing advertisements and the rule, as given by the United States Employment Service for the State of New York, are especially interesting.

One firm advertised for machinists as follows: "Highest prevailing wages; plenty of overtime; 10 per cent bonus." Another corporation advertised for boys as follows: "Good salary; time and a half for overtime; cafeteria with best food at cost price." Both of these advertisements were held to infringe the "special inducement" clause of the rule. Another common infringement is the statement of wages, as, for instance: "Boy, sixteen years old, at $8 salary." This is a violation of the rule.

The rule of the United States Employment Service which has been applied in the above instances reads as follows:

"Advertising for all grades of workers above laborers is permitted provided that such advertising shall not contain mention of wages or hours or special inducements. The wording of the advertisement for the more skilled workers shall be confined to a statement of the number of workers wanted, the different grades and occupations and the place where applicants shall apply."

Let Dollars Fight the Kaiser

METAL MARKET SITUATION

Campaign Started to Bring About the Conservation of Tin as a War Necessity

Generally speaking, the various metal markets have been quiet this week. There is little speculation regarding the coming meeting relative to the fixing of the price of copper after Nov. 1. A campaign was started this week for the conservation of tin as a prime war essential. The war requirements in aluminum have made it necessary to scrutinize more closely than heretofore stocks carried, production, consumption and character of the consumption. To do this properly the trade has been requested to provide definite specific information regarding its operations.

The Department of the Interior, Bureau of Mines, has issued in pamphlet form the rules and regulations under the act of Oct. 6, 1917, as amended by the act of July 1, 1918, limiting the sale, possession and use of platinum, iridium and palladium and compounds thereof. All communications regarding applications, licenses, inventories or other matters pertaining to these regulations should be addressed to Platinum Section, War Industries Board, Washington, D. C.

NEW YORK METAL MARKET PRICES

	Sept. 24	Oct. 1
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26.00
Casting	Govt. price 26.00	Govt. price 26.00
Wire base	29.25	29.25
Lead, trust price	8.05	8.05
Antimony	13.87½	14.00 to 14.12½
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	15.00	15.00
Spelter, spot	9.65	9.40
Tin, Chinese *	No quotations	No quotations
Aluminum, 98 to 99 per cent	Govt. price †33.10	Govt. price †33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	23.50 to 24.50	23.50 to 24.50
Brass, heavy	14.00 to 15.00	14.00 to 14.25
Brass, light	11.50 to 12.25	11.50 to 12.00
Lead, heavy	7.50 to 7.75	7.50 to 8.00
Zinc, old scrap	6.50 to 6.75	6.50 to 6.75

*No Straits offering. † In 50-ton lots or more; carload, 33.10 cents per lb.; 1-ton to 14-ton lots, 33.20 cents per lb.

THE WEEK IN TRADE

SO FAR as can be learned, the volume of business in electrical supplies and materials is continuing as large as ever. Reports still come in showing the extent to which the trade is working on government or closely allied orders. There is now very little left of the ordinary commercial trade. The War Industries Board's recent ruling has had a noticeable effect in curtailing new construction, building permits having fallen off considerably.

Price changes are still taking place, the most important this week being in incandescent lamps. The other changes are many of them the result of labor conditions and of the high price of cotton. Deliveries do not appear to be much better if any.

Among the new projects is that of the Hydro-Electric Power Commission of Ontario for the initial hydraulic equipment of the Chippawa-Queenston power development. Bids were called for until Oct. 1 on four 52,500-hp. turbines, a total of 210,000 turbine horsepower.

NEW YORK

So far as possible every one is working on the Liberty loan drive, in which the local electrical trade is taking an important part.

A few price increases were made this week, the most important being that on incandescent lamps. The greatest secrecy accompanied this increase, and very few people knew of it until it had actually taken effect on Tuesday of this week.

Building is still falling off, but there still exists a spirit of optimism and expectancy that conditions will be such in the spring that building can start up again in a limited way. The military operations of the past week have served to heighten this belief.

METERS.—Watt-hour meters have advanced in price 10 per cent since Sept. 10.

CROSS-ARMS AND PINS.—The Emergency Fleet Corporation has commandeered all plants manufacturing locust pins for cross-arms, and the price per 1000 for carload lots has doubled. The production of fir and yellow pine cross-arms has been considerably reduced owing to government airplane and shipping requirements. All deliveries from factories are very slow owing to the labor and railroad situation.

LAMPS.—Prices on "Mazda B" incandescent lamps advanced on Oct. 1 roughly 15 per cent. Type C lamps were not advanced. Manufacturers are still busy signing up local agencies among the retail trades. Indications are that the coming year will be the best lamp year ever seen in the East.

WIRE.—Weatherproof advanced this week anywhere from 2 to 3½ cents a pound, due largely to labor and excessive cotton costs. Wire base is still ranging at from 30 to 37 cents. Considering the discounts, however, wire base may be said to be 34 cents. One jobber reports an advance in insulated wire of 25 to 30 per cent.

INSULATION.—Varnished cambric advanced in price about 10 per cent on Sept. 15. Further price movements will be governed chiefly by the price of cotton.

CONDUIT.—There has been no change this week except perhaps that the market is still tighter.

APPLIANCES.—Following the order of the times, conservation, the largest dealers are advising their customers to have old appliances repaired. One large central station has found this work to have increased as much as ten times since the war broke out. The delivery of raw materials is exceedingly slow, but the trade hopes that by Oct. 15 this situation will be much improved. No advance in prices is contemplated now. Great difficulty is experienced in obtaining stocks of appliances and of repair parts. Manufacturers are urging customers to curtail purchases wherever possible.

CHICAGO

Indications are that increasing demand for electrical supplies should be expected over and above the usual increase in fall business. The following are specific instances setting forth some of the activities which should create this demand: The Consumers' Packing Company of Chicago will build a new packing plant, to cost $1,250,000, in the stock yards district. The plant will comprise a power house, abattoir, cold-storage building, machine house and several other buildings. It is stated that the company has secured the approval of the Agricultural Department of the government and that the work of construction will be pushed to as speedy a completion as possible. Contracts for 374 houses accommodating 400 families, together with all necessary public utility connections, have been awarded to the Central Engineering Company of Davenport, Iowa. Other similar government contracts were awarded to the Henry W. Herst Company of Rock Island for 321 houses at Moline, East Moline and Rock Island. Contracts were let on a fixed-fee basis. The Illinois Manufacturers' Association now has representatives in Washington seeking a fifty-million-dollar aeroplane contract which it is expected to apportion among a number of wood-working and metal-working plants in the Chicago district. To assemble the parts produced by these plants an immense assembly station is planned, the site selected being one which will give facilities for testing both aëroplanes and hydro-aëroplanes.

Government activities continue to be the center of interest in the trade at Chicago. Chicago jobbers are unanimous in approving the action of the government in limiting the number of styles and types of devices manufactured by different electrical concerns. These jobbing distributers see a considerable advantage to the merchandising section of the industry since the action will go a long way toward standardizing their stock and permit millions of dollars of capital to be released from the industry. As a logical result of this it is likely that the jobbers will be able to effect a more rapid turnover, which will mean that they can operate on a lower margin of profit, and this in turn should ultimately have its effect on prices. This should not be taken to mean, however, that an immediate price revision is in contemplation.

POLE-LINE HARDWARE.—An increase of about 20 per cent in pole-line hardware has gone into effect. Jobbers' stocks of commercial pole-line hardware and line material generally are said to be good in Chicago in spite of the fact that the government has taken a large amount of this material to be used for construction abroad.

CONDUIT.—There is no change in the conduit situation. Only orders with a priority of AA and A are being filled promptly.

PORCELAIN STRAIN INSULATORS.—New prices on porcelain strain insulators have gone into effect. It is stated to be, however, simply a matter of convenience, the adjustment, amounting to a few cents, being made in order to give all jobbing distributers the same discount.

FARM-LIGHTING SETS.—After a meeting of farm-lighting plant manufacturers, a committee has gone to Washington to call upon the Priority Board and learn what is to be the status of the farm-lighting plant business.

INCANDESCENT LAMPS.—The jobbers as yet have felt no effects from the government's ruling on carbon and "gem" lamps. The order is fully understood in the jobbing circles of Chicago, and the government's wishes in the matter will be carried out to the letter.

BOSTON

Business remains good, though all branches of the trade have been severely hit by a temporary increase in labor shortage caused by the epidemic of influenza in this part of the country. Seven hundred telephone operators were out last week on the New England company's system and with business houses short-handed generally it was most difficult to care for orders promptly. Conditions are improving somewhat at this writing. Stocks are in a rather spotty condition at present, though little fear is expressed that essential requirements cannot be met indefinitely. The fourth Liberty loan drive is making fine progress. So far collections continue reasonably good, but credits are being scrutinized with much care. Deliveries show some improvement.

MOTORS.—Factory stocks are showing some enlargement, with little change in prices. For the moment there is not quite so much government local buying, the reason being that orders have been placed for enormous totals of motor equipment to go into plants still under construction, and further extensions of these plants have not in many cases reached the point where bids are wanted on electrical apparatus on the immense scale hitherto attained. The war plant work of the country is being rushed to the limit, but many of these installations have reached the point where mass production can be forced from now on. In a word, the utilization and completion of the great war installations is just now of more concern than designs for new plants. Of course, expansion must continue in many branches of industry as long as the war lasts, and it would not take long to exhaust the existing stocks of motors. Up to 25-hp. rating, certainly, increased manufacturing facilities have been effective in establishing at least a modest reserve for immediate shipment on priority service. The second-hand market is a trifle quiet just now.

TRANSFORMERS.—Stocks are low and prices show a slight tendency to stiffen. No marked advances, however, are noted. Standardization of designs is being discussed rather favorably in the interest of saving material and labor. An important paper on this matter by M. O. Troy of the N. E. L. A. apparatus committee was well received at the New England Section, N. E. L. A., convention at Springfield, Mass., last week. Many central-station men appear ready to fall into line with the committee's suggestions toward reducing the number of sizes, types, etc., as a means of patriotically conserving material and labor. Deliveries range from a few weeks in smaller sizes to a half year or thereabouts in units of 5000-kva. rating.

FLATIRONS.—The market appears almost unlimited in its capacity to absorb present production. Sales are being made with little effort, and the factories are hard put to it to meet the demand. One factory turning out 800 irons a day recently informed the Electrical World that orders totaling over 25,000 units are on its books. Prices are steady, and the public appears ready to buy without much regard to the 1918 advances.

LAMPS.—An advance, as nearly as could be learned, of about 10 per cent was scheduled for Oct. 1. General co-operation in cutting out carbon and metallized-filament lamps is noted in New England by central stations, dealers and the public. Stocks of standard lamps are now in very fair shape. Increased overtime and night work in war plants are adding somewhat to the consumption of lamps, but there is, on the other hand, a good deal of curtailment in residential, window and street lighting.

WASHING MACHINES.—These products are showing extraordinary popularity, and if enough washers could be supplied business would be amazingly good. Even the smaller homes are coming into the market, and price advances are being well cared for by the deferred-payment plan.

ELECTRIC RADIATORS.—Jobbers are wondering where they will be able to supply the demand for these units if it continues as indicated. The fuel conditions have focused popular attention on the electric heater, and it would not be surprising if exhausted stocks were soon reported here and there.

ATLANTA

The continual agitation and prospects of a fixed price for cotton has tended to cause considerable uncertainty in the cotton states, but no effect is observed in the volume of business transacted at this time, as government work is expanding at the expense of non-essential enterprises, which experience further curtailment.

The recent restriction issued by the Priorities Committee against building will be felt keenly. Housing and building facilities are at a premium at certain points now, which is borne out by the fact that Atlanta alone had only 204 houses for rent in August and 36 in September. This condition exists in other industrial centers where large government undertakings are under way.

The Grass Fiber Paper Pulp Company, Moore Haven, Fla., has leased 75,000 acres of saw-grass land and will construct a large plant for the manufacture of paper. R. D. Grier will erect a cotton-spinning mill at North Wilkesboro, N. C. A steam power plant will be installed at present, with ultimate arrangements for hydroelectric power. Tucker & Laxton, Charlotte, N. C., have been awarded the wiring contract for additional construction at Camp Jackson, Columbia, S. C. In conjunction with the half-million-dollar steam turbo-pumping equipment to be purchased by the city of Atlanta, the government will install electrical repumping stations at Hemphill, Atlanta and Buckhead, Ga., for Camp Gordon.

POLES.—The call for these is following closely the steady demand for line material. Prices remain firm and shipments are good.

HARDWARE.—A potential market exists for all classes of small pieces, but government restrictions shut off to a great extent many orders. Shipments are fair and prices are steady.

INSULATORS.—No advance has been recorded during the month. Jobbers are having more difficulty getting glass products and have secured porcelain much more quickly. The tendency is to buy the material that can be delivered in the shortest time.

ELECTRIC RANGES.—Distributers report a fairly good stock on hand. They claim, however, that sales are slowing up slightly on account of the user's doubts regarding the shortage of power in the Southeast and its conservation. It is expected that the retailers will explain conditions and that an increased flow of business will be recorded this fall.

SCHEDULE MATERIAL.—Jobbers state that 80 per cent of sales are for government account, and no cessation in the call is noticed. Deliveries are very good. Prices advanced about 5 per cent during the past week.

SEATTLE—PORTLAND

Retail dealers report an added stimulus in trade due to the constantly expending residence buiding program and the influx of war workers from the Middle West and West. The volume of wholesale trade continues heavy, particularly along industrial lines. Central stations report a healthy activity although no special campaigns to push sales are being waged. The retail trade is considerably perturbed over the question of essential and non-essential products. Jobbers' stocks as a whole in the Seattle territory are low. Prices are holding firm with practically no changes for the past few months. Conservative observers are expecting some increase this fall. The labor shortage, already acute, shows no indications of being relieved. All branches of trade in the Northwest are seriously affected by the new draft, owing to unsettled labor conditions brought about by men leaving old lines of employment for assured war work. The field for employment of women is broadening. Prominent jobbers report that Christmas buying has not yet begun, and no particular interest is being shown in this community. The War Department has ordered the installation of a new cable between Seattle and Port Angeles and Port Angeles and Victoria, B. C. Approximately $120,000 will be expended.

Relief from congestion and delay in delivery of freight after arrival in Seattle yards is promised within ten days by the Railway Administration. Through arrangements with federal shipping board heads, the business men and property owners in Seattle who recently pledged themselves to build homes for war workers are assured that these homes have been put on same basis with reference to priority as houses which the government is erecting at Puget Sound Navy Yard.

Portland jobbers report that, aside from the opening of bids for transformers and motor equipment for a government spruce mill at Vancouver, Wash., and Toledo, Ore., there is practically no movement in power apparatus of any importance. Stock conditions are virtually the same as reported for several weeks. The Jager Shroufe Company, electrical contracting engineer, Portland, has secured contracts for wiring all concrete vessels to be built by the Great Northern Concrete Shipbuilding Company at Vancouver, Wash.; for wiring vessels to be outfitted at the plant of the Pacific Marine Iron Works and for twenty vessels built by the Foundation Company, besides all vessels being built by the Coast Shipbuilding Company and the Supple-Ballin Shipbuilding Company.

Collections for past week were normal, and it is believed that the influence of the present Liberty bond drive will have slight effect on collections for the near future. Credits are being placed quite easily, although no unusual transactions are noted. Retail collections and credits show a very satisfactory condition.

SAN FRANCISCO

The past week marks the end of an old era and the beginning of a new one in which all non-essential work will be automatically wiped off the slate. Pacific Coast electrical jobbers have signed the war pledge to ship no material unless it be for essential work, and they have circulated similar pledges among all electrical dealers and contractors.

Collections are still very fair and shorter in term, some merchants inclosing patriotic appeals to that effect with their invoices.

WIRE.—Some big orders for rubber-covered wire, especially for size No. 14 single-braid solid, are reported. In some cases an average month's total is being sold in one week's time. Shipments of No. 14 wire have increased about 50 per cent over the sales of the corresponding period in 1917. The quantity price in the above size has recently increased by 20 per cent and is now around $16 per 1000 ft. f.o.b. at Pacific Coast houses.

HORNS.—Houses that carry electrical horns report a steady sale, though not of large volume, of 110-volt signals to be direct-connected to the lighting circuit in factories.

SCHEDULE MATERIAL.—Schedule material, such as switches, sockets, cut-outs and sign receptacles, has sharply advanced from 10 to 15 per cent. Deliveries are fair, although Eastern factories are handicapped by the government requirements of brass and copper. Certain kinds of schedule material, such as ⅛-in. cap brass sockets or pendent cap sockets, are more domestic than industrial and will, it is expected here, be restricted by the new patriotic pledges.

LAMPS.—All Pacific Coast jobbers are required to furnish quotas, based upon stocks, shipments and back orders, by which their stocks are adjusted. All such houses have just been advised that their quotas, small though they were, will be still further cut. Most of those lamps will go to factories, because consumers are, it is rumored, to be asked to dispense with one lamp out of four in their homes, thus cutting down maintenance orders. Hand in hand with this comes the news that the lightless nights order of the federal Fuel Commissioner expiring on Oct. 1, northern California having five such nights, southern California two, will be indefinitely extended.

CONDUIT.—Local stocks are miserable. Eastern shipments arrive in fair time but require many months for completion.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED, CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B & S. Size	List per 1000 Ft.
No 14 solid	$61.00
No. 12 solid	71 00
No. 10 solid	90 00
No. 8 solid	106 00
No. 6 solid	145 00
No. 10 stranded	95 00
No 8 stranded	115 00
No. 6 stranded	160 00
No. 4 stranded	205 00
No. 2 stranded	266 00
No. 1 stranded	315 00

Twin-Conductor

No. 14 solid	104 00
No. 12 solid	135 00
No. 10 solid	185 00
No. 8 stranded	235 00
No. 6 stranded	370 00
No. 4 stranded	575 00

NET PRICE AND DISCOUNT PER 1000 FT NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10%

Twin-Conductor

	No. 14 Solid
Less than coil	$105 00 to list
Coil to 1000 ft	90 00—10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20% to list
Coil to 1000 ft	List to 15%

	No. 12 Solid
Less than coil	+20% to list
Coil to 1000 ft	List to 15%

Twin-Conductor

	No. 14 Solid
Less than coil	$115.00 to + 5%
Coil to 1000 ft	100 00 to + 5%

	No. 12 Solid
Less than coil	+20% to +5%
Coil to 1000 ft	5%

ATTACHMENT PLUGS

List ranges from $0 22 to $0 30 each
Standard packages from 100 to 250

DISCOUNT—NEW YORK

Less than 1/5 std pkg	12%
1/5 to std pkg	20%
Std pkg	44%

DISCOUNT—CHICAGO

Less than 1/5 std pkg	+30% to 12%
1/5 to std. pkg	+5% to 20%
Std. pkg	18% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 45—$0.46	$0 45—$0 47
12 to 50	40	40— .41
50 to barrel	.35— 36	36 37
Barrel lots	32 320	33— 329

BATTERIES, DRY Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.	$0.40 to $0 44	$0 40 to $0 44
12 to 50.	35 to 39	35 to 39
50 to barrel.	319 to 342	329 to 37
Barrel lots	289 to 332	299 to 342

CONDUIT, METALLIC FLEXIBLE

Size, In	Ft per Coil	List per 100 Ft.
5/16	250	$5 00
⅜	250	7 50
½	100	10 00
¾	50	13 00
1	50	21 00
1¼	50	26 00
1½	25–50	35.00
2	25–50	45 00
2½	25–50	52 00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single.trip	$75 00	$63 75— 69 75
⅜-in. double strip	75 00— 82 50	72 00— 75 00
½-in. single strip	100 00	85.00— 93 00
½-in. double strip	100.00—110.00	96.00—100 00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$63 75 to $64 25
⅜-in. double strip	78 25 to $78 75	71.25
½-in. single strip	100.00	75 00 to 85.00
½-in. double strip	105.00	93 00 to 95 00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0.05½	1	$0 25
¼	06	1¼	33
⅜	09	1½	40
½	12	1¾	47
⅝	15	2	55
¾	18	2¼	65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$35.00–55.00	$32 00–35.20	$29.00–30.25
¼-in.—	40.00–60 00	35 00–38.40	32 00–33 00

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$60 00	$30.00	$26.50
¼-in.—	65 00	32 50 to 33 50	29 00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In	Conduit, List per Foot
¼	$0 08½
⅜	08½
½	08½
¾	11½
1	17
1¼	23
1½	27½
2	37½
2½	58½
3	76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0 05	$0 19
⅜	06	19
½	07	19
¾	10	25
1	13	37
1¼	17	45
1½	21	50
2	28	1 10
2½	40	1.80
3	60	4 80

DISCOUNT—NEW YORK

	¼ in. to ½ in	¾ in. to 3 in
Less than 2500 lb	7% to 12%	9% to 14%
2500 to 5000 lb.	10% to 15%	12% to 17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb	1.5% to 6.8%	3 5% to 8.8%
2500 to 5000 lb.	4 5% to 10.7%	6 5% to 12.7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5 00 to $6 00
Discount	30%

CHICAGO

List price	$6 00 to $7 00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp	100	$0 25
35-amp. to 60-amp	100	35
65-amp. to 100-amp	50	90
110-amp. to 200-amp	25	2 00
225-amp. to 400-amp	25	3.60
450-amp. to 600-amp	10	5 50
600-Volt		
3-amp. to 30-amp	100	$0.40
35-amp. to 60-amp	100	60
65-amp. to 100-amp	50	1 50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5 50
450-amp. to 600-amp	10	8 00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30% to 31%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6 00 to $8.75
1/5 to std. pkg	5 25 to 7 00

Standard packages, 500 List, each, $0 07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8.00
1/5 to std. pkg	7 00

Standard packages, 500 List, each, $0 07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

	Std. Pkg	List, Each
Regular, Clear:		
10 to 40-watt—B	100	$0.35
60-watt—B	10	40
100-watt—B.	24	85
75-watt—C	50	70
100-watt—C	24	1 10
200-watt—C	24	2 20
300-watt—C	24	3 25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25	50	60
25-watt—G 25	50	60
40-watt—G 25	50	60
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30	24	82
Round Bulbs, 4⅜-in., Frosted		
100-watt—G 35	24	1 15

DISCOUNT—NEW YORK

Less than std pkg	List
Std pkg	10%

DISCOUNT—CHICAGO

Less than std pkg	List
Std pkg	10%

LAMP CORD

Cotton-Covered, Type C, No 18

NEW YORK

	Per 1000 Ft Net
Less than coil (250 ft)	$20 20—$35.90
Coil to 1000 ft	27 18

CHICAGO

	Per 1000 Ft Net
Less than coil (250 ft)	$38 00
Coil to 1000 ft	28 00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24 00

CHICAGO

Net per 100	$21 75 to $30 00

OUTLET BOXES

Nos	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30 00
102—B.A., 6200, S E., 300, A.X., 1½, 4 S.	30 00
103—C.A., 9, 4R, B 1½	25 00
106—F A., 7, C.S., 1½, 3 R	20 00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%	20%
$10.00 to $50.00 list	36%	36%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	30% to 40%	20% to 35%
$10.00 to $50.00 list	40% to 50%	30% to 45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1 5 std pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1 5 std pkg	5%
1 5 to std. pkg	15%
Std pkg	25%

PORCELAIN CLEATS UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1 5 std. pkg	$21.00 to $38.00
1/5 to std. pkg	17 85 to 19 00

Standard package, 2200 List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1 5 std. pkg	$16 80
1/5 to std pkg	15 80

Standard package, 2200 List per 1000, $20.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std Pkg. 3500 5½ N C	Std. Pkg. 4000 Solid Nail-it—N C.
Less than 1 5 std. pkg	$16 00 to $20 20	$32 00
1 5 to std pkg	13 60 to 15 60	27 20

CHICAGO

Per 1000 Net	Std Pkg 3500 5½ N C	Std. Pkg. 4000 Solid Nail-it—N.C.
Less than 1 5 std. pkg	$11.70 to $24 00	$33 85
1 5 to std. pkg	10 15 to 20 00	26 60

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets.	500	$0 33
½-in. cap keyless socket	500	1 30
½-in cap pull socket	250	60

DISCOUNT—NEW YORK

Less than 1 5 std. pkg	+10%
1 5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1 5 std pkg	List
1 5 std pkg	10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0 80
60-amp. S. P. S. T	1 20
100-amp. S. P. S. T	2 25
200-amp. S. P. S. T	3.48
300-amp S. P. S. T	5 34
30-amp D. P. S. T	1 20
60-amp. D. P. S. T	1 78
100-amp. D. P. S. T	3 38
200-amp. D. P. S. T	5 20
300-amp. D. P. S. T	8 00
30-amp. 3 P. S. T	1 80
60-amp. 3 P. S. T	2 68
100-amp. 3 P. S. T	5 08
200-amp. 3 P. S. T	7 80
300-amp 3 P. S. T	12 00
Low Grade:	
30-amp. S. P. S. T	$0 42
60-amp. S. P. S. T	74
100-amp. S. P. S. T	1 50
200-amp. S. P. S. T	2 70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T	1 22
100-amp. D. P. S. T	2 50
200-amp. D. P. S. T	4 50
30-amp. 3 P. S. T	1 02
60-amp. 3 P. S. T	1 84
100-amp. 3 P. S. T	3 76
200-amp. 3 P. S. T	6 76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+5% to Net
$10 to $25 list	11% to 15%
$25 to $50 list	14% to 20%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16% to 25%
$15 to $50 list	24% to 28%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 15%
$10 to $25 list	List to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15% to 16%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg	List
5-amp. single-pole	250	$0 28
5-amp. single-pole, ind	250	32
10-amp. single-pole	100	48
10-amp. single-pole, ind.	100	54
5-amp. three-point	100	54
10-amp. three-point	50	76
10-amp., 250-volt, D. P	100	66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0 45
10-amp. three-way	50	.70
10-amp double-pole	50	70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1 5 std. pkg	+20%
1 5 to std pkg	List
Std pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1 5 std. pkg	+30% to 10%
1 5 to std. pkg	+5% to 16 %
Std pkg	18% to 25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar	List Each
No. 155	$0 34
No. 160	60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list.	Net to 40%	Net to 30%
$2.00 to $10.00 list.	10% to 50%	5% to 40%
$10 00 to $50.00 list	20% to 60%	10% to 52%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2 00 list	25% to 40%	20% to 30%
$2.00 to $10 00 list	25% to 50%	20% to 40%
$10 00 to $50 00 list	25% to 64%	20% to 50%

TOASTERS, UPRIGHT

NEW YORK

List price	$6 00
Discount	30%

CHICAGO

List price	$6 35 to $7 00
Discount	25% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0 454–$0 51
No. 18, full spools	404– 49

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0 65 to $0 72
No 18, full spools	55 to 605

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15 00–$20 00	$13 50–$15.00	$13 00–$14 00
12	23.58– 27 10	21 62– 23 20	17.05– 17 68
10..	30.20– 39 80	27 45– 32 40	23.47– 23 75
8..	42 74– 53.35	38 85– 45 70	33.21– 33 35
6.	61 50– 84 40	55 35– 72 35	52.58– 53 05

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$22 00–$25 00	$18 00 $22 00	$15 50–$16 50
12.	29 46– 31 44	29 46– 31 44	25 54– 31 44
10..	41 10– 43 84	41 10– 43 84	34 62– 38.36
8.	59 90– 61 76	39 90– 61 76	50.18 54 04
6	85 31 97 68	85 31 85 47	72 27 85 47

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4 0 to 3 Inc

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$37 75 to $40 40
25 to 50 lb	37 75 to 38 40
50 to 100 lb	34 40 to 36 75

CHICAGO

	Per 100 Lb. Net
Less than 25 lb	$37.00 to $39 70
25 tc 50 lb	36 00 to 38 72
50 to 100 lb	35 00 to 37 72

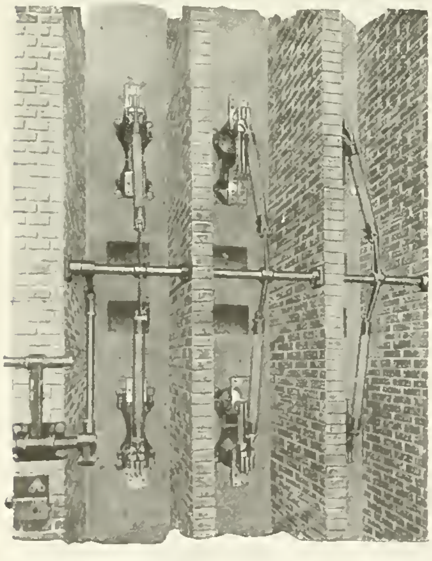
NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Steel Switching Cabinets

To be installed in locations where conditions are exceptionally hard on switching apparatus, a steel switching cabinet made for single-phase, quarter-phase and three-phase circuits in capacities up to 300 amp. at 15,000 volts and 800 amp. at 600 volts has been placed upon the market by the General Electric Company of Schenectady, N. Y. All current-carrying parts in this unit are inclosed, and provision is made for bringing the leads out at the top, bottom or sides of the unit. The cabinet consists primarily of instrument transformers, oil circuit breakers and disconnecting switches inclosed in a sheet-steel compartment with instruments, operating levers, etc., mounted on the sheet-steel front.

The oil circuit breaker is mechanically interlocked with the disconnecting switch so that this switch cannot be opened or closed while the oil circuit breaker is closed. The disconnecting switch is operated by means of a special handle or wrench from the front of the panel and is so interlocked that the rear door cannot be opened while the switch is closed, nor can the switch be closed while the door is open. This makes it impossible for any one to gain admittance to the compartment while the current-carrying parts are alive.

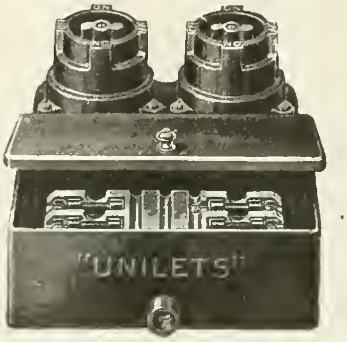


INTERIOR AND FRONT VIEWS OF COMPLETE SWITCHING UNIT

These contrivances have been designed for use as distribution and tying-in switches, as control switches for induction and synchronous motors, etc. They are usually mounted as a single unit but may be installed in groups if desired. When made with a drip roof the switching cabinet is particularly adapted to use in mines or other damp places. It can be made proof against water, gas and dust and can also be used to control large motors in steel and cement mills, pumping plants, etc., where conditions often exist which cause the switching apparatus to become damaged and put out of service by dust, moisture or chains from traveling cranes.

Fittings for Cartridge Fuse Cut-Out

Owing to the increased use of motor-driven machinery in textile mills, the Appleton Electric Company of Chicago has designed the fitting shown herewith to meet the demand for a suitable device in which to mount a cut-out and attach a projected snap switch. The fitting will accommodate either the Bryant or General Electric snap switches with protective covers. Such an installation gives absolute protection to the inclosed parts from mechanical injury, it is said. This fitting is to be known as the type ZG "unilet."

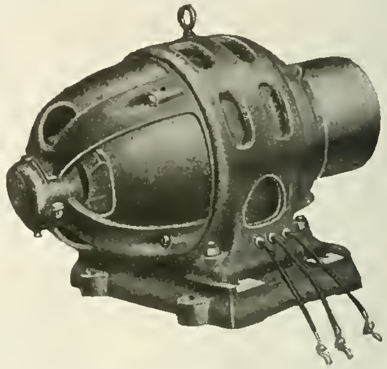


GIVES PROTECTION AGAINST MECHANICAL INJURY

Polyphase Induction Motor

No auxiliary starting apparatus is required for a polyphase induction motor that is being manufactured by the Triumph Electric Company, Cincinnati, Ohio. The motor automatically controls the starting current within predetermined limits and eliminates the "personal equation" of the operator. It has a starting torque three and one-half times that of an ordinary motor started through an auto-transformer. The efficiency and other operating characteristics are said to be very high, and no open circuit or disruptive discharge voltages are present in the rotor windings. The motor can be operated from any convenient point, no matter how distant. The manufacturer claims that the motor is simple, reliable, durable and efficient.

The rotor of this motor is star-wound, each leg of the star being two or more sections of different resistances connected through a centrifugal switch, so that when the switch is in the open position all windings are in series and of the proper total resistance to meet the starting conditions. When the switch is in the closed position the windings are connected in separate and distinct stars which divide their loads in proportion to the generated voltage in each and its impedance. The cycle of operations is as follows: The main line switch, installed at any convenient point, is closed. The current flowing to the motor is limited to a predetermined maximum by the total resistance of all the windings. Because of the high starting torque of this type the rate of acceleration is rapid. At approximately three-quarters synchronous speed the centrifugal switch closes, providing a low and high resistance path for the current to follow. Both windings are effective in producing torque, which brings the motor quickly to full speed. When the main line switch is opened the motor comes to rest, the centrifugal switch opens, and the windings are then properly connected for starting.

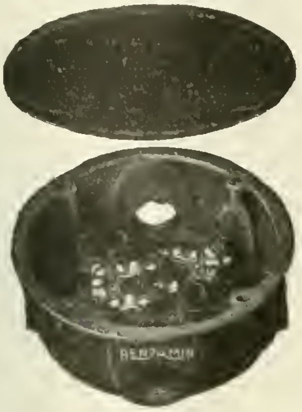


INDUCTION MOTOR WITH HIGH STARTING TORQUE AND EFFICIENCY

One claim that is made for this motor by the manufacturer is that the centrifugal switch never opens a circuit in which current is flowing, and that in closing it merely shunts current out of the closed circuit; also that the contacts carry only the difference of current in two circuits. There is, therefore, no disruptive discharge or open-circuit voltage which might endanger the insulation.

Double-Pole Switch and Watertight Junction Box

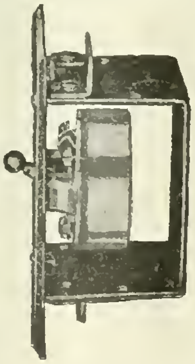
Designed for marine and navy use, a watertight combination double-pole switch and junction box is said to be very well designed. The switch is of very heavy construction and has a watertight plunger key control. The mechanism is of positive, quick-acting, make-and-break type, breaking on both sides of the circuit at two points. The brass parts for current carrying are unusually rugged and the insulating portions are of high-heat-molded material. This device is manufactured by the Benjamin Electric Manufacturing Company, 806 West Washington Boulevard, Chicago, Ill.



QUICK-ACTING AND POSITIVE MECHANISM

Flush Tumbler Switches

Ample room is provided for the wires and brass plate in a tumbler switch that is being manufactured by the Duncan Electrical Company, Ltd., Montreal, Canada. The accompanying illustration shows how easily this switch and a brass plate may be attached to any standard metal box. The switches are rated at either 3 amp. at 250 volts or 5 amp. at 120 volts.



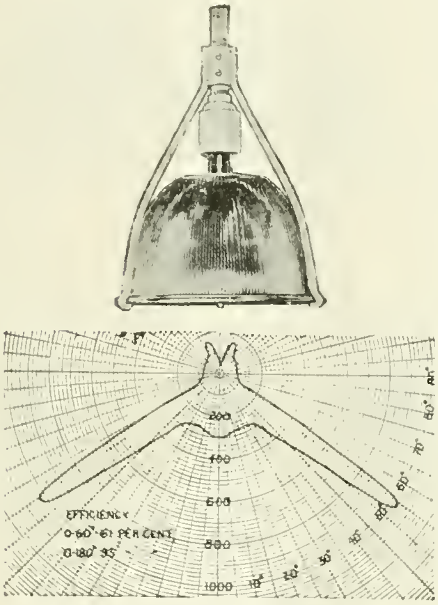
SWITCH MAY BE ATTACHED TO ANY STANDARD BOX

Wide Beam Reflector for Floodlighting Unit

The National X-Ray Reflector Company of Chicago has placed upon the market a reflector known as No. 810 which is adapted for use with the No. 51 floodlight projector also manufactured by this company. This reflector is manufactured in both corrugated and plain types. It is said to produce a wide distributing beam of light. The manufacturer claims that this can easily and simply be placed in the reflector.

Industrial Lighting Units

In line with the requirement of the War Industries Board that manufacturers in their designs are to eliminate multiplicity of sizes and shapes, the Holophane Glass Company, 340 Madison Avenue, New York City, has placed on the market an industrial lighting unit which is made in two types to produce an extensive and an intensive distribution of light. Two sizes of units are made to accommodate all gas-filled lamps in sizes from 75 watts to 500 watts. The correct lamp position for each is obtained by a simple adjustment to the sliding collar, the stem being calibrated for the various sizes of lamps.



UNIT GIVES HIGH ILLUMINATION ON VERTICAL SURFACES

The distribution curves have been predetermined to give uniform illumination, high illumination on vertical surfaces and absence of glare, the makers say. The high efficiency of 93 per cent in the 0-180 deg. zone and 61 per cent in the 0-60 deg. zone is said to be obtained.

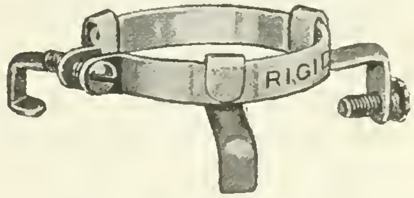
Some of the advantages claimed for this unit are: high efficiency, absence of glare, high illumination on vertical surfaces, ease of cleaning, freedom from deterioration, softening of shadows, mechanical strength, simplicity, shielding of the light source, low brightness of inside lower edge of reflector, the light given to the ceiling design of the holder on the ice-hook principle, uniform illumination between units, and that it comes complete ready to install.

Direct-Connected Farm Lighting Unit

For use where buildings are not too widely scattered, the Western Electric Company, Inc., 195 Broadway, New York City, has developed a direct-connected farm-lighting set. This 32-volt outfit, designed for power and light purposes complete, is made up of a direct-connected set, a storage battery of sixteen cells and a control board mounted on the base which contains circuit breaker, fuses, automatic control apparatus and meters. By pressing the starting lever on the control panel the generator of the set operates as a motor, turning the engine over and causing it to operate on its own power. The automatic engine stop shuts down the engine when the batteries are charged and opens the circuit between generator and battery when the engine stops. Another switch is located on the control panel which cuts off the generator, so that all the power of the engine can be used to drive machinery from the auxiliary pulley if desired. The current indicator on the control panel shows whether the battery is being charged or discharged. Besides the starting lever there are three switches on the panel—one for giving the battery the periodic soaking charge, this switch being one of the features in the dual-control charging method of this outfit. The generator of this set is specially designed and the engine operates in such a manner as to give a tapering charge to the battery. This tapering charge allows just the right amount of current to flow in the battery, and when the charge is completed the engine is automatically stopped by the little device on the control panel. In addition to the tapering charge given regularly to the battery an occasional soaking charge is provided for by the battery switch. This combination of tapering charge and periodic soaking charge offers a dual control of battery charging and is the best method for charging a battery, according to the makers.

Rigid Shade Holder

Only one screw is required to adjust a shadeholder that has been placed upon the market by the Duncan Electrical Company, Ltd., Montreal, Canada. This device is known as the "Rigid" and is made 2½ in. (6.4 cm.) in diameter to fit in the standard Edison socket. As shown in the accompanying illustration, two of the clamps are non-adjustable.



SHADEHOLDER FOR STANDARD EDISON SOCKET

Trade Notes

FUSION IN SWEDISH BALL-BEARING INDUSTRY.—An important fusion will shortly take place within the Swedish ball-bearing industry, according to Commercial Agent Norman L Anderson, the Nordiska Kullager company having bought the majority of shares in the Baltiska Kullager Company. The Baltiska Kullager concern has a capital stock of 8,000,000 crowns (approximately $2,000,000) and the Nordiska Kullager concern will therefore have to extend its capital with 1,000,000 crowns (approximately $1,000,000), whereby the capital of this company will be nearly 22,000,000 crowns (approximately $5.500,000). Last year the Nordiska Kullager company paid a dividend of 10 per cent.

NEW ESSINGTON WORKS EXCEED SCHEDULE BY 50 PER CENT.—The shipyards of the country, which at the present time are working at utmost speed in fulfilling the government's tremendous shipbuilding program, are in a large part entirely dependent upon the manufacturers who produce the necessary machinery that goes into these ships. These manufacturing establishments are doing more than what is demanded of them toward winning the war and filling the government's orders. The war-time spirit has been well demonstrated by the Essington Works of the Westinghouse Electric & Manufacturing Company in South Philadelphia. Their record for the month of August was not only larger than the shipment for any similar time since the works commenced operations, but it was actually 50 per cent in excess of what the schedule called for.. These works have concentrated their efforts upon the construction of ship propulsion machinery, such as steam turbines, mechanical reduction gears, condensers, pumps and other auxiliary steam apparatus, all of which comprise the Westinghouse marine power system. One hundred per cent of the material being turned out is on government contracts, and 90 per cent of it goes to the United States Navy.

E. F. DUNLAP, city electrical inspector of the city of Portland, Ore., has become Oregon representative of the Economy Fuse Company, being away on a temporary leave of absence from the city department.

JAMES H. GILHULY, San Francisco, Cal., representative of the Youngstown (Ohio) Sheet & Tube Company, has been elected vice-president of the Electric Agencies Company, special representative of the Youngstown company on the Pacific Coast.

THE NORTHEAST ELECTRIC COMPANY, manufacturer of automobile electrical supplies, is soon to open a branch factory in Atlanta, Ga., according to an announcement recently made by the assistant secretary of the Atlanta Chamber of Commerce. The building at 55 West Peachtree Street is now in the process of construction and, it is understood, will be ready for occupancy shortly.

E. O. SHREVE has been promoted from assistant manager to manager of the San Francisco office of the General Electric Company. Graduating from the Iowa State College and receiving his apprentice work at Schenectady Mr. Shreve went West in 1906. He passed successively through the stages of salesman at the San Francisco office, manager of the Reno (Nev.) office, turbine expert at San Francisco, manager of the supply department at San Francisco, and finally to his present post.

YOUNG & RUSSELL, Philadelphia, manufacturers of gas and electric portable lamps, have notified the trade that because of the serious paper shortage and shortage of printers they will not publish a catalog this year. The last edition of their catalog is entirely exhausted. They have, however, made special arrangements for customers to inspect their line, which is on display in the showrooms of E. W. Hammond, 10 West Twenty-third Street, New York City, and Himmelstern Brothers, 718 Mission Street, San Francisco, Cal.

THE UNIVERSAL MOTOR COMPANY of Oshkosh, Wis., reports that it has just made the first shipment of its generating systems direct to Uruguay. This shipment consisted of three 4-kw. sets. The company has already secured representation in the city of Montevideo with the Enrique Abals Company. The company states that the need of generating outfits in the remote districts, and even in many of the larger towns of Uruguay, makes it safe to say that increased attention will be paid to this product by American manufacturers of generating sets.

Changes in Bryant Electric's Sales Staff

GEORGE V. W. INGHAM, who was recently appointed Eastern sales manager of the Bryant Electric Company, was educated in the public schools of Syracuse, N. Y., and at Syracuse University. For several years he engaged in the typewriter business in Syracuse and in the fall of 1906 removed to Chicago as Western manager of Pass & Seymour of Syracuse, N. Y., joining the Bryant company in 1911. For twelve years he has traveled constantly through the western sections of the country.

G. V. W. INGHAM

FREDERICK B. EAVES, who has been field representative of the company in New England, New York State and eastern Canada for the last seven years, has been given indefinite leave of absence in order that he may serve in the electrical and power equipment section of the War Industries Board in Washington. This section is assisting all electrical manufacturers and resale distributers of electrical equipment, apparatus, appliances and supplies to mobilize their resources for direct and indirect war needs.

WALTER E. NOURSE, formerly New England representative of the Square D Company, succeeds Mr. Eaves.

WILLIAM O. DAHLSTROM, for the last three years with the Inland Electric Company of Chicago, returns to the Chicago office of the Bryant company, with which he previously served for ten years, and will be the company's field representative in the territory west and northwest of Chicago, the territory formerly traveled by Mr. Ingham.

Trade Publications

ROOF PAINT.—The Monarch Paint Company, Cleveland, Ohio, has issued a circular describing its Hydro-Carbonite paint for roofs and iron.

PREFERENCE LIST.—Preference List No. 2, issued Sept. 3, 1918, may now be had in booklet form (Circular No. 20 War Industries Board, Priorities Division). The booklet includes a list of plants having preference.

INCLOSED SWITCHES.—The Trumoull Electric Manufacturing Company, Plainville, Conn., is distributing a catalog illustrating and describing boxes for inclosing switches and fuses. The switches are operated by means of external handles.

METAL REFLECTORS AND FITTINGS.—Catalog No. 276 issued by the Ivanhoe-Regent Works, General Electric Company, Cleveland, Ohio, contains information regarding the design of lighting systems as well as detailed catalog information about metal reflectors and fittings.

ELECTRIC HEATING APPLIANCES.—The Hotpoint Division of the Edison Electric Appliance Company, Inc., 5660 West Taylor Street, Chicago, has issued a catalog and price list of Hotpoint electrical appliances as of July 15, 1918.

ELECTRIC FURNACES.—Four catalogs are being distributed by the Electric Furnace Company, Alliance, Ohio. One describes and illustrates the use of Baily electric furnaces in the production of war materials, including the treatment of airplane parts, the treatment of shells and for the melting of aluminum in bronze or submarine castings. Another catalog gives the general description, dimensions, capacity and power requirements of electric brass-melting furnaces. It includes also a discussion and table of comparative costs of melting brass of fixed ingredients by electricity, oil and coke. A third catalog states the advantages of electric furnaces over fuel-fired furnaces and compares the relative economy of furnaces supplied by oil, gas, coal and electricity, showing prices of each which make the costs equal for all fuels. This catalog is profusely illustrated with pictures of furnaces used for the treatment of steel and melting of bronze. The fourth bulletin contains a description of the Baily automatic electric furnaces for heat treatment of high explosive and shrapnel shells. The process of treating the shells is very fully described and illustrated. Data are also furnished showing the over-all dimensions of furnaces, the heating capacity and the power required.

New Incorporations

THE ELECTRICAL NECESSITIES COMPANY of Cleveland, Ohio, has been incorporated with a capital stock of $20,000 by Guy A. Burgess and others.

THE MORRIS (N. Y.) LIGHT & POWER CORPORATION has been incorporated with a capital stock of $10,000, by H. and E. C. Linn and G. Whitman of Morris, N. Y.

THE ACORN INSULATED WIRE COMPANY of Brooklyn, N. Y., has been incorporated with a capital stock of $300,000 by F. and W. R. Prosser and W. George, 102 Dean Street, Brooklyn, N. Y.

THE BEATRICE ELECTRIC COMPANY of New York, N. Y., has been chartered with a capital stock of $5,000 by W. E. Lamboen, F. M. Stackman and B. M. Johnson, 1245 Putnam Avenue, Brooklyn, N. Y.

THE McDONALD STORAGE BATTERY COMPANY of Clarksburg, W. Va., has been incorporated with a capital stock of $10,000 by Frank C. Welch, M. E. McDonald, Aimee McDonald, Maud Walsh and John F. Kearns, all of Clarksburg.

THE PLEASANT MILLS (IND.) LIGHT & POWER COMPANY has been incorporated by Amos W. Gulick, Edward Koos, E. T. Jones, Amos Z. Smith and others. The company is capitalized at $5,000 to construct and operate an electrical distributing system.

THE PENN ELECTRIC SMELTING CORPORATION of New York, N. Y., has been incorporated with a capital stock of $100,000 by C. Batcheller, W. W. Gephart and D. P. Earlie, 165 Broadway, New York City. The company proposes to operate a plant for milling, smelting, concentrating and refining metals.

THE PREMIER INCANDESCENT LAMP WORKS of New York, N. Y., has been incorporated with a capital stock of $30,000 to manufacture incandescent lamps. The incorporators are; A. Emerson, 518 West 135th Street; W. L. Morck, 476 West 143d Street, and J. S. Epstein, 362 Riverside Drive, New York City.

THE MONTAGUE-HOWLAND ELECTRIC COMPANY of Lincoln, Me., has been incorporated with a capital stock of $10,000 to do a general electrical business in Enfield and Howland. The officers are: S. N. Marsh of West Enfield, president; J. A. Thompson of West Enfield, treasurer, and William C. Kirk of Lincoln Center, clerk.

THE LITSCHER LITE CORPORATION of Grand Rapids, Mich., has been incorporated with a capital stock of $100.000 to manufacture and sell electric power and lighting plants for farms and detached localities. The officers of the company are: Christopher J. Litscher, president and treasurer; Fred N. Rowe, vice-president; W. Russel Patton of Milwaukee, Wis., secretary and sales manager.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

ASHLAND, N. H.—Work has begun on the construction of a new power plant, 60 ft. by 60 ft., at the works of the Ashland Woolen Mills.

PENACOOK, N. H.—The Stanish Worsted Company, it is reported, has leased the local power station of the Concord (N. H.) Electric Company to furnish electricity for lighting its mill.

BURLINGTON, VT.—The Board of Aldermen is considering a new contract from the Burlington Light & Power Company to furnish hydroelectric power for the municipal electric lighting system. The board will also take up the question of securing energy from the electric company at Fairfax Falls, which, it is understood, has submitted a proposal to furnish electricity to operate the municipal plant.

BOSTON, MASS.—Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning to call for new bids for an addition to the machine shop and foundry at the Charlestown Navy Yard, Boston, to cost about $900,000. No bids were submitted on the former call.

CHICOPEE, MASS.—Work has been begun on the construction of a power house for the Dana S. Courtney Company.

TAUNTON, MASS.—The Narragansett Electric Light Company has submitted a new proposal to the City Council for furnishing electricity for the municipal electric light system.

NEW LONDON, CONN.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 14 under Specification 3385, for distributing system to cost about $275,000.

Middle Atlantic States

CHAMPLAIN, N. Y.—The property of the Electric & Milling Company together with the Nye water power is reported to have been purchased by R. E. Lapham and C. E. Sample.

HUDSON, N. Y.—Bids will be received by Mrs. Annie Windsor Allen, president board of managers, New York Training School for Girls, Hudson, until Oct. 11, for electric work on additional lights, Cottages 5, 7 and 10, at New York Training School for Girls. Drawings and specifications may be consulted at the above school, at the New York office of the Department of Architecture, 1224 Woolworth Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher, Capitol, Albany, is architect.

LOCKPORT, N. Y.—Contract has been awarded by the Board of Supervisors of Niagara County to the Dunlap Electric & Motors Company, 54 Pine Street, for the installation of new electric lighting fixtures, etc., at the county institution.

TOTTENVILLE, N. Y.—Arrangements, it is reported, have been completed by the Richmond Light & Power Company for extensive improvements and extensions to its plant and system. The United States government, it is understood, will finance a loan to the company of about $600,000, to provide funds for the work.

SYRACUSE, N. Y.—The Syracuse Lighting Company has announced that no additional extensions or installations will be made except to provide for war work and that no new contracts for power will be entered into until further notice.

CAMDEN, N. J.—Plans have been prepared by the Public Railway Company for the construction of a new administration building at its terminal at Broadway and Morgan Street, near the plant of the New York Shipbuilding Corporation.

NEWARK, N. J.—The Instant Electric Vaporizer Company, recently organized, proposes to operate a plant at 52 Grove Street, in the Irvington section, for the manufacture of electric evaporizers and kindred electric specialties. Frank F. Jackson is interested in the company.

NEWARK, N. J.—A. P. Munning & Company, 202 Emmet Street, Newark, recently incorporated to manufacture electrical specialties, will take over the present plant of the Munning-Loeb Company, Church Street, Matawan. It is proposed to increase the capacity of the works and move the Newark plant to the Matawan site. New buildings, it is said, will be erected later on. The company is capitalized at $500,000.

ROCKAWAY, N. J.—Plans have been completed by the Empire Steel & Iron Company for the installation of a turbo-generator unit at its plant at Mount Hope to replace the one now out of commission.

SUMMIT, N. J.—The Board of Public Utility Commissioners has granted the Commonwealth Electric Company permission to issue $22,000 in bonds and $6,000 in capital stock, the proceeds to be used, it is understood, for extensions.

TRENTON, N. J.—A number of buildings are being acquired by Charles W. Brick of Trenton in connection with the establishment of an ice-manufacturing plant. Plans, it is understood, are under consideration for the installation of a new electric plant.

CHAMBERSBURG, PA.—The Chambersburg Plumbing & Heating Company has been awarded a contract by the Railroad Administration for installations at Hagerstown and Chambersburg, amounting to approximately $30,000. The work at Hagerstown includes the erection of power house, car and passenger station and heating installation with a system of underground piping in concrete conduits. The company will also install a fan system of heating for the foundry building of the Chambersburg Engineering Company.

MILTON, PA.—To provide power for the Milton Manufacturing Company, which is engaged in manufacture of munitions and supplies for the army, the War Department has authorized the construction of a 4000-kw. electric plant with necessary equipment, to cost $350,000. The company eventually will take over the plant, paying for it by deducting a certain portion on future contracts.

PHILADELPHIA, PA.—The Delaware Storage & Freezing Company, American and Callowhill Streets, is contemplating building an addition to its engine plant.

PHILADELPHIA, PA.—Plans have been prepared by the Delaware Storage & Freezing Company, American and Callowhill Streets, for alterations and improvements in the engine plant at its works.

PHILADELPHIA, PA.—Plans are being prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for structural-steel shop, machine shop, smith and electrical shop to be erected at the League Island Navy Yard, Philadelphia. Plans are also under way for a second machine shop and machinery building and electrical shop at the navy yard, and for a new aircraft factory, hangars and allied buildings. Contract has been awarded to the George F. Pawling & Company, 1422 Penn Square, for the construction of new seaplane hangars.

PITTSBURGH, PA.—Arrangements, it is understood, are being made by the receivers of the Pittsburgh Railway Company to apply to the United States for authority to expend about $1,000,000 for improvements to the system.

SUNBURY, PA.—The Borough Council has accepted the report of Ballard & Company, electrical engineers, on the appraisal of the electric plant and system of the Northumberland County Gas & Electric Company. The report places the value of the plant at $135,000 and the total cost of placing the plant in condition to generate electricity at $200,000. The proposal to authorize a loan of $225,000 for the purpose of taking over the plant will be submitted to the voters at the general election in November.

WILKES-BARRE, PA.—Contract has been awarded by the Market Realty Company, East Market Street and Pennsylvania Avenue, to the Pine & Minick Company of Buffalo, N. Y., for the erection of a one-story power house, 30 ft. by 80 ft.

BALTIMORE, MD.—Contract has been awarded by the United Railways & Electric Company, Continental Building, to the Singer-Pentz Company, Equitable Building, Baltimore, for the erection of a service station, including electric lighting and heating plant at Columbia Avenue and Baltimore & Ohio Railroad tracks.

MOUNTAIN LAKE PARK, MD.—A committee has been appointed to take steps to have two charters governing the town repealed and to procure a new charter giving the community the right to own and operate an electric light and power plant and waterworks system and other public improvements. Alexander Zeck, Lee M. Bender and others are members of the committee.

FAIRMONT, W. VA.—The Monongahela Valley Traction Company is contemplating an addition to its power plant at Hutchinson.

LOGAN, W. VA.—The Guyan Machine Shops would like to receive prices on a low-voltage generator and magnet wire.

ALEXANDRIA, VA.—Plans are being prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a torpedo-assembling works at Alexandria, to cost about $950,000.

PETERSBURG, VA.—Notice has been filed by the Petersburg Telephone Company of an increase in capital stock from $200,000 to $300,000, the proceeds to be used for expansion.

PORTSMOUTH, VA.—The United States government plans an expenditure of $10,000,000 to acquire, improve and operate the public utilities in the Norfolk-Portsmouth section. The War Industries Board has authorized an expenditure of $1,000,000 for electric power and gas facilities during the period of the war, to include high-tension power connections between Richmond, Petersburg, Suffolk, Portsmouth and Norfolk, additions to power plants in all cities and ultimate connection with hydroelectric developments on Roanoke River, upon which the government will expend several million dollars. The board has also loaned the traction companies $1,100,000 for street-railway improvements in Portsmouth and Norfolk. Rear-Admiral F. R. Harris, president of the board of control of war construction activities for Hampton Roads district, is in charge of the work.

YORKTOWN, VA.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., to the F. W. Mank Construction Company, Finance Building, Philadelphia, Pa., for the erection of a new fuel oil plant with equipment at Yorktown, to cost about $600,000.

WASHINGTON, D. C.—Plans are being prepared by the War Department for the construction of a power plant and laundry building at Camp Meigs, near Washington, to cost about $150,000.

WASHINGTON, D. C.—Bids will be received at the general engineer depot, U. S. Army, 1438 U Street, Washington, D. C., until Oct. 8 as follows: Proposal 1123—145 60-in. parabolic searchlight mirrors; Proposal 1126—30,000 high intensity carbons for use with searchlights.

WASHINGTON, D. C.—The United States government is planning to erect a radio and wireless station in Union County, N. C., probably at Bakers, about 4 miles from Monroe. The plans provide for erection of twenty separate wireless stations, to cost $135,000 each. The total cost is estimated at $2,700,000. For further information address Captain David W. Todd, director naval communication, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Philadelphia, Pa., Schedule 6092½—telephone cable; Philadelphia and Norfolk, Schedule 6139½—seven electric locomotives and a number of platform cars. New York, N. Y., Schedule 6099½—insulating tape; Schedule 6126½—50 instrument boxes. South Brooklyn, N. Y., Schedule 6104½—three telephone switchboards. Newport, R. I., Schedule 6108½—50,000 ft. wire cable. Great Lakes, Schedule 6131½—Six 5 hp. motors and one coal crusher; Schedule 6157½—3000 ℔. weatherproof wire, 5000 ft. lamp cord, 25 ℔. magnet wire and a quantity of rubber-covered wire. Washington, D. C., Schedule 6120½—One slotting machine, one oil press transformer and one testing transformer; Schedule 6230½—One electrically operated grab bucket. South Boston, Mass., Schedule 6133½—lighting wire. Gloucester, N. J., Schedule 6137½—insulators, wing type clamps, wire and 100 exciter battery base mounts. Norfolk, Va., Schedule 6140½—10,000 ft. stranded cable; Schedule 6179½—cable; Schedule 6180½—400 ft. copper wire; 6181½—electrical material. F.o.b. works, Schedule 6143½—2500 cast brass junction boxes and covers; Schedule 6172½—30 000 cast brass switch boxes; Schedule 6174½—switch cams; Schedule 6188½—7000 switch boxes; Schedule 6198½—one condenser; Schedule 6201½—160,000 receptacle caps; Schedule 6200½—30,000 cast-brass switch boxes. Hoboken, N. J., Schedule 6144½—one refrigerating plant. Newport, R. I., Schedule 6147½—8000 ℔. copper tubing. Hingham, Mass., Schedule 6152½—160,000 ft. line telephone wire and 50,000 ft. copper telephone wire; Schedule 6153½—telephone supplies; Schedule 6154½—telephone hardware; Schedule 6155½—cross-arms and telephone poles. White Plains, Md., Schedule 6185½—switchboards. New Orleans, Schedule 6229½—radio apparatus and spare parts. Brooklyn, Schedule 6231½—128 searchlight bases and trunion arms. Various yards, Schedule 6247½—electrical supplies, including projectors, wire, etc. Puget Sound, Schedule 6259½—one refrigerating apparatus and spare parts. Applications for proposal blanks should designate the schedule desired by number.

North Central States

AKRON, OHIO.—C. W. Baum, safety director, has applied to the Capital Issues Commission for authority to expend $50,000 for improvements to the fire and police signal system.

DEFIANCE, OHIO.—The property of the Auglaize Power Company was purchased by W. P. Wallace of Defiance at a receiver's sale on Sept. 14 at $680,650.

HAMILTON, OHIO.—The City Council has granted the Henry Ford Company permission to erect an electric transmission line from the plant of the Hamilton & Hydraulic Company to the site of the new works of the Ford Company.

ANDERSON, IND.—Contract has been awarded by the Board of Public Works to the Hatfield Electric Company of Indianapolis for three boilers and stokers, to cost about $94,400, for the municipal electric light plant.

BLOOMFIELD, IND.—The capital stock of the Indiana Power & Water Company has been increased from $500,000 to $1,000,000.

SOUTH BEND, IND.—The Board of Public Works is considering replacing the present ornamental cluster lamp standards with single lamp standards.

CHICAGO, ILL.—Plans for an army reconstruction hospital to be erected by the United States government at Speedway Park, Chicago, near Maywood, will include shops and instruction buildings, in which soldiers will be fitted for occupations to make them self-supporting. The total cost of the hospital is estimated at $4,500,000, of which $3,500,000 will be for land and buildings and the remainder for equipment. The Shank company has the general contract. Twenty-eight buildings will be erected, the main structure to be 2040 ft. long and four stories high and to be completed in 100 days. It will be known as the United States General Hospital and will be designated by a number.

DECATUR, ILL.—Investigations are being made by the City Council relative to securing water power from the new dam.

GALESBURG, ILL.—The Dependable Truck & Tractor Company of Galesburg has purchased a site just north of Galesburg, consisting of five acres and a building containing 45,000 sq.ft. which the company will repair and use as a temporary building in which to assemble its first trucks. This building will later be used as a machine shop and power house. Plans have been prepared by the company for the construction of a factory building consisting of approximately 40,000 ft.

HAVANA, ILL.—The installation of a municipal electric light plant in Havana is reported to be under consideration.

BIRON, WIS.—L. A. DeGuere, consulting engineer, has been engaged by the Consolidated Water Power & Paper Company to prepare plans and supervise the construction of an addition to its hydroelectric power plant in Biron. The cost is estimated at $75,000.

LITTLE FALLS, MINN.—The property of the Little Falls Water Power Company has been purchased by L. P. Runkel, H. C. Hornby, H. C. Stevens and A. L. Lynds of Cloquet, owners of the General Light & Power Company of Cloquet. The new owners plan improvements to the system and a contract has been let to concrete the west wing of the dam. L. P. Runkel has been appointed general manager of the new company. T. C. Gordon, present manager, will continue in that capacity for the new concern.

NEW MUNICH, MINN.—The Council is considering the purchase of new electrical equipment.

MUSCATINE, IOWA.—Bids will be received by the Muscatine-Louisa Drainage District No. 3 at the office of the County Auditor of Muscatine County, Muscatine, Iowa, until Oct. 8 for a steam-driven pumping plant, complete, containing one each 36-in. and 24-in. double-suction centrifugal pump. Bids will also be received for building to house said plant. Further information may be obtained on application to the Elliott & Harman Engineering Company of Peoria, Ill.

KENNETT, MO.—O. B. Gwyn, superintendent of the Gideon-Anderson Lumber Company, is contemplating the construction of a 12-ton ice plant, bottling works and electric-lighting system in Kennett.

ST. LOUIS, MO.—The Oliver Electric & Manufacturing Company, 2219-21 Lucas Avenue, is reported to have purchased a site on Forest Park Boulevard, east of Boyle Avenue, on which it proposes to erect a new plant. Work, it is understood, will begin on construction of the proposed plant at once. Fielding W. Oliver is president.

COLONY, KAN.—The local electric light plant is reported to have recently been destroyed by fire.

FREDONIA, KAN.—A petition has been presented to the Council urging the establishment of a municipal electric light plant.

LEAVENWORTH, KAN.—Bids will soon be asked for construction of community school, including heating, wiring and plumbing. The cost of the building is estimated at $90,000. T. W. Williamson & Company, 418 Central National Bank Building, Topeka, are architects.

PERU, KAN.—Plans have been prepared by Archer & Stevens, engineers, New England Building, Kansas City, Mo., for improvements to the electric light and water plant. The cost is estimated at $25,000. Fred Mallonee is city clerk.

WAMEGO, KAN.—The City Council has passed an ordinance authorizing the Riverside Light, Power & Gas Company of Abilene to erect an electric transmission line through the west city limits to the Wamego municipal light and water plant and from there to the Young Alfalfa and Lord flouring mills; also for the erection of a transformer station and to furnish electricity to the municipal plant and manufacturing industries in Wamego.

Southern States

BELHAVEN, N. C.—Bids will be received by the Mayor and Board of Aldermen, Belhaven, until Oct. 8 for furnishing and erecting one 100-hp. crude-oil engine and appurtenances, one 90-kva., 2300-volt engine-type alternator, with exciter and switchboard, and also for construction of power house. Proposal forms and further information may be obtained from William M. Piatt, engineer, Durham, N. C.

GASTONIA, N. C.—The capital stock of the Piedmont Telephone Company has been increased from $400,000 to $600,000, the proceeds to be used for extensions and improvements.

NORTH WILKESBORO, N. C.—A company has been organized by R. D. Grier, Clem Wrenn and others to erect a cotton mill at Gordon, a suburb of North Wilkesboro. The proposed mill will be operated by steam power at first, but later it is planned to secure water power. The company is capitalized at $250,000.

ST. PAUL'S, N. C.—Plans have been prepared for changing the motive power of the St. Paul's Mills from steam to electricity.

TARBORO, N. C.—The City Council has approved of a $50,000 bond issue for extensions and improvements to the municipal electric light plant.

CHATTANOOGA, TENN.—The construction of a separate lighting plant for the county is recommended by W. A. Conner, county judge.

NASHVILLE, TENN.—The City Commission has entered into a contract with the Nashville Railway & Light Company for electricity to operate the municipal electric light and power system during the period of the war. The city has closed down the electric generating plant at the request of United States government.

DOTHAN, ALA.—The Columbia Power Company, which is building a hydroelectric plant at Columbia, 29 miles from Dothan, has contracted with the city to furnish 1500 kw. to be delivered at the switchboard in Dothan. The contract was to take effect July 8, but has been extended to Oct. 8. The company has also entered into contracts with the cities of Headland, Alabama, Columbia, Ashford and Webb to furnish electricity.

GADSDEN, ALA.—Plans have been prepared for equipping the pumping station of the waterworks system for electrical operation. Three large pumps with motors and auxiliary equipment will be installed.

MOBILE, ALA.—The City Commission has granted the Mobile Light & Railroad Company a franchise to build tracks on Conception, Texas, St. Emanuel, Delaware, Lawrence and Georgia Streets, to the large shipbuilding plants in the southeastern part of the city. The cost of the improvements is estimated at $110,000 of which 60 per cent will be loaned by the Emergency Fleet Corporation.

NEW ORLEANS, LA.—Arrangements, it is reported, will be made by the New Orleans Railway & Light Company with the New Orleans Belt Railway Company to operate street cars on the belt line tracks. Extensions and improvements, it is stated, to cost about $200,000 will be made.

ARDMORE, OKLA.—The East Ardmore Coal Company of Ardmore is contemplating the purchase of mining equipment, including power plant. J. W. Weeks is interested.

HOUSTON, TEX.—The Houston, Richmond & Western Traction Company has leased dam and water-power rights on the Guadalupe River at Oak Forest, 9 miles from Gonzales, and will build a large hydroelectric plant. Energy generated at the plant will be used to operate the proposed interurban railway between Houston and San Antonio, a distance of more than 200 miles. Surveys have been made for the road and most of the right-of-way has been secured. The height of the dam will be increased from 8 ft. to 15 ft. E. Kennedy of Houston, is president.

Pacific and Mountain States

SEATTLE, WASH.—An ordinance authorizing an appropriation of $10,000 to complete the city substation at Ballard has been introduced in the City Council.

SEATTLE, WASH.—The Puget Sound Traction, Light & Power Company has been granted a permit to erect a substation at 3773 Fourteenth Avenue, Northeast, to cost about $3,500.

CRESCENT, ORE.—The development of a power site at Crescent, it is reported, is under way by Dr. N. E. Winnard of Heppner. The power generated at the plant will be used for pumping water on lands in the Fort Rock district in Lake County.

BUTTE CITY, CAL.—The Great Western Canal Company is reported to be considering the construction of a power plant to develop about 500,000 hp.

MARTINEZ, CAL.—Contract has been awarded by the Town Council to M. P. Holmes of Berkeley for the construction of a pumping station to be used in connection with the new sewerage system, at a cost of about $34,000. The proposed plant, it is understood, will be equipped for electrical operation.

SAN FRANCISCO, CAL.—Application has been made to the State Water Commission by K. E. Enslow of San Francisco, Richard Day and the Adams Pipe Works for water rights on the Middle Fork of the Feather River, to be utilized to develop 25,000 hp. It is proposed to store 50,000 acre-ft. a year in Gold Lake and Grizzly Valley in Sierra County. The same parties have also applied for 250 cu.ft. of the waters of the Middle Fork of the Feather River for the irrigation of 85,320 acres. The main canal will be about 20 miles long.

STOCKTON, CAL.—The first stage of construction of the dam of the Twin Lakes reservoir, which, it is expected, will store 1000 acre-ft. of water for the coming season for the hydroelectric development on the American River near Placeville of the Western States Gas & Electric Company of California, will be completed by Oct 1 This is the fourth reservoir to be provided the company through the purchase in 1917 of four lakes in the Sierras. The company is controlled by H. M. Byllesby & Company of Chicago, Ill.

CŒUR D'ALENE, IDAHO.—To do away with steam motive power in its local yards the Northern Pacific Railroad Company is now equipping its line within the city limits of Cœur d'Alene for electrical operation.

SALT LAKE CITY, UTAH.—The Public Utilities Commission has granted the Utah Power & Light Company of Salt Lake City permission to furnish the town of Perry with electricity for power and heating purposes, but not for lighting.

CHEYENNE, WYO.—The Nevada-California Power Company, Symes Building, Denver Col., has applied to the State Water Commission at Cheyenne, Wyo., for permission to use 3763 acre-ft. per annum of the waters of Rush Creek, tributary to Mono Lake, for power development. The cost is estimated at $45,000.

Canada

MONCTON, N. B.—The Moncton Tramways, Electricity & Gas Company is considering the construction of an extension to Sunny Brae.

CORNWALL, ONT.—The International Joint Commission has granted the St. Lawrence Power Company, a subsidiary of the Aluminum Company of America, permission to construct a submerged dam across the south channel of the St. Lawrence River near Cornwall.

PETERBORO, ONT.—The Hydro-Electric Power Commission of Ontario is planning to construct a hydroelectric plant at Ranney's Falls, Campbellford, near Peterboro, to develop from 800 hp. to 10,000 hp. The cost is estimated at $1,250,000.

MONTREAL, QUE.—Plans are being considered by the City Commissioners for equipping one-half of the waterworks pumping station for electrical operation in order to comply with the demand of the Fuel Controller to reduce the consumption of coal.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Oct. 16, for copper cable and wire, electrical material, ceiling fans, repair parts for cars, etc. Blanks and information relating to this circular (1231) may be obtained at the above office or the office of the assistant purchasing agent, 24 State Street, New York City; 606 Common Street, New Orleans, La., and Fort Mason San Francisco, Cal.

Directory of Electrical Associations

Printed in the First Issue of Each Month

Alabama Light and Traction Association. Secretrry-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

American Association of Engineers. Secretary, A. H. Krom, 29 South La Salle St., Chicago, Ill.

American Electric Railway Association. Secretary, E. B. Burritt, 8 West Fortieth St., New York City.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

American Institute of Consulting Engineers, Inc. Secretary, F. A. Molitor, 35 Nassau St., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

American Physical Society. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

American Society for Testing Materials. University of Pennsylvania, Philadelphia, Pa.

Arkansas Public Utilities Association. Secretary-treasurer, W. J. Tharp, Little Rock, Ark.

Associated Manufacturers of Electrical Supplies. General secretary, C. E. Dustin, 30 East 42d St., New York City.

Association of Edison Illuminating Companies. Secretary, H. T. Edgar, Stone & Webster, Boston, Mass.

Association of Iron and Steel Electrical Engineers. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

Association of Railway Electrical Engineers. Secretary-treasurer, Joseph A. Andreucetti, Chicago & North Western Railway, Chicago, Ill.

British Columbia Association of Electrical Contractors and Dealers. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C.

Canadian Electrical Association, affiliated with N. E. L. A. Secretary-treasurer, W. Volkman, Toronto Electric Light Co., Toronto, Ont.

Colorado Electric Light, Power and Railway Association. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

Commercial Section, N. E. L. A. Secretary, Henry Harris, Pittsburgh, Pa.

Eastern New York Section, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

Electrical Credit Association of the Pacific Coast. Secretary, Albert E. Elliott, 502 Flatiron Building, San Francisco, Cal.

Electrical Manufacturers' Club. Secretary, Shiras Morris, Hart & Hegeman, Hartford, Conn.

Electrical Supply Jobbers' Association. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Meeting, Cleveland, Ohio, November.

Electrical Trades Association of Canada. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

Electric Power Club, Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

Electric Vehicle Section of the N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York City.

Empire State Gas and Electric Association. Secretary, Charles H. B. Chapin, 29 West 39th St., New York City.

Florida Engineering Society. Secretary, J. R. Benton, Gainesville, Fla.

Illinois State Electric Association. Secretary, R. H. Abbott, Petersburg, Ill.

Illuminating Engineering Society. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual meeting Oct. 10.

Indiana Electric Light Association. Secretary, Thomas Donohue, Lafayette, Ind.

Industrial Electric Heating Association. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

Institute of Radio Engineers. Secretary Alfred N. Goldsmith, College City of New York, New York.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). General secretary, C le Maistre, 28 Victoria St., Westminster, London, S. W., England.

Iowa Section, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

Jovian Order. Jupiter (president), Henry J. F. Strickland, Dallas, Tex.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo. Annual convention, Dallas, Tex., Oct. 14-16.

Kansas Public Service Association. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan. Annual meeting, Kansas City, Kan., Oct. 17-19, 1918.

Michigan Section, N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Detroit, Mich.

Minnesota Electrical Association. Secretary, H. C. Hoffman, St. Paul Gas Light Co., St. Paul, Minn.

Mississippi Electric Association. Affiliated with the N. E. L. A. Secretary-treasurer, L. D. Gordon, Jackson Light & Traction Co., Jackson, Miss.

Missouri Association of Public Utilities. Secretary-treasurer, F. D. Beardslee, 721 Locust St., St. Louis, Mo.

National Association of Eletrcical Contractors and Dealers. Secretary, H. C. Brown, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin.

National Association of Electrical Inspectors. Secretary-treasurer, William L. Smith, Concord, Mass.

National Electric Light Association. Executive secretary, T. C. Martin, 33 West 39th St., New York City.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

National Fire Protection Association. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

Nebraska Section, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

New England Electrical Credit Association, Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

New England Section, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

New Mexico Electrical Association. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

New York Electrical Credit Association. Secretary, Franz Neilson, 120 Broadway, New York City.

New York Electrical Society. Secretary, George H. Guy, 29 West 39th St., New York City.

Northwest Electric Light and Power Association. Affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

Oklahoma Gas, Electric and Street Railway Association. Secretary, L. W. W. Morrow, Norman, Okla.

Pacific Coast Section, N. E. L. A. Secretary, A. H. Halloran, 618 Mission St., San Francisco, Cal.

Pennsylvania Electric Association. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

Public Service Association of Virginia. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

Public Utilities Association of West Virginia. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston. W. Va.

Radio Club of America. Secretary, T. J. Styles, 152 Beach St., Yonkers, N. Y.

Rocky Mountain Association of Municipal Electricians. President, Lawrence Stone, Denver, Col.

Society for Electrical Development, Inc. General manager, J. M. Wakeman, 29 West 39th St., New York City.

Society for the Promotion of Engineering Education. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

South Dakota Electrical Power Association. Secretary-treasurer, O. J. Gronsdahl, Hartford, S. D.

Southeastern Section, N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus, Ga.

Southern California Electrical Contractors and Dealers' Association. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

Southwestern Electrical and Gas Association. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

Southwestern Society of Engineers. Secretary, C. E. Barglebaugh, 703 First National Bank Building, El Paso, Tex.

Toronto Electrical Contractors' Association. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

Tri-State Water and Light Association. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

Vermont Electrical Association. Secretary-treasurer, A. B. Marsden, Rutland, Vt.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill. Annual meeting, Chicago, Jan. 28-30, 1919.

Western Society of Engineers, Electrical Section. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

Wisconsin Electrical Association. Secretary, J. P. Pulliam, 1408 First National Bank Building, Milwaukee, Wis.

Record of Electrical Patents

Notes on United States Patents

1,276,618. Tuning Transformer; Carlyle B. Campbell, Sully, Iowa. App. filed Feb. 16, 1917. Unused portions of the inductance are completely cut off from the circuit.

1,276,634. Electric Light Socket; Joseph C. Forsyth, Brooklyn, N. Y. App. filed Feb. 24, 1917. Main body of the box may be detached from the head section thereof without disconnecting the current wires.

1,276,649. Electroplating Apparatus; Forest H. Hartzell, Dayton, Ohio. App. filed Dec. 24, 1915. Means for facilitating the discharge of the contents of the cylinder or drum.

1,276,675. Electric Switch; Ezra B. Merriam, Schenectady, N. Y. App. filed Feb. 10, 1914. Circuit interrupted promptly.

1,276,682. Dynamo-Electric Machine; Lewis W. Nelson, Niagara Falls, N. Y. App. filed Aug. 14, 1914. Employed in an automobile starting and lighting system.

1,276,714. Electric Battery; Raymond C. Benner, Fremont, Ohio. App. filed Feb. 7, 1918. Dry cells.

1,276,726. Brush Holder for Dynamos; John L. Creveling, New York, N. Y. App. filed Sept. 29, 1911. Current delivered by the dynamo to line will remain unidirectional regardless of reversals.

1,276,727. Reversible Brush Holder for Use with Dynamos; John L. Creveling, New York, N. Y. App. filed Dec. 26, 1911. For dynamos having rotors subject to reversals in direction of rotation.

1,276,737. Electric Gas Lighter; Roy F. Dowdy, Roanoke, Va. App. filed March 6, 1917. Novel construction of the handle.

1,276,739. Making Manganese Compounds; Carleton Ellis, Montclair, N. J. App. filed Oct. 27, 1916. For dry batteries of the Leclanché type.

1,276,754. Electric Battery; Walter Grothe, Fremont, Ohio. App. filed Feb. 5, 1916. Novel arrangements for supporting the electrode elements within the containers.

1,276,761. Telephone-Exchange System; Edward E. Hinrichsen, New York, N. Y. App. filed May 22, 1917. Less apparatus is required in accomplishing the same result.

1,276,766. Burned-Out-Lamp Replacer; Winthrop K. Howe, Rochester, N. Y. App. filed July 13, 1914. Burned-out lamp, particularly one of the kind used in railway signaling, may be replaced automatically by a perfect lamp.

1,276,767. Circuit Controller; Winthrop K. Howe, Rochester, N. Y. App. filed July 3, 1916. For governing the operating circuits of automatic trips or similar signal appliances.

1,276,771. Storage Battery; Harold W. K. Dell, Edgeley, N. D. App. filed May 7, 1917. Positive and negative plates are formed of carbon.

1,276,772. Telephone-Exchange System; Charles W. Keckler, Newark, N. J. App. filed May 24, 1917. Central-energy type.

1,276,783. Lightning Arrester; John R. McFarlin, Philadelphia, Pa. App. filed July 14, 1917. Effectively prevents a following flow of line or dynamic current.

1,276,800. Electric Fuse; Elmer L. Ogle, Chicago, Ill. App. filed April 23, 1917. Number of parts reduced to a minimum.

1,276,804. Electric Hammer; George M. Painter, Chicago, Ill. App. filed July 20, 1917. Impact member will move either slowly or fast, as desired.

1,276,827. System of Electrical Distribution; Harry L. Tanner, Brooklyn, N. Y. App. filed Aug. 28, 1914. For use as a system of electric lighting for railway trains and automobiles.

1,276,856. Method of Making Commutators; Vincent G. Apple, Dayton, Ohio. App. filed Feb. 14, 1918. The conducting bars of a dynamo-electric machine are made in one integral unit.

1,276,857. Art of Armature Construction; Vincent G. Apple, Dayton, Ohio. App. filed Feb. 14, 1918. Method of joining the terminal ends of armature conductors together and simultaneously to appropriate commutator segments or bars.

1,276,869. Automatic Controller; Guido E. Caglieri, San Francisco, Cal. App. filed Oct. 16, 1916. To be used in conjunction with the speedometer and the engine of an automobile.

1,276,911. Control System; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed March 13, 1916. Motors may be accelerated in a smooth and uniform manner with favorable torque characteristics and with absence of commutation difficulties.

1,276,912. Field-Control System for Single-Phase Commutator Motors; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed April 12, 1916. Maintains the strength of the main field at such values as to insure ample torque and good commutation under varying conditions of speed and of load.

1,276,913. System of Control for Single-Phase Commutator Motors; Rudolf E. Hellmund, Pittsburgh, Harry E. Meyer, Wilkinsburg, and Andrew H. Candee, Pittsburgh, Pa. App. filed April 12, 1916. Enables a motor to be accelerated with ample torque and with favorable commutating conditions under widely varying loads and line voltage.

1,276,914. Supply System for Pulsating-Torque Motors; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed May 20, 1916. Load may be driven with a substantially uniform torque by means of motors.

1,276,925. Watt-Hour Meter; Charles L. Inglefield, Midland, Pa. App. filed Dec. 15, 1914. Eliminates variable and uncertain element.

1,276,930. Steering-Wheel Hand Warmer; Charles W. Kemper and John T. Kemper, Oakland, Cal. App. filed April 17, 1917. Can be conveniently grasped to steady and turn the wheel while driving and to provide electrically operated heating elements.

1,276,934. Electric Lighting System for Automobiles; Ernest W. Lane, Waverly, Iowa. App. filed July 26, 1918. Supplies a convenient means for switching lamps which are in series circuit with a magneto or other source of electric current into a multiple circuit with a source of electric current of lower voltage.

1,276,966. Electric Light Fixture; Harry Rubin, Baltimore, Md. App. filed Aug. 31, 1917. Reflector and bowl constitute a two-piece electric lighting unit.

1,276,997. Telephone System with Instantaneous Disconnect and Recall; Thomas J. Tune, Cleveland, Ohio. App. filed Oct. 10, 1914. Instantaneous disconnect circuits.

1,277,003. X-Ray System; Harry F. Waite, New York, N. Y. App. filed Oct. 18, 1917. For dental and similar work in which rotating parts are eliminated.

1,277,025. Telephone and Telegraph Cable; Gustavus A. Anderegg, Oak Park, and Wilbur E. Mougey, Chicago, Ill. App. filed June 30, 1916. Duplex cable.

1,277,042. Dry Cell; Charles F. Burgess, Madison, Wis. App. filed March 26, 1917. Obviates the expense and disadvantages of a soldered bottom.

1,277,044. Inclosed Electric Fuse; Robert C. Cole, Hartford, Conn. App. filed March 28, 1918. Semi-refillables.

1,277,045. Electric Fuse Link; Robert C. Cole, Hartford, Conn. App. filed March 28, 1918. Simple, cheaply formed and accurately calibrated link.

1,277,071. Electric Plug; Harold P. Hastings and Lloyd C. Smith, Syracuse, N. Y. App. filed July 30, 1915. Simple and compact in construction.

1,277,078. Ignition System; John W. Jepson, Depew, N. Y. App. filed July 9, 1915. Has a battery and generating armature for feeding the ignition circuit and charging the battery.

1,277,091. Telephone-Exchange System; Frank A. Lundquist, New York, N. Y. App. filed Dec. 2, 1916. Automatic switches are employed in extending connections from one line tó another.

1,277,095. Lightning Arrester; John R. McFarlin, Philadelphia, Pa. App. filed Oct. 26, 1916. Expulsion type.

1,277,101. Motor-Controlled Switch for Headlights of Automobiles; Seth Mulvaney and Elmo L. Borner, Inglewood, Cal. App. filed Aug. 14, 1916. Used in connection with an automobile electric generator.

1,277,133. Protective Device; Roy G. Sands, Waukegan, Ill. App. filed March 19, 1917. Lightning arresters used for outdoor service in connection with telephone lines.

1,277,147. Multicell Electric Battery; Arthur V. St. Armande, Paisley, Scotland. App. filed Feb. 15, 1918. Consists in shrinking on to the cells a wrapper of insulating or waterproofing material as celluloid.

1,277,175. Automobile Signal; Robert C. Barfield, Salem, Ore. App. filed March 20, 1917. Operator of the automobile may readily notify the traffic in front and rear of the automobile in which direction a turn is contemplated or if a stop is contemplated.

1,277,223. Electric Switch; Franz Kratz and Gottlob Honold, Stuttgart, Germany. App. filed March 9, 1915. For internal-combustion engines on automobiles, motorboats and other moving vehicles.

1,277,225. Self-Steering Bomb; Hans Lausen, Wisdom, Mont. App. filed May 18, 1918. For automatically directing the projectile toward the object to be struck or bombed.

1,277,237. Tie Clamp for Insulators; Theodore R. Mausen, New Brunswick, N. J. App. filed Aug. 2, 1917. One of the jaws moves bodily with respect to the other in both the clamping and unclamping actions.

1,277,249. Overload Definite-Time-Limit Relay; Lloyd C. Nicholson, Buffalo, N. Y. App. filed Sept. 7, 1915. Will produce a certain definite motion in a certain definite number of alternations during which an overload current of greater value than a predetermined quantity remains in the circuit.

1,277,267. Automatic Speed Control for Automobiles; Arthur L. Skells, Henry, S. D. App. filed Nov. 12, 1917. Automatically cuts off the supply of electric current to the spark plug of an engine.

1,277,270. Lamp Support; Alexius Sunden, Coquille, Ore. App. filed Aug. 25, 1916. Object carried by the supporting stand may be adjusted in any desired direction and raised or lowered as required.

1,277,274. Artificial-Line-Selecting System; John F. Toomey, New York, N. Y., and Walter V. H. Read, Newark, N. J. App. filed March 31, 1917. Two-way two-repeater type wherein each transmission-line section is balanced by an artificial line.

1,277,303. Automobile Signal; Eugene Frey, Oakland, Cal. App. filed May 23, 1917. May be easily attached to existing vehicles and will be visible both from the front and rear.

1,277,304. Metal-Protected High-Potential Insulator; Bela Gati, Budapest, Hungary. App. filed July 22, 1915. Metal casing covering the insulation body projects beyond the insulation body, and the surface of the same not covered by the metal casing is formed in accordance with the principles of electrostatic strain.

1,277,321. Meter Panel; Hubert F. Krantz, Brooklyn, N. Y. App. filed Jan. 23, 1913. Means for contacting any selected meter bar while by the same movement contacting a contact member of opposite polarity.

1,277,348. Ignition Mechanism; Christian Aalborg, Wilkinsburg, Pa. App. filed Aug. 28, 1915. Usual separate devices of ignition system combined in simple manner.

1,277,360. Locomotive or Car Truck; Asa F. Batchelder, Schenectady, N. Y. App. filed Jan. 11, 1918. Uses electric motors as part of mechanical portion.

1,277,365. Vacuum-Type Converter; Wilfred T. Birdsall, Montclair, N. J. App. filed Oct. 9, 1915. Cathode blast interposed between two anodes subject to short-circuiting.

1,277,371. Motion-Translating Device; James M. Boyle and Fritz Reichmann, New York, N. Y. App. filed Jan. 9, 1914. Magnetism substituted for mechanical contact.

1,277,378. Sterilizing Apparatus; Ralph E. Case, South Norwalk, Conn. App. filed March 13, 1916. Electrolytic cell controlled by quantity of liquid passing.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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Government Ownership of Transmission Systems

THE president of the Turners Falls Power & Electric Company, in an address before the New England Section of the National Electric Light Association, recently made bold to prophesy government ownership of electric transmission systems in the near future. This is no new thought, because economists have for years in a vague and general way contended for the same thing. But the time when the nation will want to own the electric transmission systems of the country is yet a great way off. Until such systems multiply manyfold and become interconnected more intimately than they are at present, no action toward national ownership is likely of passage. Except in a few localities, transmission networks are incomplete and very much disjointed. State ownership and operation of electric transmission systems like that in the Province of Ontario, Canada, are more likely to come first than national ownership, for obvious political and business reasons.

The economic theory back of the government ownership scheme is that if a nation wants or needs development along certain lines is must provide the means for making and carrying on such a development without regard to profit. Does it want to sell its products in foreign countries, then it must provide a merchant marine. If it needs to develop its own resources by means of highways, railways, canals, etc., then the government must tax or bond itself or guarantee private bonds in order to subsidize the needed improvement. Moreover, the government can direct where the improvements shall be made, and this may not necessarily be where the returns are highest, as is the case under private speculation. But it is only the basic industries that may be affected—those upon which all industries depend for material, for mechanical power and for markets—and were electric transmission the most fundamental of all national activities, there might be some possibility of the government taking it over. However, the chances are remote.

For the present electric transmission systems supply a very limited territory and not all industries in that territory. The telephone and telegraph, the railroads and the express are national in scope, and it was but natural that when they were consolidated and interconnected so intimately the national government should take them over. The gas, electric, street-railway and water-supply systems are purely local enterprises and are in no danger of state or national ownership, although the possibilities of municipal ownership are ever present. Besides, electricity is not yet the dominant motive power. It will be some day, and when that time arrives we can begin to give serious thought to state ownership of transmission systems. Even then, if private utilities continue to serve the public better than those owned by the government, they will survive.

You have joined yourselves to the entire manhood of the country and pledged, as did your forefathers, "your lives, your fortunes and your sacred honor" to the freedom of humanity.—President Wilson to the Students' Army Training Corps.

War and Engineering Education

LAST week about 500 colleges opened their doors to receive some 150,000 students. These young men were inducted into the Students' Army Training Corps and have thus become candidates for commissions in the army. The part of the engineering colleges will be to train men especially for the Engineer Corps, the Signal Corps and the Chemical Warfare Service, and it may be noted with pardonable pride that the training previously given in engineering is considered the best preparation for these branches of the service. Under the new régime, however, the maximum time allowed for the full engineering course is two years, including work in the summer quarters, and the further training of men with advanced standing will be curtailed accordingly. Each college will be expected to outline its courses much on its own initiative, especially for men who have already spent a year or more in that institution.

At this stage of the development of engineering education for war we are reminded of the work done by teachers in the engineering colleges beginning a year ago last May, when they were asked on about two weeks' notice to prepare to receive men for training in military aëronautics. While the lecture material and laboratory apparatus were collected and arranged under difficult circumstances, the officers in responsible charge in Washington were enabled to choose the best methods developed in the six different schools and thus quickly arrange a satisfactory training course. It is to be hoped, however, that the engineering colleges will not follow in the footsteps of the aviation schools in at least two respects. It seems undesirable to put civilian instructors in uniform and certainly a mistake to have them decorated with brevet officers' bars. An instructor with any character should have no trouble in gaining the respect of his classes in this serious undertaking. Again, in the matter of standardization, we trust the engineering colleges will not make animated phonographs of their teachers.

It is quite evident that the War Department has outlined an excellent device for producing a high grade of men to lead the army. Those who lag behind in their college work are transferred to army cantonments, while those who complete their college courses with credit are sent to officers' training camps and there must prove their ability to handle men before they receive commissions. Only the most capable men will survive such tests.

While we are thus assured that the primary purpose of developing a high class of officers will be attained, it is interesting to speculate upon the effect of this intensive training on engineering education. Much of the preliminary work in mathematics, languages and science will be eliminated or curtailed, and we shall have an opportunity to view the results of this system of education, provided that the war lasts several years. On the one hand, it is doubtful if these men will have the training which will probably be required for meeting the tremendous problems of reconstruction. It would seem desirable, therefore, to encourage them to complete their engineering preparation after the war, and the plan of giving credit for the intensive war courses toward a degree in engineering should be adopted. On the other hand, it is reasonably certain that the character of the men who complete the new engineering courses will be excellent, and the colleges should insist upon this high standard of scholarship and character after the war.

To succeed you must not only be inspired by the ideals for which this country stands, but you must also be masters of the technique with which the battle is fought. You must not only be thrilled with zeal for the common welfare, but you must also be master of the weapons of to-day.—President Wilson to the Students' Army Training Corps.

Engineering Experiences Helpful

IN SUCH times as these when liberty is at stake and when indifference may mean submission to autocracy every one should think of some way in which he can help the cause of democracy most effectively. One task which confronts operators is to bring industrial plants to their maximum efficiency and maintain them there so that they can supply our armies with necessities that permit them to wage war. For this latter purpose continuous and adequate motive power is necessary. Without it production will be curtailed, and any interruption may result in a reduction in output that may not only mean hardships "over there" but perhaps reverses to our military program.

The task of supplying continuous motive power is for the most part clearly up to the electrical industry. The manufacturer must furnish the equipment; the consulting engineers and industrial plant engineers must select and install the factory equipment properly. The equipment needs to be inspected and maintained by the factory electrical force, and finally the generating stations supplying power must also be properly manned, equipped and operated. Here lies the big problem because electric companies, like other industries, are confronted with labor shortage, scarcity of necessary building and operating materials like copper, steel and coal, difficulty of securing money to finance extensions, or inability to operate successfully under existing rates.

Every engineer should therefore consider it his patriotic duty to give the rest of the electrical industry the benefit of his experience regarding special problems arising. He should not be satisfied with merely making it available, but should present it where it will reach the largest number as quickly as possible and not a year from now, when it may not be needed. If every one will contribute his share, the entire industry will benefit immensely.

A new era begins in which all the learning of America is now laid upon the altar of service, and it is your high privilege to minister to that great sacrifice.—Elihu Root to the Students' Army Training Corps.

Affiliated Local Sections of Technical Societies

THE important work being accomplished by the United Engineering Society and by the Engineering Council in the name of its affiliated national engineering societies is gradually leading to a similar affiliation of local sections or chapters of these societies in some large cities. Atlanta, Indianapolis, San Francisco and Philadelphia are the best known examples of such affiliation. The larger a local association and the more general its name, the more influence it can exercise in public and business affairs. The public and the legislators are more liable to listen to a measure urged by the American Medical Association than to a resolution passed by an institute of ear and nose specialists. The same is true of large engineering problems or projects, in which a combined judgment of at least two kinds of engineers is usually required. In union there is strength, and there is little danger that such a union of local engineers would not be in accord with the best public interests. The affiliated technical societies will, as a rule, voice sound engineering principles against grafting or incompetent city politicians, or help willing officials in perplexing technical problems.

The broadening aspect of such an affiliation upon the engineers themselves should be very beneficial. Narrow clannishness, petty jealousies, lack of interest in other branches of engineering, rust and mildew, all these will be quickly removed by rubbing against one's professional cousins and uncles. Of course, wisdom would dictate an arrangement of successive meetings of interest to various large groups of members. An opportunity should also be provided for a small group of specialists to come together occasionally to talk over their pet schemes and demonstrate their discoveries.

The problem of organization is probably different in a scattered large city and in a close industrial center or a technical college, and it is best that each locality work out its own problem. In Philadelphia a prosperous and active engineers' club is available to which many members of affiliated societies belong, and that club has naturally become the nucleus for the affiliation. In Atlanta, where no such club is available, an executive committee was created consisting of two representatives from each of a number of national societies. There are many cities in this country in which engineers could and should organize in one body, like other professions, for their own benefit and for that of their communities. The present troubled times and the reconstruction after the war will offer many an opportunity for important discussion and action by such local affiliated technical societies throughout the country.

Heating of Conductors by Intermittent Loads

WE PUBLISH this week the second part of an article by Henry C. Horstman and Victor Tousley dealing with the effect of intermittent loads in heating conductors. It admirably supplements their previous discussion of some of the more general phases of heating and is peculiarly pertinent just now when conditions require the utmost discretion in the use of material. The fact is that the customary rules for the size of conductors were settled not on the basis merely of fully meeting the actual requirements but of playing safety to an extent that would be generally condemned if applied to an ordinary engineering problem. One does not design an ordinary bridge, and should not design it, on the theory that by some chance in the dim future it may be necessary to load it with a 42-in. Howitzer battery in full action. It is enough to proportion the steel with an ample factor of safety for any loads that may reasonably be anticipated. Present wiring rules seem to be designed with reference to the abnormal rather than the normal, and hence information as to the real effect of conditions that are merely unusual rather than extreme is of very definite value.

As the authors indicate, intermittent loads are of two very distinct kinds. One of them is simply cyclic, the load coming on and going off in a manner altogether regular, although perhaps subject to some variation in amount and periodicity. This presents an easy problem on account of the regularity of the conditions. The other variety is more difficult to treat because it is altogether and fundamentally periodic and irregular, times of no load and extreme load following one another without semblance of uniformity. For each of these cases Horstman and Tousley present carefully worked-out tables, based in the one case upon the effect of determinate periodic applications of load and in the other case upon the estimated conditions of full and of peak load. In the former class of work it is fairly easy to determine the integrated heating and cooling effects and the consequent rate of rise of temperature up to the point where it is balanced by increased cooling. In the examples worked out, which seem to be altogether typical, it appears that the conductors specified by the code are quite unnecessarily heavy. The second class of intermittent load demands more detailed examination, but by following the plan of using the tables with a proper tabular correction for peak a result is reached in fairly close accordance with the more rigorous and vastly more troublesome root-mean-square method as derived from actual or estimated graphs of the load.

Making Ready for Fuel Contingencies

OUR report this week from the big new railway plant in Buenos Aires conveys a serious lesson in preparedness of the kind that does not propose to be caught napping. Argentina was and is exposed to probable shortage of fuel from lack of transport, and in building the new plant for the suburban work of the Central Argentine Railway preparation had to be made in advance for meeting a condition that was surely at hand. The station itself, a three-phase, 25-cycle plant, transmitting power to the substations at 20 000 volts, is planned so as to meet any sort of difficulty that might arise in the generation of steam. Provided a single boiler is in operation, any of the four turbo-generators can feed the distributing system and all the various auxiliaries. The whole organization of the plant, in fact, is a recognition of the modern viewpoint that the generating units are thoroughly efficient and reliable and that the greatest outstanding chance for better economy and immunity from operative difficulties lies in giving close attention to furnaces and boiler equipment.

In the present instance not only was a very complete coal and ash handling equipment provided and a system for treatment of the feed water installed, but, realizing the coming difficulty of securing coal, plans were inaugurated for using both wood and oil. Certain of the boilers were equipped with a complete system for burning crude oil; storage and filtering facilities were provided, and all was made ready for immediate use. A little later it became evident that coal and oil were alike involved in the war situation, and other furnaces were adapted to utilize wood efficiently. At the present time, therefore, all three fuels are in use side by side, and recent records show that wood predominates, although there as here it is probably uneconomical when anything else can be had. Selected dry hard wood tested for calorific value by laboratory methods shows very respectable results. Secured as it comes in the market, mixed and unseasoned, the costs per thermal unit utilized are high.

From the standpoint of conservation, too, wood must really be classified among the undesirables. It takes per unit thermal value much more labor to get out than coal, requires handling several times, stick by stick, takes up four times as much room in the cars with resulting increase in dead weight hauled, burdens the transportation systems, and is inconvenient to store and fire. Labor and rolling stock can be much more efficiently employed in mining and shipping coal.

The Coming Issues

WITH coal as scarce as it now is, every effort should be made to utilize the lower grades where no other source of power is available and where such fuel can be obtained without long transportation. In this way the drain on the higher-quality coal will be reduced and a hitherto much overlooked supply utilized. One of the most successful ways of burning the real low-grade fuels has been by pulverizing and then igniting them as they are projected in the furnace. Some recent experience in connection with such operation will be presented in an early issue. Features of design and construction embodied in a new generating station to make it immune from the usual operating troubles will also be discussed. Economy in the use of existing equipment is just as important as economy of coal, so a method will be outlined by means of which it will be easy to determine the most economical loading for individual transformers operating in multiple. Some information on the cost, speed and effectiveness of electric spot welding will also be given.

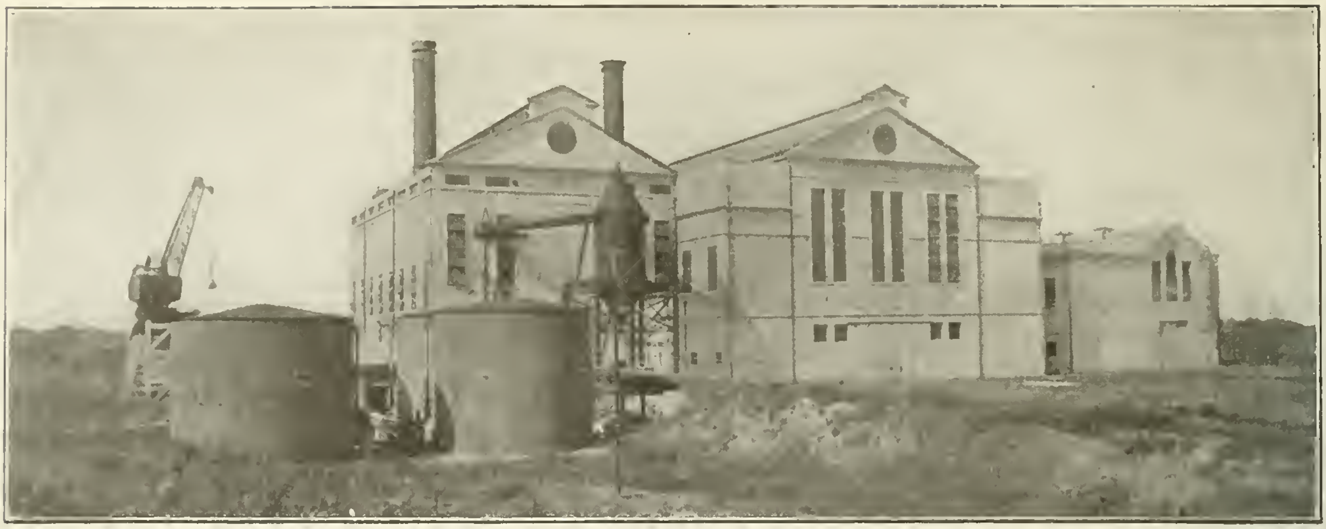

FIG. 1—CENTRAL ARGENTINE POWER HOUSE AT BUENOS AIRES

Plant Designed to Meet War-Time Conditions

Equipment Selected and Arranged to Provide Utmost Flexibility of Operation—Arrangements for Burning Coal, Oil and Wood—Electrical Features of Power Plant

THE power plant required for the electrified section of the Central Argentine Railway, serving the northwestern suburbs of Buenos Aires is interesting because it was designed to meet extraordinary conditions imposed by the war and its distance from the great electrical markets of the world. The station was made very complete in detail and flexible in design, with every device to provide against shutdown in case of accident to any part of the equipment. A noteworthy example of the completeness of the design is shown in the provision for burning coal, oil or wood under the boilers.

The complete electrification includes a 15,000-kw. power station, 57 miles (92 km.) of high-tension transmission cables, four substations and the electrical equipment for 100 miles (160 km.) of single track. Power is produced in three-phase form at 20,000 volts, 25 cycles, and supplied to the trains at 800 volts through a third rail. The engineering work was carried out by Merz & McLellan of London, England, with the coöperation of the railway's consulting engineers, Livesey, Sun & Henderson. The whole of the apparatus used in connection with the electrification was manufactured in Great Britain, and the principal contracts covering the erection of the plants were handled by English contractors. A description will be given in considerable detail on account of the unusual conditions encountered.

POWER HOUSE LAID OUT ON THE UNIT SYSTEM

The power house is built on swampy ground between the Tigre Line and the Rio Lujan, about 3000 reinforced-concrete piles having been driven to support its weight. A concrete cap reinforced with old rails was cast on top of the piles with conduits embedded in it to carry the station power cables. The plant contains six Babcock & Wilcox marine-type boilers of 4170 sq.ft. (390 sq.m.) heating surface each; four Parsons horizontal reaction turbines, with high-pressure and low-pressure cylinders, connected to three-phase, 25-cycle, 2500-volt generators; the necessary steam, electrical and mechanical auxiliaries of all kinds.

The turbine and boiler rooms are arranged parallel to each other with coal and ash handling sidings behind the latter. In front of the turbine room are a rotary converter substation, a laboratory and the offices. A fittings shop and workmen's accommodation are provided at the permanent end of the turbine room, the other end being arranged for later expansion. The boilers are arranged four on a side, grouped in pairs, each boiler having its own superheater and economizer. One steel chimney with induced-draft fans serves each pair of boilers, and forced draft is supplied to the furnaces by four fans in the basement The boilers are designed for a working steam pressure of 210 lb. per square inch (14.8 kg. per sq.cm.) and 600 deg. Fahr. (315 deg. C.) temperature. They are equipped with underfeed stokers, Green economizers and four feed pumps, two of the centrifugal type driven by impulse turbines, two of the vertical reciprocating Nichols type.

PROVISION FOR COAL SHORTAGE

In anticipation of the shortage of coal two of the boilers were arranged for oil firing, and a complete equipment of the Wallsend Howden system was provided, with the necessary storage tanks, filters and pumps. As the shortage of both coal and oil, owing to war conditions, became more acute other boilers were adapted for wood firing. The present situation will be understood from the statement that during a recent week the plant consumed 72½ tons of coal, 15½ tons of oil and 620 tons of wood. The calorific value of the wood is from a quarter to a third that of coal containing 15,000 B.t.u. per pound (8300 calories per kg.). Water is pumped from the River Lujan to a reservoir where it is treated with alumino-ferric to precipitate the sediment.

The storage and handling of coal is accomplished by means of an elevated railway track running alongside the boiler house at firing-floor level, a gantry crane running parallel to the buildings and carrying a jib crane with a 2-ton bucket, and two sidings at ground level. The coal can be lifted from the railway cars and transferred either direct into two 15-ton receiving hoppers or into bottom-discharge wagons which can be hauled along the elevated siding by a winch until they come over the receiving hoppers. In the latter case the coal passes through crushers to gravity bucket conveyors by means of which it is elevated to a distributing conveyor which discharges it into the coal bunkers above and between the two rows of boilers.

The coal bunkers, which have 1000 tons capacity, are built of mild-steel plates lined with reinforced concrete. The bottoms are V-shaped in section. The stock coal is lifted from the trucks and stored below and around the gantry within range of the jib crane, which can work to a radius of 50 ft. (15 m.). The stock storage is 10,000 tons.

The ash-handling system comprises a suction ash plant with two 38-hp. exhausters which take the ashes from the furnace ash pits through electrically operated crushers and specially heavy cast-iron pipes to an 80-ton steel ash bunker lined with reinforced concrete. This is erected at the end of the boiler house at such a height that railway tracks can pass underneath it to receive and remove the ashes. Alternately the ashes can be taken from the ash pits by half-ton cars along tracks laid on each side of the boiler-house basement and deposited outside the site.

The generating equipment is so arranged that, provided one boiler is steaming, any one of the turbo-alternators can be used to feed the main busbars and all station auxiliaries. The breakdown of any part of one generating unit will not prevent the operation of the remaining equipment. Each of the four turbines has its own steam-driven oil pump to float the bearings and facilitate starting up. The exciters, which are self-excited, are directly connected to the alternator shafts. The high-pressure and low-pressure portions of the turbines are in separate casings, the high-pressure stage being of cast steel. Each turbine is connected with its condenser, below, by an expansion joint. The generators, which are totally inclosed, are ventilated by fans on the rotors that draw air through a dry-air filter and discharge it into the turbine room. The stator slots are completely closed, and each contains only one conductor.

Leads from the alternators run direct to "unit" transformers, which in turn apply 440 volts to "unit" distribution boards. From these boards are fed the motors which operate the unit auxiliaries. The auxiliaries common to the whole station, such as economizers and fan motors, are fed from a station distribution board made in four sections. The main leads from each alternator run to a step-up transformer which is housed in the same compartment as the unit transformer and raises the voltage from 2500 to 20,000. The station equipment as a whole is divided into two independent parts, and the main busbars are divided in the middle by a busbar sectionalizing switch. The combination of an alternator and a step-up transformer as one unit permitted the alternator voltage to be so selected as to give the simplest and most robust stator winding.

The step-up and unit transformers belonging to each

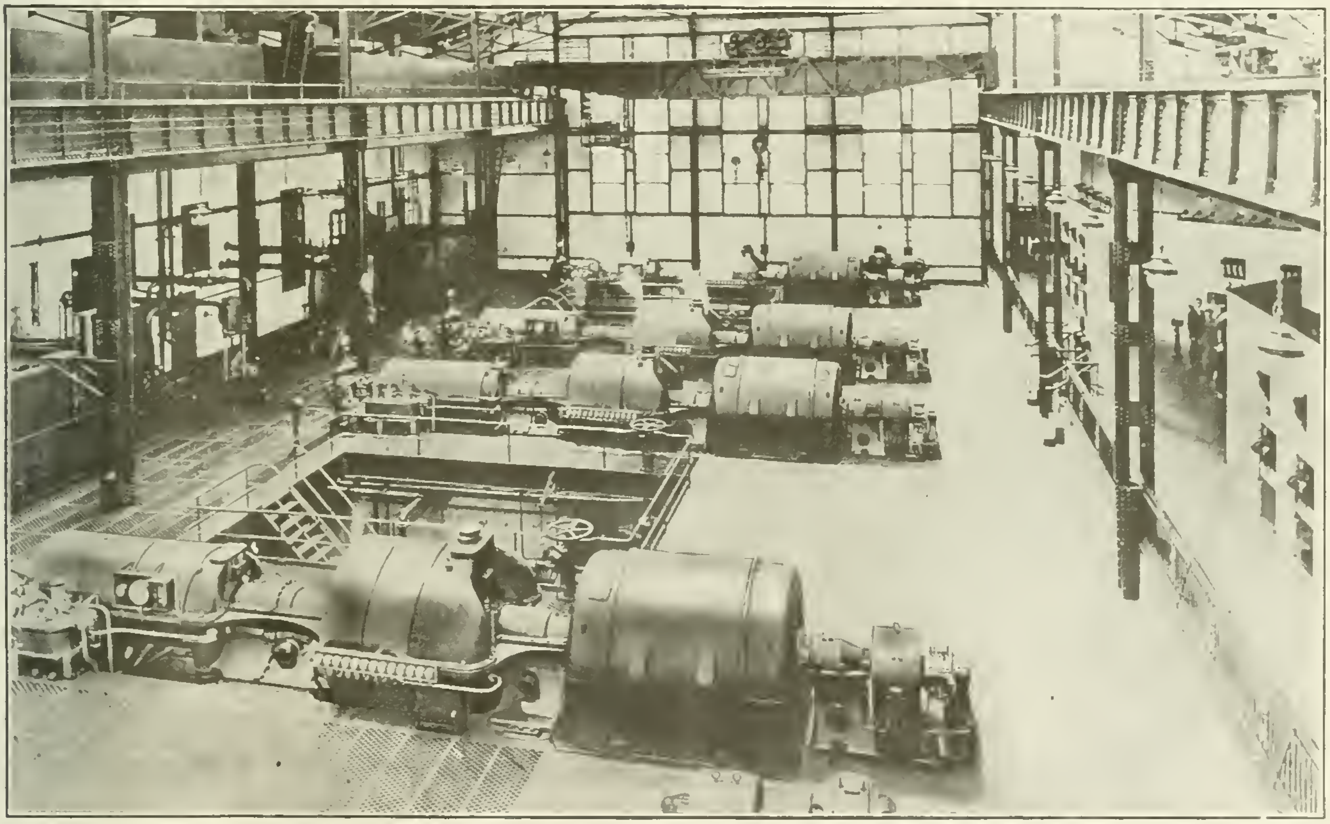

FIG. 2—GENERATOR ROOM WITH RAISED OPERATING PLATFORM AT RIGHT

generating set are housed in chambers in the basement, openings being provided in the turbine-room floor through which they can be handled by the crane. These chambers are ventilated by fans which draw air through the basement. Each step-up transformer has its own oil cooler through which the oil is circulated by a rotary pump. The unit transformers are air-cooled.

The condensing water is taken from the River Lujan and discharged into the Rio Rosquetes, a small creek. The condenser shells are of cast iron and the tube plates are of rolled brass 1⅛ in. (291 mm.) thick. The tubes are ¾ in (19 mm.) in external diameter and are of solid drawn copper No. 18 S. W. G. Aluminum blocks are fixed in the water chambers in metallic contact with the tube plates.

Centrifugal circulating pumps are used with bodies of cast iron and impellers of gunmetal. The motors driving these pumps are housed in a steel-frame corrugated-iron sheeted house erected on a wooden jetty projecting from the bank of the river. In addition to the main circulating pump motors the jetty carries a centrifugal pump capable of delivering 300 gal. (1100 l.) per minute against a head of 20 ft. or 95 ft. (6 m. or 29 m.). This supplies water through a 6-in. (15-cm.) pipe either to the purified water reservoir or direct to the storage tanks in the pump house. Two motor-driven air exhausters are also installed in the pump house, each capable of producing in three minutes a vacuum of 20 in. (508 mm.) in any one of the main pumps including its suction pipe and discharge pipe up to the discharge valve.

SOME ELECTRICAL FEATURES OF THE POWER PLANT

All main switching is carried out at 20,000 volts, the main switchgear being installed in a bay on the side of the turbine room opposite the boiler house. The operating gallery is about 4 ft. (1.2 m.) above the turbine-room floor to give the operator a good view of the machines. The generator panels, which are in the middle of the gallery, are set round a semicircle, while the station transformer and feeder panels stand on either side of the generator panels parallel to the axis of the engine room.

Each operating panel consists of two cast-iron plates built into a wall of molded concrete, 11 ft. (3.35 m.) high, faced with glazed tiles. At the back of this wall, which is set forward 3 ft. (90 cm.) from the main panels, is the auxiliary wiring. In the case of the generator panels the instruments are mounted on the wall above the upper cast-iron plate, and below them are the indicating lamps showing the oil-switch positions. The operating levers, trip coils and time-limit fuses are carried on the plates, as are also the integrating wattmeters and several minor sets of switches. In front of the generator panels are pedestals carrying the exciter instruments and control equipment and signaling apparatus.

The main panels are formed of molded concrete cubicles 5 ft. (1.5 m.) wide, the main well being 9 in. (22 cm.) thick and the sides 4 in. (10 cm.). These are separated each into five stories occupied, beginning at the bottom, as follows: Potential transformers, cable-isolating switches and current transformers, all switches, busbar isolating switches and busbars. The compartments are protected by screens of standard metal inter-

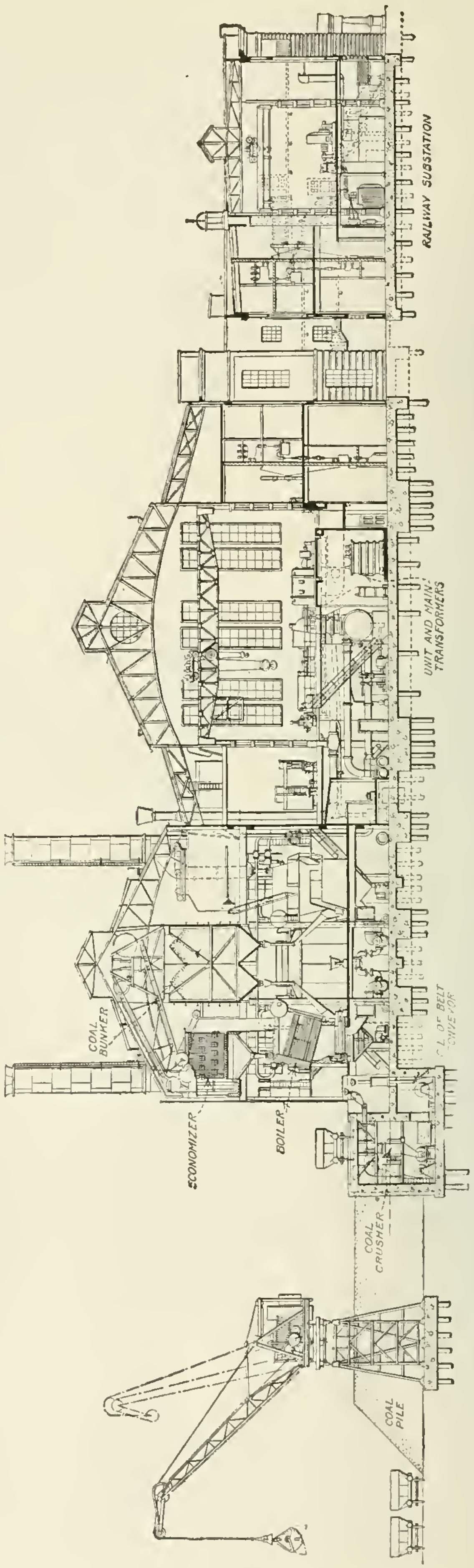

FIG. 3—RELATIVE POSITIONS OF IMPORTANT PARTS OF ARGENTINE POWER HOUSE

locked with the main switch so that they can be opened only when the switch is opened. The three phases of each high-tension switch are contained in one tank, which is built of wrought-iron plates with special stiffening channels to take care of the maximum pressure generated in the tank when the switch opens on a fault. A vent pipe leads from the top of the tank to the outside of the switch cubicle to carry off any gases that may form. The leads to the switch terminals enter through cast-iron "U" bands filled up solid with compound.

The current transformers are of two types, one for mounting against a wall, the other passing through the floors between the compartments of the panels. The use of the latter saves floor insulators and economizes space. Permanent testing busbars are provided on the generating panels, a water resistance being furnished to take the load of the generator under test.

The unit distribution boards are built of enameled slate panels and have the busbars mounted in front. Porcelain-handle fuses connect the busbars to studs which pass through the slate to the motor leads at the back. Feeders are run from the station distribution board to the station auxiliaries and also to the unit distribution boards, so that the latter can be energized when power is not available from the unit transformers. In order to avoid any risk of paralleling generators out of phase through their unit transformers the switches on the two feeders to each unit distribution board are interlocked so that only one can be closed at once. They are also arranged in such a way that the change-over from one supply to the other can be so quickly effected while the auxiliary plant is running that there is no drop in the speed of the motors that reaches an appreciable point.

When the plant was under consideration the split-conductor system of feeder protection had not been sufficiently tried out to justify its adoption in foreign work of such importance. Consequently 20,000-volt underground feeders with three simple cores were employed and pilot cables used for the protective devices.

The high-tension cables have $\frac{1}{10}$ sq.in. (64 sq.mm.) of section and are of the three-core, paper-insulated, lead-covered, single-wire armored type. The pilot cables are 0.005 sq.in. (0.32 sq.mm.) in cross-section of the same general type. In general, these cables are laid in the same trench with the telephone cables at a distance of about 1 in. (2.5 cm.) from each other. Above the high-tension cable and about 4 in. (10 cm.) from it is placed a creosoted plank. All joints in the high-tension cables were made in gun-metal sleeves, wiped to the lead of the cable, the sleeves themselves being surrounded by a creosoted wooden box with an iron cover. The sleeves were filled with compound. Wherever the armoring is interrupted the joint is spanned by a copper bond of 0.05-sq.in. (0.32-sq.cm.) section.

How Best to Educate Power-Plant Operators

After Trying Engineering Society Activities, Classes in Academic Subjects, Classes in Practical Topics and Correspondence School Courses, Toledo Company Favors Self-Governing Boiler-Room Club

BY W. E. EAST*

EXPERIENCE leads the Toledo (Ohio) Railways & Light Company to believe that the best way to educate power-plant operators is to make arrangements to let them conduct their own educational work. It is believed best to have meetings at the plant when the men are off duty and to pay the men for the time thus occupied if necessary to secure full attendance. The classes should be run on a club basis. It has been learned that if a group of men from the "front office" try to initiate a movement for the benefit of the plant men the whole plan will be viewed with suspicion. So educational work must proceed from the inside out, not from the outside in. The part of the company's officials and department heads in this work should be to make the operators feel the need of educational activities and then to let them take it up among themselves, helping them, of course, if they desire help, but never trying to force assistance upon them.

It is also believed that such abstract studies as arithmetic, physics, electricity and mechanical drawing have no place in these meetings. Men who wish to take such subjects will avail themselves of other opportunities to learn them. The real province of the power-plant club is to take up problems of ordinary operation. Questions arise daily as to the best methods of operating stokers, boilers, condensers, etc. At a weekly get-together meeting the club can handle these topics. A fireman, for example, may have ideas of his own, based on his experience, as to how to operate his stokers. The boss may have told him to run his stokers in a way that seems quite wrong, but if he is the right sort of a fireman he will be willing to learn that he is wrong through discussion in the weekly meetings.

Meetings appear to be most successful when the program includes discussion and study of only one piece of apparatus. A good plan is to have some one previously appointed to give a description of the apparatus illustrated with blueprints and catalogs. A question box should be established and used. If manufacturers' rules pertaining to operation of the apparatus are available, they should be read. Then the meeting should be thrown open for discussion by every one from the ashman to the boss. Material and literature from manufacturers should be preserved to form a reference library for the club.

Employees of the Toledo company have such a club. It is known as the Water Street Boiler-Room Club, because its membership consists of practically every boiler-room operator at the Water Street generating station. Mr. Washburn, the boiler-room fireman, was instrumental in organizing it, and the men have supported it enthusiastically, electing him president. All suggestions are acted on by the club before the reports of those suggestions which seem worth while are submitted by the club president to the superintendent of production. The club, in general, works along the lines discussed above, although it also engages in some social activities. While the club is still young, successful results thus far indicate that it will serve to promote general welfare of the men and the company.

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*From a paper presented before the station operating committee of the Ohio Electric Light Association.

Other Correlated Activities Also Important

In addition to the boiler-room club, the employees and the Toledo company participate in other educational activities. One of these is the joint section of four national engineering societies, the National Electric Light Association, the American Gas Institution, the American Electric Railway Association and the National District Heating Association. The joint section was organized for the educational improvement of its members and to foster good fellowship through social events. It has conducted a number of weekly evening classes in arithmetic, algebra, electricity and mechanical drawing. Day classes have sometimes been held for night shifts. The company has paid for instructors and furnished the meeting room. The classes have been conducted on the same principle as classes in grade schools. On the whole, the work has been successful in teaching general subjects, and the joint section is largely responsible for other educational work which has since been started. As a further means of providing men with opportunities for general education the company pays three-fourths of the cost of a correspondence-school course if an employee completes the course.

Another plan that was used for a time to teach practical topics was the "station-operating class." As a part of this plan a course of study was laid out and speakers were asigned various topics as follows:

Introductory meeting; outline and discussion of work planned; fuels and combustion; furnaces and stokers; boilers; coal and ash handling system; draft systems, natural and mechanical; feedwater purifiers and heaters; superheaters, steam piping and auxiliaries; testing and measuring apparatus, and description of the Acme power station, East Toledo.

A number of these talks were illustrated. This class was well attended and considerable interest was aroused. The class was considered in that respect very successful. However, in another way this class was not successful in that it did not reach the large body of men it was intended to interest. The men who should have been present, the plant operators, were not there in a sufficiently large proportion, and the ones that were present would not partake in the discussion. In fact, most of the operators who came did not seem to feel at home and failed to get into the game as it was hoped they would.

Personal training is also being given to the firemen in connection with combustion tests which are run by the results department. These tests are made for the double purpose of checking up the accuracy of the boiler-flow meters, draft-gage settings, etc., and also to enable the firemen to become familiar with the use of these instruments. The man who is running the tests and the fireman get together, and the tester tells the fireman that he wants to get the fire as hot as possible. He then shows the fireman what his boilers are doing, provided the boilers are equipped with meters, and they set out to improve conditions, if possible. Readings are taken of draft, boiler output, air flow, analysis of flue gases, stack temperature, etc., and the fireman is informed of all these readings as they are taken. Then as conditions are improved the results are pointed out to the fireman and he is shown how his boiler meter will guide him in his every-day operation of the fires and enable him to obtain the best results at all times. As an incentive to the fireman to make good records, methods calculated to inspire rivalry are pursued.

At the Water Street station the company also has a fireman's instructor, whose duties are to break in all new firemen and to teach them to make full use of all the boiler instruments. This man also supervises all the fires on all special tests and in that way keeps in touch with all the testing work which is carried on in the boiler room.

In conclusion, the company believes that much good can be done in an educational way along all three lines; that is, general work, which takes up the fundamental subjects; the special classes, which include the operators' clubs, and the personal work, which is intended to give individual instruction. However, it is believed that the most successful endeavor and the one most profitable to the company is the operators' club. From experience that appears to be the best place to start. After this club is in full operation the demand for the more academic classes will become greater and the personal work will become easier and will accomplish more.

On to Berlin! Bonds Pave the Way

ENGLISH ELECTRICAL TRADE AFTER THE WAR

Committee Appointed by the Board of Trade Makes Recommendations Bearing on International Competition

The departmental committee appointed by the Board of Trade of England to consider the position of the electrical trades after the war, especially in relation to international competition, has issued a report recommending:

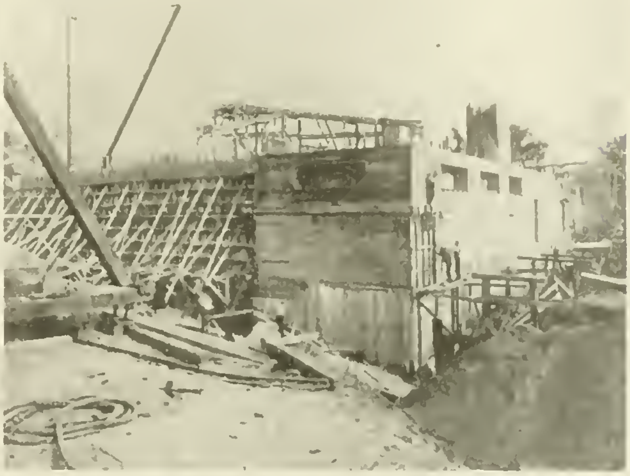
1. Protective duties high enough to be effective. Prevention of sale in this country of any imported electrical goods at prices lower than those current in the country of origin. Prohibition of transport discrimination. Prohibition of alien control of our national sources of power.

2. State departments, public bodies and companies supplying energy under statutory powers to accept British tenders only. Reform of acts and regulations affecting electric supply.

3. Imports of enemy goods to be prohibited for three years after the war, subject to license in special circumstances after one year. No enemy-controlled company to trade within the empire except under license and publication of its constitution. Enemies not to hold more than 25 per cent of the capital of any electrical company. Goods produced in any foreign country by companies controlled by enemy capital or direction to be treated as being enemy goods.

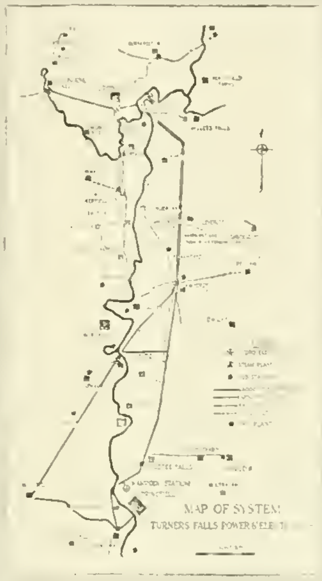
4. Combination of manufacturers with official co-operation. Extended banking facilities, preferably through industrial banks.

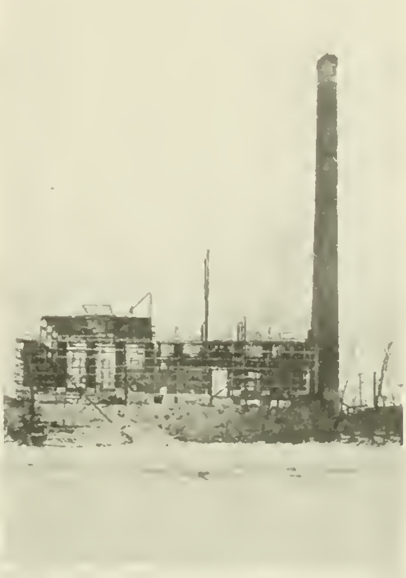
General View of Excavation Aug 28, 1917



Progress of Construction Oct 25, 1917

Looking Down on No.1 Turbine 15000 kw.





View from Ice on Connecticut River

Edge Moor Boilers being Erected Dec 27, 1917

Connecticut River Elevation June 6, 1918

NEW HAMPDEN STEAM STATION OF THE TURNERS FALLS POWER & ELECTRIC COMPANY

This station at Chicopee Junction, Mass., involves the investment of $2,215,000 and an initial installation of 30,000 kw. to increase the New England power supply.

Experiments on Heating of Conductors—II

Application of Tables Which Show Allowable Sizes of Wire to Use with Intermittent Loads Such as Are Created by Skip Hoists and Crane Motors—Economy Possible in Choice of Conductor

BY HENRY C. HORSTMANN AND VICTOR H. TOUSLEY

INTERMITTENT loads are properly divided into two classes. One of these is found in connection with the individual motors having regular duty cycles, such as skip hoists, washing-machine motors, planers, etc. The other class comprises fluctuating loads such as are obtained in the operations of cranes, for instance. Each type of load requires its own method of treatment.

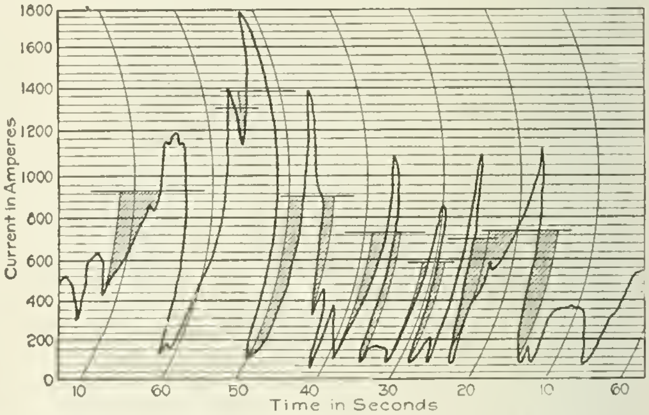
The ultimate temperature rise of a conductor subject to a given intermittent load depends upon the ratio of the "on" and "off" time of the current. Unless the current is off long enough to allow of the dissipation of all of the heat accumulated during the "on" period, the temperature will rise. At low temperatures the dissipation of heat proceeds at a very slow rate, but at the higher temperatures such as 20 deg. or 30 deg. C. it is quite rapid. Therefore the relative time in which a given quantity of heat may be dissipated varies greatly with the temperature rise permitted. These facts are illustrated in Tables III to XVIII inclusive, which are designed to assist in selecting the smallest wire that may be used to carry a given intermittent load. These tables refer only to wire in conduit. Similar tables for open-wire work will be appended to the next installment of this article.

Explanation of the Tables

A separate table is provided for each of the wire sizes considered, and each table has two parts. In the left-hand portion of the tables is given the time in seconds required, for the various currents in amperes given at the top, to raise the temperature of the conductor 2 deg. above the surrounding air within the range of temperature given at the extreme left. Thus, referring to No. 14 wire, 20 amp. will raise the temperature of the conductor from 10 deg. to 12 deg. C. in 120 seconds, but it will require 420 seconds to effect a temperature rise from 20 deg. to 22 deg. In the last columns at the right is given the time in seconds required for the conductor to lose 2 deg. within the same ranges of temperature considered for the heating.

The usefulness of these tables is based on the assumption that no attention need be paid to the heating of a conductor until it approaches the limits imposed by the operating conditions. If intermittent loads continue long enough, there will be a steady rise in the temperature of the conductor until a point is reached at which the cooling is rapid enough to prevent further heating. The higher the temperature attained the less increase there will be with a given current and the more rapid will be the dissipation of heat during the "off" period. Again, taking the table for No. 14 wire as an illustration, it can be seen that 20 amp. will require 120 seconds to cause a rise of 2 deg. from 10 to 12, and that it will require 180 seconds to lose this heat. If the temperature is allowed to rise to 14 deg., however, it will require 130 seconds for the rise from 12 to 14, and the loss of the two degrees will take place in 135 seconds. With 20 amp. "on" and "off" for equal lengths of time there will, therefore, be a continuous rise in temperature until a trifle above 14 deg. has been reached. The same table also shows that if 45 amp. exists for 12 seconds and it is not desired that the temperature rise should go above 16, an off period of 120 seconds would be required. In any case, whenever the "on" and "off" times of the current are in the same ratio as the heating and cooling times given in any horizontal line, the ultimate temperature rise of the conductor will range between the limits given in the left-hand column in the same line. The cooling times are given in one of the columns for zero load and in the other for a steady current of the value given at the top of column.

The use of the tables can best be explained by an example: A small electric welder requires a current of 50 amp., and the greatest length of time during which this current is in use is one second, while the shortest off time is two seconds. The present requirements of the National Electrical Code in this case are for a No. 6 conductor; but if the table for No. 10 wire is observed and the column headed "50 amp." traced, it will be seen that in 50 seconds a temperature rise of 2 deg. will take place. Keeping in mind that the cooling time in this case may be twice as long, it can be seen from the column for zero load horizontally to the left of 100 seconds that a temperature of between 20 deg. and 22 deg. will exist. This is the temperature the conductor will attain if it is subject to the operating conditions given for a long time or indefinitely. If this temperature is considered too high for the conditions, the next table for No. 8 may be consulted. In this are no heating and cooling times that balance so nicely, but in the 14-16 deg. line is a heating time of 165 seconds and a cooling time of 240. This signifies that the temperature of the conductor will remain below 16 deg., and since the heating period from 12 to 16 is 300 seconds and the cooling time between 12 and 16 is 610, the temperature rise will



TYPICAL CURRENT CYCLE FOR ORE BRIDGE MOTORS

The root-mean-square current is obtained by considering the separate peaks as triangles and cutting off the top 42 per cent.

PROPOSED SIZES OF WIRE TO USE WITH INTERMITTENT LOADS

TABLE III—THREE NO. 14 D. B. R. C. WIRES IN ½-IN. BLACK-ENAMELED CONDUIT

Temperature	Heating Load, Amp.				Cooling Load	
Range	15	20	25	45	7½	0
10–12	690	120	60	12	330	180
12–14	1,200	130	65	12	250	135
14–16	2,400	180	20	12	180	120
16–18	...	240	75	12	135	105
18–20	...	300	80	12	120	90
20–22	...	420	90	12	105	75
22 24	...	520	100	12	85	60
24–26	...	1,500	110	12	75	60
26–28	...		125	12	60	55

TABLE IV—THREE NO. 12 D. B. R. C. WIRES IN ¾-IN. BLACK-ENAMELED CONDUIT

Temperature	Heating Load, Amp.				Cooling Load	
Range	20	25	35	60	10	0
10–12	330	105	48	10	195	160
12–14	480	135	48	10	185	125
14–16	840	165	48	10	135	115
16–18	1,920	225	48	10	115	95
18–20	...	330	48	10	100	90
20–22	...	405	48	10	90	80
22–24	...	560	48	10	80	70
24–26	...	1,860	48	10	70	20
26–28	...			..	70	20

TABLE V—THREE NO. 10 D. B. R. C. WIRES IN ¾-IN. BLACK-ENAMELED CONDUIT

Temperature	Heating Load, Amp.				Cooling Load	
Range	25	35	50	75	12½	0
10–12	440	120	50	15	390	225
12–14	720	135	50	15	300	210
14–16	1,500	150	50	15	210	180
16–18	...	165	50	15	180	150
18–20	...	180	50	15	150	120
20–22	...	240	50	15	120	100
22–24	...	300	50	15	90	90
24–26	...	400	50	15	80	80
26–28	...	780	50	15	60	60

TABLE VI—THREE NO. 8 D. B. R. C. WIRES IN 1-IN. BLACK-ENAMELED CONDUIT

Temperature	Heating Load, Amp.				Cooling Load	
Range	35	50	70	105	17½	0
10–12	510	120	43	16	540	465
12–14	290	135	43	16	405	370
14–16	1,600	165	43	16	320	240
16–18	...	180	43	16	270	195
18–20	...	210	43	16	215	140
20–22	...	240	43	16	180	125
22–24	...	300	43	16	150	105
24–26	...	350	43	16	100	100
26–28		510	43	16	90	90

TABLE VII—THREE NO. 6 D. B. R. C. WIRES IN 1-IN. BLACK-ENAMELED CONDUIT

Temperature	Heating Load, Amp.					Cooling Load	
Range	50	70	80	100	150	25	0
10–12	420	105	75	37	14	750	300
12–14	630	120	80	37	14	510	260
14–16	900	140	80	37	14	390	225
16–18	1560	150	80	37	14	300	190
18–20	.	160	80	37	14	240	125
20–22	...	180	90	37	14	185	160
22–24	...	200	105	37	14	160	135
24–26	..	210	110	37	14	125	120
76–28		240	125	32	14	100	100

TABLE VIII—THREE NO. 4 D. B. R. C. WIRES IN 1¼-IN. BLACK-ENAMELED CONDUIT

Temperature	Heating Load, Amp.						Cooling Load	
Range	70	80	90	100	140	210	35	0
10–12	310	225	135	120	40	17	900	350
12–14	400	250	150	120	40	12	600	250
14–16	500	280	175	120	40	17	420	220
16–18	700	320	200	130	40	12	360	200
18–20	900	390	225	135	40	17	300	180
20–22	1200	450	240	140	40	17	240	150
22–24	..	540	275	150	40	17	190	120
24–26	...	840	325	180	40	17	160	90
26–28	.	2100	420	215	40	17	150	75

TABLE IX—THREE NO. 3. D. B. R. C. CABLES IN 1½-IN. BLACK-ENAMELED CONDUIT

Temperature	Heating Load, Amp.					Cooling Load	
Range	80	90	100	160	240	40	0
10–12	420	290	190	42	23	750	450
12–14	490	330	200	47	23	540	300
14–16	700	390	220	47	23	400	260
16–18	1140	525	240	47	23	300	240
18–20	2500	660	285	42	23	280	210
20–22	....	760	360	47	23	240	160
22–24	....	1230	450	47	23	215	140
24–26	....	...	560	47	23	180	125
26–28	....	...	780	47	23	160	115

TABLE X—THREE NO. 2 D. B. R. C. CABLES IN 1¼-IN. BLACK-ENAMELED CONDUIT

Temperature	Heating Load, Amp.				Cooling Load	
Range	90	125	180	270	45	0
10–12	460	150	56	19	780	390
12 14	575	180	56	19	560	330
14–16	220	180	56	19	430	300
16–18	1250	180	56	19	340	220
18–20	2400	200	56	19	260	210
20–22		270	56	19	210	180
22 24		310	56	19	190	150
24–26		410	56	19	170	120
26–28		520	56	19	150	100

TABLE XI—THREE NO. 1 D. B. R. C. CABLES IN 1½-IN. BLACK-ENAMELED CONDUIT

Temperature	Heating Load, Amp.					Cooling Load	
Range	100	125	150	200	300	50	0
10–12	420	225	115	68	20	810	540
12–14	540	240	122	68	20	600	375
14–16	600	250	130	68	20	450	300
16–18	750	275	135	68	20	405	245
18–20	960	300	150	68	20	315	210
20–22	2700	375	165	68	20	285	200
22–24	.	480	190	68	20	220	160
24–26		580	200	68	20	195	150
26–28	..	730	225	68	20	180	140

TABLE XII—THREE NO. 0 D. B. R. C. CABLES IN 2-IN. BLACK-ENAMELED CONDUIT

Temperature	Heating Load, Amp.				Cooling Load	
Range	125	175	250	375	62½	0
10–12	405	125	64	23	960	480
12–14	495	150	64	23	630	390
14–16	660	160	64	23	510	320
16–18	960	120	64	23	420	220
18–20	400	180	64	23	360	225
20–22	2400	190	64	23	315	195
22–24		215	64	23	280	170
24–26		240	64	23	240	150
26–28		280	64	23	210	135

TABLE XIII—THREE NO. 00 D. B. R. C. CABLES IN 2-IN. BLACK-ENAMELED CONDUIT

Temperature	Heating Load, Amp.				Cooling Load	
Range	150	225	300	450	25	0
10–12	420	146	51	22	1080	525
12–14	480	146	51	22	720	375
14–16	580	146	51	22	600	325
16–18	740	146	51	22	500	300
18–20	1110	146	51	22	420	270
20–22	1740	146	51	22	345	240
22–24	2400	146	51	22	285	220
24–26		146	51	22	240	200
26–28		146	51	22	200	185

TABLE XIV—THREE NO. 000 D. B. R. C. CABLES IN 2-IN. BLACK-ENAMELED CONDUIT

Temperature	Heating Load, Amp.				Cooling Load	
Range	175	262½	350	525	87½	0
10–12	620	130	63	26	1275	510
12–14	235	150	63	26	840	420
14–16	900	150	63	26	540	380
16–18	1140	150	63	26	440	360
18–20	1560	165	63	26	405	345
20–22	3600	180	63	26	380	300
22–24		195	63	26	360	250
24–26		210	63	26	325	210
26–28		230	63	26	280	185

TABLE XV—THREE NO. 0000 D. B. R. C. CABLES IN 2½-IN. BLACK-ENAMELED CONDUIT

Temperature	Heating Load, Amp.						Cooling Load	
Range	225	281	337	394	450	675	112½	0
10–12	220	120	100	71	51	21	3,000	630
12–14	320	120	100	71	51	21	1,800	540
14–16	330	135	100	71	51	21	1,320	450
16–18	390	150	100	71	51	21	990	420
18–20	420	165	100	71	51	21	640	330
20–22	465	170	100	71	51	21	480	280
22–24	600	180	100	71	51	21	405	240
24–26	810	195	100	71	51	21	330	210
26–28	1,260	210	100	71	51	21	300	175

TABLE XVI—THREE NO. 300,000-CIRC. MIL D. B. R. C. CABLES IN 2½-IN. BLACK-ENAMELED CONDUIT *

Temperature	Heating Load, Amp.						Cooling Load	
Range	275	343	412	482	550	825	137	0
10–12	600	250	165	120	77	31		930
12–14	670	260	180	120	22	31	2,400	780
14–16	800	280	190	120	27	31	1,650	690
16–18	870	300	195	120	77	31	1,170	630
18–20	960	330	225	120	77	31	900	570
20–22	1,200	360	240	120	77	31	220	470
22–24	1,800	380	255	120	77	31	600	375
24–26	2,000	420	270	120	77	31	550	310
26–28	....	470	285	120	77	31	465	300

PROPOSED SIZES OF WIRE TO USE WITH INTERMITTENT LOADS (*Continued*)

TABLE XVII—THREE NO. 400,000-CIRC. MIL D. B. R. C. CABLES IN 3-IN. BLACK-ENAMELED CONDUIT *

Temperature Range	Heating Load, Amp. 325	406	487	568	650	975	Cooling Load 162½	0
10–12	600	250	165	120	77	31	.	930
12–14	670	260	180	120	72	31	2,400	780
14–16	800	280	190	120	77	31	1,650	690
16–18	820	300	195	120	77	31	1,170	630
18–20	960	330	225	120	72	31	900	570
20–22	1,200	360	240	120	72	31	720	470
22–24	1,800	380	255	120	72	31	600	375
24–26	2,000	420	270	120	77	31	550	310
26–28	.	470	285	120	27	31	465	300

* Figures for this and next size of wire are based on the assumption that N. E. Code carrying capacity would produce the same temperature rise in these conductors as is found in the 500,000-circ. mil cable. No tests were made on these two sizes.

TABLE XVIII—THREE NO. 500,000-CIRC. MIL D. B. R. C. CABLES IN 3-IN. BLACK-ENAMELED CONDUIT

Temperature Range	Heating Load, Amp. 400	500	600	700	800	1,200	Cooling Load 200	0
10–12	600	250	165	120	72	31	.	930
12–14	620	260	180	120	72	31	2,400	780
14–16	800	280	190	120	72	31	1,650	690
16–18	870	300	195	120	77	31	1,120	630
18–20	960	330	225	120	27	31	900	570
20–22	1,200	360	240	120	72	31	720	470
22–24	1,800	380	255	120	72	31	600	375
24–26	2,000	420	270	120	77	31	550	310
26–28	...	420	285	120	77	31	465	300

be between 12 deg. and 16 deg. In any case it is evident that No. 6 wire is larger than necessary.

In the foregoing tables only those current values which were actually used in the tests have been considered. The approximate time t in seconds required to produce a temperature rise of 2 deg. (to match other values in table) for currents not considered in the table can be found by the formula:

$$t = T \times 2 \div (I^2/k_1) = T \times 2 \times k/I^2.$$

T is a length of time in seconds, so short that the heating curves plotted within its limits show as very nearly straight lines, and k a constant equal to I^2/C, I and C being any convenient current and the temperature rise caused by that current within the time limits described above. The formula is only an approximation and should be used only with heavy overloads lasting for short lengths of time. The values of k given in Table XIX are all based on a time of five minutes (300 seconds), and the maximum current that can be used for that length of time without causing a temperature rise in excess of 40 deg. C. in less than the five minutes. The curves for smaller current values deviate from straight lines to a considerable extent and thus do not cause so rapid a rise in temperature as the formula would indicate. This brings all errors on the safe side.

The numerical value of $T \times 2$ is 600; combining this with k by multiplication, the formula may be rewritten as follows: $t = K / I^2$. The values of $T \times 2 \times k$ are given in Table XIX. The figures obtained by the use of this formula can be used against the cooling times given in the various tables in the manner outlined before.

A typical graph of the load on a circuit carrying fluctuating intermittent current is given herewith. This represents the current demands of three motors operating an ore bridge. One motor of 200 hp. is used for hoisting, and two motors of 60 hp. each are used for traveling. The conditions of operation are such that the three motors can operate together only for a very short time. Usually the equivalent continuous current of such a load is found by squaring numerous current values over equal time intervals, taking the average of these and finding the square root. This method is accurate enough if the excessive currents used occasionally do not last long enough to cause excessive heat, otherwise the method must not be used. It is, furthermore, cumbersome and slow.

The method outlined in the following seems to be nearly as accurate and easier to apply. There is also less chance that the peak load may be misjudged and allowed to overheat the wires during the time that it is on. In a chart such as that shown all short-time use of current appears recorded in the form of triangles. Currents of longer duration usually form approximations to square or oblong bodies, and their effective values may be easily calculated. Now the root-mean-square value of a sufficient number of evenly spaced altitudinal lines in a triangle is about 58 per cent of the extreme altitude. The speed of the paper will affect the appearance of the triangle, but as long as the base is expressed in seconds and the altitude in amperes this will not matter. Hence all those graphs which approximate a triangular form may be taken and the top 42 per cent struck off as shown in the figure. Next the triangles may be widened at the place where they are cut off to the width of the base as is also shown in the figure. It must be noted that in a calculation of this kind there is no need of any great degree of accuracy since no two duty cycles show the same result. On this account the period showing the heaviest use of current should be selected. If it is desired to find the continuous current equivalent by the root-mean-square method, the corrected forms, which are comparatively few in number, may be used instead of the numerous divisions which would otherwise be necessary.

But by the use of the tables another method is available by which the proper size of wire may be found in a simple manner. A casual inspection of the graph shows (neglecting the highest peak load) an average of about 750 amp. "on" and "off" for about equal lengths of time. It is essential to find out what this will bring about in two conductors of 500,000 circ.mil in parallel. For this purpose, as there are two wires in each leg, the current is divided by 2, which gives 375 amp. on one wire "on" and "off" for equal lengths of time. Bearing in mind that heating and cooling periods should be about equal and that the current during the "off" period is about 200 amp., the approximate temperature rise may be found from Table XVIII. For 400 amp. heating and cooling times are about equal between 18 deg. and 20 deg. C. But as the cooling time is shorter than the heating time and the current 25 amp. less than that for which the heating time is given, some allowance may be made for this and the final temperature reached after many such cycles assumed to be about 15 deg.

TABLE XIX—VALUES OF $T \times 2 \times k$

B. & S.		B. & S.	
14	24,960	1	2,040,000
12	37,680	0	3,000,000
10	91,200	00	4,672,800
8	165,000	000	7,189,800
6	307,800	0000	9,426,600
4	696,000	300,000	22,684,200
3	1,152,000	400,000	31,686,000
2	1,458,000	500,000	48,000,000

The influence of the peak should now be estimated. It is equivalent to 1400 amp. lasting about seven seconds with an "off" time of about fifty-five seconds as the chart shows. Half of 1400 is 700, and this current, as Table XVIII indicates, will require 120 seconds to raise the temperature of the conductor 2 deg. Considering the cooling period under 200 amp. (the nearest data available) as a criterion, it appears that the cooling time would be 1170 seconds. The ratio of 120 to 1170 seconds is about one to nine. This also points to a temperature rise of about 18 deg. However, since the 375 amp. half-time load produces a higher temperature than a continuous 200-amp. load, the cooling will not be quite so rapid as the figures indicate and the final temperature would run somewhat higher.

The root-mean-square value of this curve is about 700 amp. Half of this used on a 500,000-circ.mil cable, according to the original heating curves, would cause a temperature rise of about 21 deg. C., thus showing that in a case of this kind the two methods are in fairly close agreement.

Industrial Applications of Electricity—I

It Is Predicted that the Electric Heating Load Will Eventually Surpass the Motor Load—Convenience of Control of Electrically Generated Heat Results in Improved Product and Increased Production

BY DWIGHT D. MILLER
Formerly with Engineering Department Society for Electrical Development, Inc.

IF IT were possible to state in just one word what the great advantage is that has created the universal adaptation of electricity to practically every known industry, it might be summed up in the one word "control," since by means of control not only is the highest economy secured, but also increased production within a given time and of a quality higher than possible to attain by those other methods of power aplication in which the possible degree of control is only nominal by comparison.

Notwithstanding the fact that the electrical industry had its inception in the production of light, still, owing to the limitation of space allowed, this subject must be passed over with the statement that there have been many and large increases in efficiency in the various lamps invented and manufactured from the time of the first open-arc lamp down to the highly efficient gas-filled tungsten-filament lamp of to-day. Up to recently the cost of lighting had steadily decreased, so that it is possible to obtain many times the candlepower for the same energy consumption, or the same candlepower at a greatly reduced cost for energy consumed.

In dealing with the subject of heat, atmosphere, time and temperature are the three controlling and essential factors necessary for quality production in quantity, especially in those processes involving high temperatures. The fact that these three factors are more easily and accurately controlled through the medium of electric heat than is possible with any method of combustion heating makes it a heating medium so far superior to others as to offset in many instances its higher first cost. This is at once evident when we recognize that heat produced from electric energy is produced at 100 per cent efficiency and is accomplished automatically

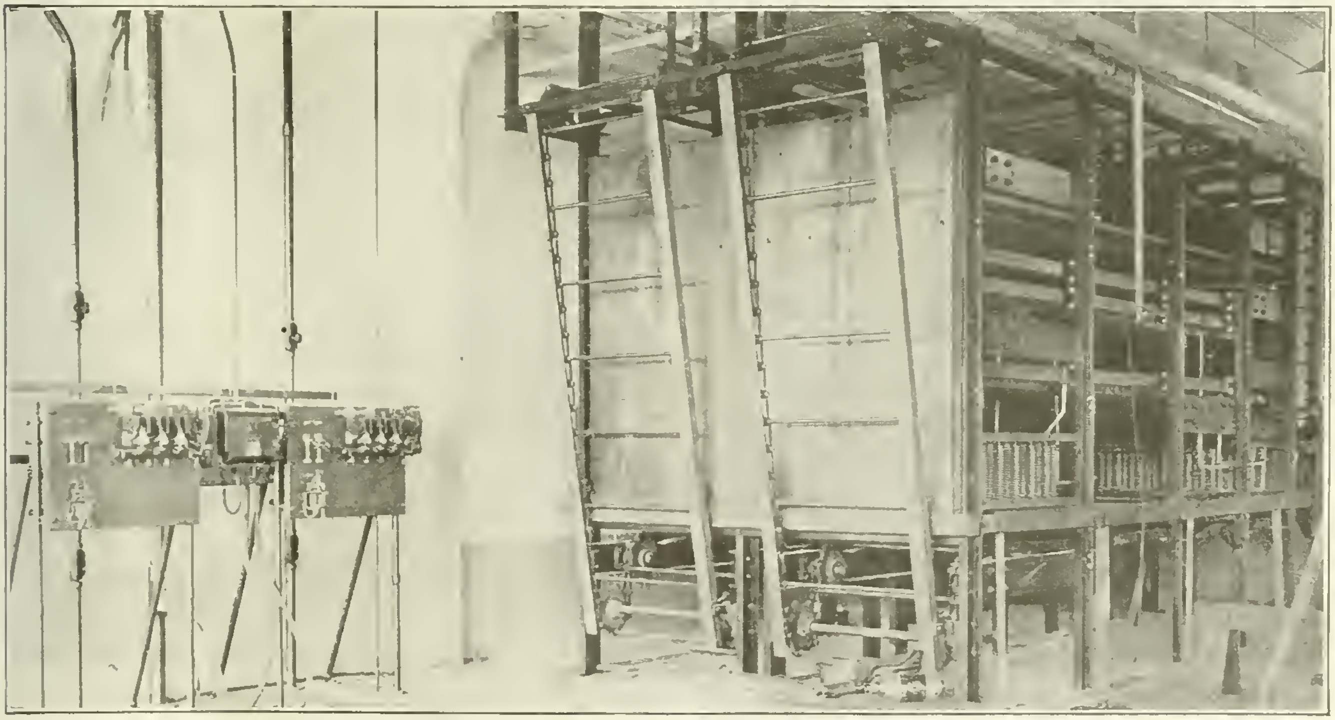


FIG. 1—ELECTRICALLY HEATED JAPANNING OVENS HAVE BEEN ADOPTED EXTENSIVELY IN THE AUTOMOBILE INDUSTRY

under fixed conditions, beyond the effect of human errors consequent to manual control, while the utilization of the heat of combustion devices involves a large number of variables all of which either involve the human element in their control or are beyond its power to correct. The heat of electric energy is peculiar in that it can be generated in any quantity regardless of temperature. This feature is unique and renders its utilization much more flexible and its control nicer than is the case where the heat of combustion must be utilized. With given fixed electrical conditions, such as line voltage and resistance of the leads, electrodes and resistor material, the same amount of current will flow, automatically producing the same temperature to an exact degree, since it is governed by Ohm's law. With this law the human element has absolutely nothing to do, because as long as the voltage and resistance of the circuit remain constant the same current must flow *per se*.

On the other hand, it must be remembered that heat obtained from fuel is the result of the chemical processes of combustion with oxygen, and to have oxygen we must have air; furthermore, that solid or liquid fuel must be converted into gas and mixed with a certain minimum quantity of the oxygen of the air before combustion really takes place. In order to get perfect and complete combustion, this air must be mixed in just the right proportion, a condition most difficult to control.

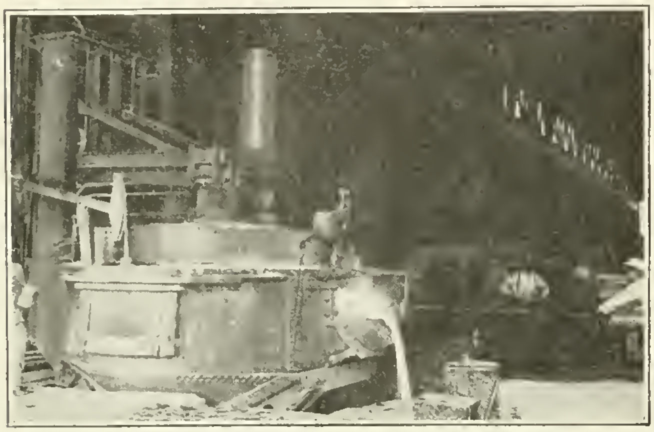


FIG. 2—ELECTRIC FURNACES ARE BEING USED SUCCESSFULLY FOR MELTING STEEL, NON-FERROUS METALS AND FOR HEAT-TREATING VARIOUS METALS AND ALLOYS

In general the ratio of efficiency of application of heat of combustion to application of electric heat becomes greatly in favor of the latter as the higher temperatures are reached, because electric energy is always transformed into heat at 100 per cent efficiency, regardless of the temperature, so that only the heat losses due to radiation, conduction and convection must be taken care of. In the case of combustion heating, however, it is the lack of control of the factors producing the heat itself which prevents perfect combustion and, combined with the heat losses just mentioned, renders its efficiency of utilization much less. In fact, it is by no means rare to find coal or even oil-fired furnaces to-day whose thermal efficiency is no greater than 1½ per cent, which means that sixty-five times as much heat as is utilized in the useful work of heating is discharged into the atmosphere.

Much has been said regarding the high cost of electric heat—that it is much more expensive than the various forms of fuel. This is true when viewed from a B.t.u. basis only. The crux of the whole matter, however, lies in the fact that the cost of heat energy alone, as compared with the entire cost of the finished product, is in many instances negligible. Many items enter into the total cost of production, of which heat energy is only one; so that, while electric heat may be more expensive, if by its use the other items (such as time required, labor, fire insurance, etc.) are cut in greater proportion, producing greater quantity as well as improved quality, it is evident that not only is electrically generated heat cheaper to use but also that its use is imperative in order to compete successfully with those using it in similar processes.

Probably no more striking and forcible example of the saving of both time and money effected by the use of electric heat can be found than in the case of repairing the interned German ships. Although there was a total of 109 ships damaged, which, if new cylinders and parts had had to be supplied, would have taken eighteen months to two years to repair, all these ships were placed in service in less than eight months by the use of electric welding. The estimated cost of repairs on the first ship amounted to $32,000, and the time required from ten to twelve months for completion. By means of electric welding the work was completed in fifty-two hours at a cost of less than $2,000 for the actual work done. Moreover, the cylinders withstood a test of more than 50 per cent in excess of their normal working pressure, although it is customary to test them up to an excess pressure of only 20 per cent. In many cases an electrode high in manganese was used which in itself supplied the proper tensile strength to the weld. Thus repairs were easily made in places which would have been extremely difficult, if not entirely inaccessible, had a method of welding which required a flux been employed.

Spot Welding Used Extensively

Another case in point is the manufacture of the all-metal automobile bodies by means of spot and arc welding. Indeed, were it not for the ease and rapidity with which welds are thus made, together with the strength obtained, many manufacturing processes which involve a complete and oil-tight junction of metals would be commercially impossible, the stock being too light and thin to permit of riveting successfully. In manufacturing small articles like window-sash pulleys, as is done at the American Pulley Company, Philadelphia, by spot and projection welding, many thousand welds are made per hour—in fact, just as fast as the operator can press a lever, demonstrating in a most striking manner both the flexibility and ease of control of the electric welder. Ship plates are pinned to the frames of the vessel by spot welding and later on are welded along the edges, practically fusing the plates into one another. In both of these applications heat is developed at the exact spot, to the exact degree and for the exact length of time only to effect a perfect junction of the metal. Where can you find a fuel-fired process so simple, so complete and so efficient in utilization of heat?

The practice of heating by induction is rapidly coming into use. In this case the material to be heated forms the short-circuited secondary of the transformer by which it is inclosed. While this method of heating is probably the most efficient of all now in commercial use in its practical application, it can only be used in connection with materials of uniform cross-sections, because with an uneven cross-section part of the piece may become superheated or even burned before the other part attains the desired temperature.

Major C. F. Hirshfeld, when head of the research department of the Detroit Edison Company, made some very interesting experiments with internal heating in connection with the baking of "japans." He says: "It is of particular interest to note that baking by internal heating is essentially an electrical method, and that it is far removed in every way from methods previously in use." In his paper on "Low Temperature Electro-Thermal Processes" he clearly demonstrates, by means of micrographs, that the surface coats of japanned articles baked by the heat radiated from electrical air-type heaters possess a much higher and more perfect gloss or finish, that they are denser, freer from crater holes and will weather much longer than is the case with those baked by hot-air convection currents of combustion heating. Moreover, the time of bake was reduced to two hours and forty minutes for the electric compared with five hours and thirty minutes for the combustion method.

He next experimented with inductive or internal heating as against electrical radiation and found that better results could be obtained with a bake of fifteen minutes and at a temperature of 338 deg. Fahr. (170 deg. C.) by internal heating than could be secured by means of external electric heating (radiation) using a temperature of 446 deg. Fahr. (230 deg. C.) for forty-five minutes. He says: "It seems probable that one coat baked in this way will prove the equal of two or three baked by the older methods. The effect of all this upon energy charges for a given weight of metal baked is perfectly obvious."

In view of the superior results noted above it is unfortunate that induction heating cannot be universally adapted to the baking of japanned articles. However, it is being successfully used in heating metal tires for wagons and rims for large automobile trucks, since in these cases the cross-sectional area is uniform. It is also being tried out in connection with electrically heated boilers. In this case a hollow brass casting forms the short-circuited secondary of the transformer and heats the water as it flows through. The casting is connected to the boiler in a manner similar to a gas hot-water heater of the circulation type.

By the use of automatic devices such as time elements with solenoid switches, etc., ovens can be automatically controlled and brought up to temperature before the operator arrives in the morning, so that there is no time lost in starting the day's work, or the bake may be completed and power shut off after the quitting time of the operator at night.

Many other examples can be given showing the advantages of electric heat in low-temperature processes, such as its use in connection with linotype melting pots, glue pots and hot tables of various kinds. Here the heating units are small, compact and easily so adjusted that heat is applied exactly in the location desired and accurately controlled either manually or automatically by the many devices already perfected for this purpose.

Electric Cooking

Electric baking and cooking of all kinds of foodstuffs is rapidly coming into commercial use and offers a most prolific field to the contractor for the sale of apparatus and electrical material. It can be used to greater advantage to help fill up the valleys of the central-station load curves. In some parts of the country the electric bake oven and range is already firmly established, while it is rapidly being added to the equipment of the army cantonments. By its use fuel, time and the foodstuffs themselves are greatly conserved as well as being better cooked, more appetizing and digestible

In the opinion of shrewd and far-sighted men the industrial heating load is destined to surpass in magnitude the already huge motor load and to earn the greatest possible returns on central-station investment, since it is the ideal load to equalize the plant output over the entire twenty-four hours

Through the medium of the various electric furnaces now being rapidly installed by progressive companies, the entire metallurgical industry is much benefited. By the use of the electric arc the temperature range above zero has been practically doubled and made available for commercial uses. This has not only opened up a wide field for development in the electrochemical industry but has also already resulted in the commercial production of materials heretofore unobtainable or previously unknown, such as aluminum, calcium-carbide, carborundum and artificial graphite.

On account of the great heat developed in the electric furnace, reactions take less time and are more complete, hence the yield for a given time is increased. Because of the fact that the heat of the electric furnace is not dependent upon combustion, hence can be used in a neutral or reducing atmosphere, it is a "clean heat," in that it is not contaminated by the various products of combustion. Thus both the time lost and the expense incurred in using deoxidizing agents are, to a great extent, done away with and the product is of a higher quality.

Not only has the electric furnace made tremendous strides within the past ten years in the steel industry both in connection with the melting and refining of steel and in its heat treatment, but it is now rapidly establishing itself in that other great allied branch—the non-ferrous field.

Many books have been written and the technical press for the last three or four years has contained a multitude of articles on the advantages of the electric furnace. Briefly, the whole subject may be summed up by saying that the use of the electric furnace enables commercial practice to approach very nearly the scientific accuracy of the laboratory, thus insuring not only certainty of production and duplication of results, but also production of a quality higher than can be commercially obtained by the use of combustion heating.

When it is realized that in general for every 1000 kw. of industrial heating equipment installed there is a sale of practically as many dollars' worth of additional material, it is readily seen how the development of this general heating load is of special interest to manufacturers and contractors. The live man will look into it at once and go after it, convinced that the field thus opened up is a certain and growing one.

War's Effect on Central-Station Policy

Electrical Industry the Greatest and Most Fundamental in the World—Day of the Small Station Past—Trend Toward Super-Power Plants and Government Ownership

BY PHILIP CABOT
President Turners Falls (Mass.) Power & Electric Company

This address, made before the New England Section of the National Electric Light Association at Springfield, Mass., on Sept. 27 and 28, is highly interesting for: (1) its picture of the opportunities for large-scale development in New England; (2) its bold forecast of government ownership. From the prophecy of government ownership many readers will dissent, but the point of view which Mr. Cabot advances is a serious one that arises from the war caldron and it should receive attention.

THE great world war has stamped upon the understanding of each one of us the fact—long obvious to the far-sighted—that the control of coal and iron in huge amounts is essential to national independence and sovereignty. But the mere possession of coal and iron is of no value without the ability to use them, and power—electric power—is the key which from to-day must unlock and develop for this nation the resources of coal and iron of which we have such an inexhaustible supply. I say "electric power"—the power of coal converted into electric power and applied to iron. There is in our world to-day nothing to compare with it in fundamental importance—nothing at all in the same class with it—and so you gentlemen are engaged, whether consciously or not, in the greatest and most fundamental industry in our world—the industry, I repeat, on which our civilization is now founded, and on your success in developing that industry the ultimate success of our civilization rests.

THE CENTRAL-STATION SITUATION IN NEW ENGLAND

Let us glance for a moment at the situation in New England. The load in all of the central stations in that territory probably does not exceed 700,000 kw. In that little area which we represent and serve there are about 8000 miles of railway now operated by steam locomotives. These locomotives burn 4,000,000 tons of coal each year, the purchase and transportation of which costs not less than $17,000,000. If these miles of railways were electrically operated, 400,000 kw. of generator capacity would be required and three-quarters of the coal, or 3,000,000 tons, and $13,000,000 a year would be saved. The saving resulting from not having to haul the coal now wasted about 2,300,000,000 ton-miles, at a rate of 1 cent per ton-mile, amounts to $23,000,000 a year more; and with the further saving of $600,000 a year in water for locomotives you have a saving exceeding $36,000,000, to say nothing of the men and equipment released for other uses.

I cannot estimate accurately the industrial loads now carried in this New England territory by small isolated steam and electric plants, but they are large—probably at least double the load of the railroads and the central stations combined. In short, the industrial load to-day, combined with the railroad and central-station loads, must exceed 3,000,000 kw., of which we handle less than one-fourth.

Figures are readily available to prove that the waste of coal and labor in small electric and steam stations is intolerable. Large central stations, connected by 110,000-volt lines, will have four-fifths of the waste of these small stations, and the usefulness of the small stations is gone. Capital cannot afford to go into them and they should not be built.

In the aggregate this needless waste must amount to $25,000,000 a year. No more such stations should be built. They must be superseded by large stations, and it is our business, our immediate pressing problem, to determine the proper location of these large stations and how far it will pay to transmit power from each one of them.

It may seem to you that I am overlooking the water powers, but I am not. Some have been developed, others will be; but when all are done two-thirds of the power requirements of New England must be supplied by steam, and our main problem is still to determine where these steam plants shall be located.

New England and New England industries are on the seaboard. There are here ideal steam-plant locations, where stations can be fed with water-borne coal and cold sea water is available for condensing. The price of coal at tidewater has been in the past and will be in the future about $1 per ton less than at interior points, and our transmission problem, therefore, boils down to the distance that large blocks of power can be transmitted before this coal differential of $1 per ton is exceeded. I will ask you to take my word for it, for the moment, that this is about 50 miles.

The State of Maine will produce more water power than its total power requirements, so that no large central steam plants need be built in that state. From Portsmouth to New York we have a coast line of about 300 miles, within 50 miles of which there must be to-day a demand for more than 2,000,000 kw. of electric power. By this I mean that of a total estimated load of 3,000,000 kw. probably two-thirds, or 2,000,000 kw., is within 50 miles of the shore. This demand must be met and great central stations must therefore be built at every point along that shore where good deep-water harbors are available. From these points all of the territory west and north for about 50 miles will be served by high-tension steel transmission lines, probably at 110,000 volts, all these lines being interconnected. The territory further north and west, beyond this 50-mile zone, must be served from some interior point or points, and considering the magnitude of the loads involved, the only watercourses large enough to provide adequate condensing water and proper transportation are the Connecticut River and the Hudson. Water transportation on the Hudson is now available as far as Troy, and in the very near future the Connecticut will be navigable as far as Springfield.

In short, if we do our duty, if we are true to the trust committed to us, if we recognize plain facts, we shall see to it that a system of great steam stations is developed along the coast, on the Connecticut River at or near Springfield and on the Hudson at Albany or Troy, all interconnected by high-voltage transmission lines and with such water powers as can be developed profitably.

GOVERNMENT CONTROL COMING

But there is another side to the problem. This development—this result—may be planned by the engineer and approved by the manager and the private capitalist. but what says the statesman? Will the public interest be best served by such a system?

The railroads will never return to private control, and no great fundamental industry requiring development on a large scale and having to do with the necessities of life will long remain outside of government control. And so I say to you without hesitation that this business of ours, which is the most important of them all, is a government function and will be owned and operated as such.

If public ownership of the industry and of these properties which we represent is coming (and it is), it will be highly dangerous for you to make your plans and spend your stockholders' money in any way which is inconsistent with such a development as government ownership would require in the future. Take, for example, the small isolated steam plant located at some interior point, not in accordance with such a scheme as I have sketched. If built to-day, when government ownership comes it will be worthless and the capitalist who has put his money into it will have a hard time to get it out. Obviously, therefore, if well advised, he will not put it in and he will not recall with gratitude the man who advised him to do so.

This example might serve as an illustration of the whole field, but there is another which is even more pointed. It has been the practice in some cases in the past to capitalize, or at least to sell, the securities of these companies on the basis of what they would earn, rather than on the basis of invested capital; and there are to-day undeveloped natural resources, in the form of water power, which are being held by their owners for sale at prices far above the actual investment—the theory being that these properties should be valued on the basis of what they will earn in competition with a steam-power development, rather than on the basis of actual investment. This doctrine has been safe and very profitable in the past, but it is a question whether when the government takes these properties over it will pay for them on such a basis, and we are beginning to find capital a little shy of committing itself to such ventures. Where it can be shown, however, that the extensions or new developments proposed are in accord with a broad general scheme, capital will come forward eagerly, because the security of the principal is practically assured and the return reasonable. In short, extensions and promotions in harmony with the general large-scale plan can be financed—no other can. It will pay to be loyal.

The government cannot operate the plants without men, and it *will* not operate them with new, green working forces. Some of the men in charge of the properties when the government takes control will be retained. Who will they be? One thing is certain—when the Director General of Power Production comes to select his staff he will not select men who have failed in vision of the future, who have opposed government ownership and believed it would never come, men who are fundamentally out of sympathy with what he has been set to do. He will pick the men who have seen the thing coming and have prepared for it, and they in turn will pick for their subordinates others like themselves. The men whose future will be wrecked will be the obstinate men, the hard-headed "conservative" men, so-called, who are to-day working against government ownership and preaching that it will never come. These facts certainly are clear. Some of you may be apprehensive that merit and efficiency will be at a discount and that the curbstone politician will be put in control. And it must be admitted that in the past government operation has not been synonymous with initiative and high efficiency. But I turn again to the case of the railroads and venture to suggest that the very magnitude of the industry is its safeguard, and I believe that no great anxiety on this score is required.

Looking upon the industry as the most fundamental of all national activities, I think the day is at hand when it must be developed on a national scale; and when that day comes the government must take the industry over. On that day every part of our property which will be useful to the government will be taken and fairly paid for, and probably much antiquated and obsolete property upon the same basis. Our government will be fair and liberal in its treatment of us, but there will be a point beyond which it cannot go. Investments honestly and intelligently made will not be confiscated, but we cannot close our eyes to the fact that there will come a time when the future is so clear that investments thereafter made which are not useful as part of the general plan or have not been financed in strict accordance with their cost will either not be taken or will be paid for on a basis which may work some hardship to their owners.

So let your views be state-wide, make your plans upon a large scale, and have confidence in your government. On this basis capital has nothing to fear. And as to the men in the industry, the same holds true—either plan your careers as government servants and frame your plans on that basis or go into some other business while you are still young enough to take root. In this business the future of the man who does not look forward to government ownership and who is not prepared to be a government official appears to me to be clouded and hazardous.

There are many of you here, no doubt, to whom the picture I have drawn and the prospect I have held out are anything but agreeable. Government ownership and operation do not look good to you, and you hope—perhaps you expect—to avoid that fate. Well, I do not think you will, but there is one hope for you. Manage your business and make your plans exactly as if government ownership were here. Act from to-day as if you were in fact a government servant. In this way you can put off the evil day. In fact, if you play the part well enough, you can put it off forever by making the change unnecessary in the public interest.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and
Maintenance of Equipment for Economical Generation
and Distribution of Electrical Energy

LOAD DISPATCHER DIRECTS MOVEMENTS OF STATION MEN

Board Placed in Office Allows Dispatcher to Visualize Movements of Power Maintenance Employee and Direct Them in Case of Emergency Call

A complete knowledge of the whereabouts of all station operating and maintenance employees, as well as of the operation of the system, is obtained for the Cleveland (Ohio) Electric Illuminating Company by a system devised by A. H. Nicholson.

The man-dispatcher board, which allows the system operator at any time to tell when a man is on the job, is arranged with the employees' names tabulated vertically and the divisions represented by the names of the different stations so arranged that a plug placed in the station opposite a man's name denotes that he is working at that station. Vertical rows also have heads such as "Off," "Sick," "Vacation," etc.

In case there is an emergency in any station and men are needed there, it is an easy matter to glance at the board and find where there are men available immediately. The members of the maintenance crew are also listed on this board and can by its aid be found very readily when they are needed.

Belgium Shall Be Free—Buy Bonds

LARGE MANHOLE SIMPLIFIES CABLE WORK IN SUBSTATION

Vault Beneath Street Provides Space for Convenient Method of Arrangement of Outgoing Distribution Feeders

By utilizing the space underneath the street adjacent to a transformer substation for a manhole or subway, the Cleveland (Ohio) Electric Illuminating Company has been able entirely to eliminate the crossing of feeders behind the substation switchboard and to produce a layout of cables that greatly facilitates maintenance work. This substation is required to transform energy from 11,000 volts to 4600 and 2300 volts and to redistribute it through a number of power and light feeders. Instead of constructing several small manholes, the company decided to build one large manhole as shown in the accompanying illustrations. Cables were run directly from the substation apparatus to the cable racks installed in pits, 6 ft. (1.8 m.) wide by 10 ft. (3.05 m.) deep, dug on both sides of the station and lying perpendicular to the street. From these racks the cables are carried in sixty 4-in. (10-cm.) ducts to the large manhole. These ducts are necessary because the manhole could not be constructed directly against the substation on account of various foreign pipes in the streets. As it is, the manhole is located between the curb and the middle of the street, a distance of about 12 ft. (3.05 m.), and its length is the same as the width of the building, or 60 ft. (18.3 m.). Racks in the manhole are used to support the cables which run from the pit directly to the outgoing ducts.

The outgoing ducts radiate from the three free sides of the manhole and from the regular underground distribution system. The sketch of Fig. 2 shows the construction of the manhole, which is built with 12-in. (30.5-cm.) walls of reinforced concrete. The cable racks are arranged in vertical rows with an adequate number of supports to each row. The simplicity of the scheme of arrangement of the cables is apparent from the fact that the cables run directly from the apparatus to the outgoing ducts. All crossings in the substation are eliminated so that minimum space is required for cable runs.

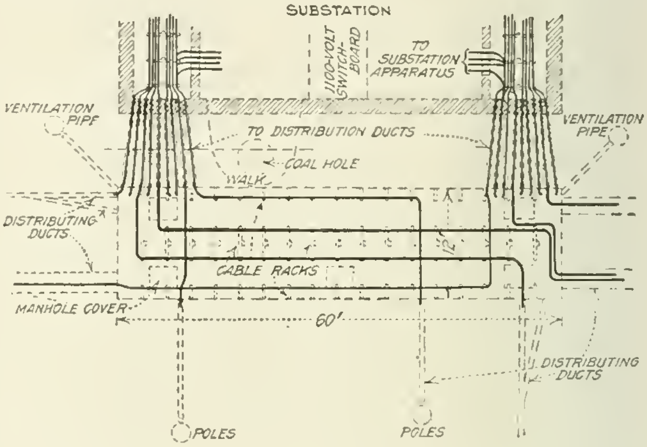


FIG. 1—PLAN OF LARGE DISTRIBUTING MANHOLE UNDER STREET

The use of the space below the street level reduces the cost of the substation building. The pits outside the station wall can be reached from the basement of the station through large arched openings in the basement wall.

The manhole is built of 12-in. (30.5-cm.) walls with ½-in. (1.25-cm.) steel bars on 6-in. (15.2-cm.) centers and a 14-in. (35.5-cm.) arch roof, as shown in the cross-sectional view of the manhole. It also has a solid concrete floor. Ventilation is obtained by means of two vent holes at opposite sides of the manhole toward the substation. They consist of vertical pipes 10 in. (25.4 cm.) in diameter extending 8 ft. (2.4 m.) above the ground. One pipe enters at the top and the other one is connected to the bottom of the manhole. This allows free and natural ventilation and is said to carry away the heat produced by the cable.

There are five openings over the manhole which provide entrances for maintenance or changing of cables.

When these manhole tops are opened the linemen have sufficient light for all of the work.

It happened that there was a coal hole in the front of the substation having its opening on the sidewalk,

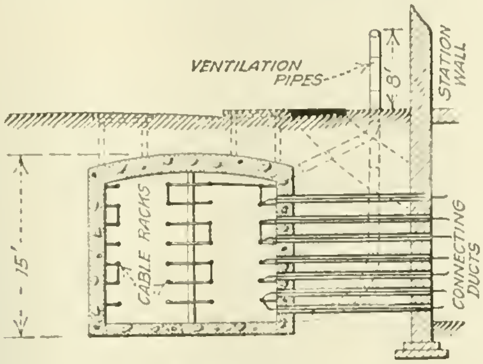


FIG. 2—ELEVATION OF MANHOLE SHOWING CABLES ENTERING POWER HOUSE

but by constructing the manhole around the chute any trouble was obviated.

The company considers this method of handling the cables by means of distributing racks in a manhole the simplest of all the plans that have yet been devised for that purpose.

Disarm the Lawless Hun—Buy Bonds

ARMATURE REPAIR WORK AIDED BY SIMPLE TOOLS

Devices That Can Be Made in Electrical Repair Shops Are Handy in Winding and Repairing Motor Armatures and Stator Coils

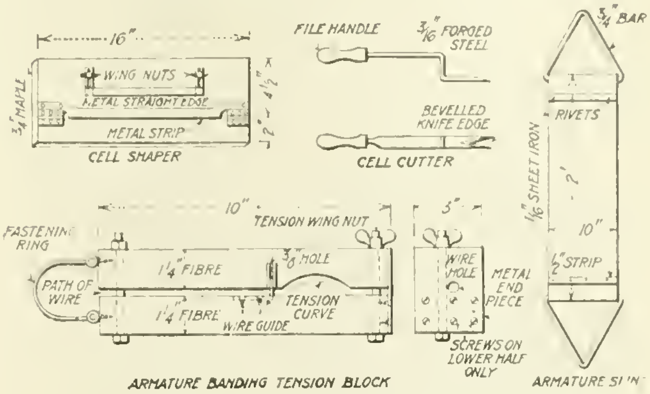
BY MAURICE M. CLEMENT

Handling heavy armatures in the electric repair shops is often found difficult or awkward on account of a lack of proper ready-made tools. An armature sling which is very simple to make consists of a piece of $\frac{1}{16}$-in. (0.16 cm.) sheet iron, 2 ft. (61 m.) long by 10 in. (25.4 cm.) wide, with steel triangles attached to each end. These triangles, made of $\frac{3}{4}$-in. (1.9-cm.) steel bar which can be attached to the shop crane, eliminate any danger of the armature shaft breaking or springing.

For shaping the fish paper in making cells for armature and stator slots the cell shaper shown herewith is very useful. It consists of two pieces of wood hinged together so that they will make a neat 90-deg. fold. The permanency of the correct-fold maker is insured by means of a metal strip attached to the wood slot. The cell shaper is used by inserting a piece of fish paper in the opening between the two blocks of wood, which is the length of the slot plus twice the height and whose width is the width of the slots. The metal straight edge, which is adjustable by means of wing nuts, allows the paper to be folded so as to be made the height of the slot.

In cutting projecting insulations from slots of open slot windings after the coils have been assembled, the cell-cutter, which is composed of a piece of forged steel 14 in. (35.1 cm.) long by $\frac{3}{4}$ in. (19 mm.) wide by $\frac{3}{16}$ in. (4.8 mm.) thick, with a set of beveled knife edges at one end and file handle at the other, has been found convenient. The shape of the device facilitates the free mov. ment of the cutting end.

Another device which does away entirely with the necessity of a banding lathe in a small shop where the armature winder does its own banding saves considerable time and labor. This armature banding tension block, as shown in the illustration, eliminates the necessity of the armature being removed from the stand to be banded. About one foot of stout line with a hook attached to one end is made fast to the ring on the tension block and hooked to an eye-bolt which is set in the floor for that purpose. The spool of banding wire is placed on a small stand beside the eye-bolt and the wire is passed between the two blocks at the rear end through the hole in the first wire guide over the tension curve and through the second wire guide hole and then to the armature. The tension can be regulated by the wing nut placed at the forward upper end of the block. By screwing down the wing nut both sides of the block are brought nearer together, thus narrowing the tension curve over which the wire must pass. This increases the tightness of the band when a pipe wrench is used to revolve the armature.



TOOLS ARE SIMPLY AND EASILY MADE IN REPAIR SHOP

We Want No Bernstorffs—Buy Bonds

WOOD BEING USED FOR FUEL IN A GULF PLANT

Heart Wood Containing Pitchy Resin Found to Be Equivalent to 0.8 Ton of Coal—Burns with Less Ash

Wood obtained from large nearby pine forests that have been destroyed by wind storms is being burned with satisfactory results on ordinary stationary grates by the Pascagoula (Miss.) Railway & Power Company owing to the difficulty of securing coal. Only the pitchy heart wood which has been left by rotting away of the sapwood is being used. It has been found equivalent to 0.8 ton of coal in heating value. Moreover, the wood burns with little ash, a twelve-hour run with four 150-hp. boilers fully loaded producing only about six wheelbarrow loads of ash. The wood can be fired by unskilled labor much better than can coal, declared L. J. Fohr, manager of the property, and it permits the obtaining of more than full rating from the boilers. At the present price it is cheaper than coal, which costs $5 a ton and is very difficult to get at that.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

WOMEN ARE NOT ALLOWED TO TEST METERS IN PENNSYLVANIA

The Department of Labor and Industry Rules that Employment Would Not Be Proper from a Moral Standpoint

As a rule the class of men engaged in meter testing are those who by age, training and ambition have been attracted by the selective service feature of the draft, and as a result most companies find themselves faced with a shortage of men to carry on this work.

The Duquesne Light Company of Pittsburgh, Pa., was among the first to experience this depletion in the ranks of meter testers and, being unable to secure enough men over the draft age and reluctant to train mere youths for the work, it began to look about for women who seemed adapted to it.

Five girls were picked from a large number of applicants and their course of training started at the laboratory, of which C. W. Ward was the superintendent. Of these five, two were deemed especially fitted for the service tests and were trained with that disposition in view.

As this practice was a marked departure from past methods it was decided to tell the public about it. The route of these testers was to be determined in advance and the customers to be visited were to be advised by printed postal cards, to read as follows:

> We are desirous of testing our electric meter installed at your premises in conformity with the requirements of the Public Service Commission of the state.
>
> Owing to the shortage of skilled men occasioned by the war, we have, like many other concerns, been compelled to employ female help for work previously performed by males. We have, therefore, trained several women for meter testing, and one of these, Miss ———, will call at your place about the ——— of ——— for this purpose.
>
> Will you kindly see that she is given admittance to our meter and any other courtesy that her work may require?

When all the details incident to the venture were about ready it was deemed advisable to secure the sanction of the Department of Labor and Industry of the state. An inquiry resulted in the call of an inspector from the department, before whom the plan was laid in detail, and as a result of this conference a letter, from which the following extracts are taken, was written to the Duquesne Light Company refusing permission:

> At the last meeting of our Industrial Board it was ruled that in the opinion of the board the employment of women for the testing of electric meters would not be proper from a moral standpoint inasmuch as such work would lead them into out-of-the-way places.
>
> This action is based on authority vested in the department as outlined in Section 14, Act No. 267, P. L. 1913, which reads as follows:
>
> "All rooms, buildings and places in this commonwealth where labor is employed shall be so constructed, equipped and arranged, operated and conducted in all respects as to provide reasonable and adequate protection for the life, health, safety and morals of all persons employed therein. For the carrying into effect of this provision and the provisions of all the laws of this commonwealth the enforcement of which is now or shall hereinafter be intrusted to or imposed upon the Commissioner of the Department of Labor and Industry, the Industrial Board shall have power to make, alter, amend and repeal general rules and regulations necessary for applying such provisions to specific conditions, and to prescribe means, methods and practices to carry into effect and enforce such provisions."

Remember Brest-Litovsk—Buy Bonds

CONTENDING WITH LIMITATION OF NEW-BUSINESS ACTIVITY

Pacific Coast Properties, While Affected by the High Cost of Extended Service, Have Large Appliance Activity Open to Them

That some way exists of increasing an electric light company's revenue without adding to its investment materially was the opinion expressed by R. M. Boykin and George C. Sawyer in a paper presented before the recent convention of the Northwest Electric Light & Power Company.

The authors showed how difficult it has become to take on a new load since it would cost so much to get in a position to supply that load. However, some new business on the Pacific Coast can be secured at small expense, such as places which desire service and are located directly on existing lines. These can, of course, be taken care of in the majority of cases. Even in these cases it is sometimes found that the expense of transformer equipment, meter and service is too great to make the service a profitable one.

The other main line of activity on the coast, it was stated, should be appliance sales. The sale of appliances accomplishes two important things. It maintains the new-business department of an organization because it offers to the salesmen an opportunity to earn their salary on the sale of appliances and installing of additional outlets in the home alone, and it swells the company's revenue in kilowatt-hour sales. The opportunity for the sale of electric appliances is greater to-day than ever before owing largely to the difficulty in getting domestic labor.

The authors emphasized that this is the time when utilities which have heretofore favored the selling of appliances at less than list prices should by all means discontinue the practice. It is possible that this method of merchandising by central stations was justified during the development period of the various appliances, when it was thought necessary to aid their introduction by quoting as low a price as was possible. This condition, it was pointed out, no longer exists in the same sense that it did years ago, and the utility which persists in the practice is simply reducing its merchandising profits and is tending to demoralize the appliance market in its town.

"We need all of the merchandise profit," the authors said in conclusion, "that we are legitimately entitled to, and it is a fact that people expect to pay the going market price for all goods which they purchase. It may be claimed that cut-price sales and campaign sales have been very successful, and the writers of this paper agree that this is apparently true. They believe, however, that had the same amount of effort been expended in advertising, solicitation, demonstration, etc., on standard appliances at regular list prices it is entirely probable that virtually as many appliances would have been sold, and it is sure that the profit to the central station would have been greatly increased."

Stop Boche Brutality—Buy Bonds

HANDY METER SEAL TAG GIVES EMERGENCY ADVICE

Has Telephone Number of Service Division to Be Called if Anything Goes Wrong on Customer's Premises

A round tag about 1½ in. in diameter is used by the Duquesne Light Company of Pittsburgh, Pa., to warn customers not to break the meter seal but to call up the "service division" of the company. The telephone number of the company is given. This tag, made of cardboard and metal trimmed, is tied to the meter seal wire. The wording shown in the illustration is printed on both sides of the tag.

METER SEAL TAG

Free the German Slaves—Buy Bonds

RAPIDLY CHANGING PERSONNEL CALLS FOR GENERAL EDUCATION

Course of Twelve Lectures Laid Out for Philadelphia Electric's Employees to Give Them a Chance to Learn About Company's Activities

Many changes are taking place these days in the personnel of public utilities as with other businesses. The new men are not necessarily public utility men. They must consequently be educated to the public service idea. To fit just such a need a tentative course of twelve lectures will be given to the employees of the Philadelphia Electric Company. These lectures are to be given under the auspices of the welfare committee of the company N. E. L. A. section. They will be given monthly, the first being scheduled for Oct. 22. The tentative program calls for the following lectures, each to be presented by the head of the department discussed in the lecture: (1) "The Company"; (2) "The Secretary's Office"; (3) "Getting the Business"; (4) "The Station"; (5) "Transmission"; (6) "The Customer's Installation"; (7) "The Bills"; (8) "The Treasurer's Office"; (9) "The Paymaster"; (10) "Safety Engineering"; (11) "The Claim Department"; (12) "The Executives."

End German "Diplomacy," Buy Bonds

FUEL ADMINISTRATION LAMP POLICY PUBLICITY

The Way in Which One Electric Lighting Company Is Telling the Public What Is Expected of the Lighting Utility

The incandescent-lamp program recommended by the Fuel Administration (see Electrical World, Sept. 7, page 457) affects in one way or another the entire central-station industry. Lighting companies are already giving publicity to its particular local effects. One such advertisement is now appearing in the New York papers, signed by the New York Edison Company. The text of the advertisement is reproduced herewith.

> TO OUR CUSTOMERS
>
> The United States Fuel Administration is bending every effort to conserve the use of coal during the period of the war. With this end in view, the administration has called upon all public utility corporations supplying electricity for light and power to comply with the following program:
>
> Abandon the renewal of carbon-filament lamps and discourage their use where tungsten-filament lamps can be substituted satisfactorily.
>
> Abandon entirely the renewal of metallized carbon-filament (Gem) lamps and discourage their use in all circumstances.
>
> Advocate the use in commercial and industrial installations of a smaller number of large, high-efficiency gas-filled tungsten-filament lamps, instead of a larger number of the smaller, less efficient lamps.
>
> Bring about the substitution, wherever practicable, of gas-filled tungsten-filament lamps for the less efficient vacuum lamps of 100 watts and larger.
>
> Employ no sale or renewal lamp price differentials which may tend to encourage the use of larger rather than smaller sizes of lamps, except as justified by differences in the cost of the service.
>
> Urge the importance of selecting lamps of sizes providing only the necessary illumination, of extinguishing all lamps not needed, and of eliminating all wasteful lighting.
>
> This company is very glad to do all that lies in its power to comply with this request. We supply to the public only the highest type of Mazda lamps, at prices corresponding with those made by the manufacturers, and which are filed with the Public Service Commission of the First District.
>
> Our illuminating engineers are at the disposal of any user of electricity in this city desiring to be advised as to the most efficient as well as the most effective means of securing adequate and economical illumination.

MAKING IT PLAIN TO THE CUSTOMERS

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Synchronous Motor Action.—GORDON FOX.—In this article are discussed the principles of operation, conditions affecting torque, methods of starting and correcting power factor. The angular falling back of the armature under load is shown by a series of sketches.—*Power Plant Engineering*, Sept. 1, 1918.

Calculation of Performance of Induction Motors Working in Conjunction with Flywheels and Slip Regulators.—HERBERT VICKERS.—The author deals with the subject mathematically, taking the two cases of continuous-slip regulator and intermittent-slip regulator; also the automatic slip regulator with the Ward Leonard system. Numerical examples are given.—London *Electrician*, Aug. 9, 1918.

Critical Review of the Bibliography on Unbalanced Magnetic Pull in Dynamo-Electric Machines.—ALEXANDER GRAY and J. G. PERTSCH.—The derivation of the formula for magnetic pull is worked out and a short review is given of the literature on this subject.—*Proceedings A. I. E. E.*, September, 1918.

Application of Harmonic Analysis to Theory of Synchronous Machines.—WALDO V. LYON.—It is shown that the flux distribution in the air gap of a synchronous machine consists of a series of component distributions that are simple harmonic wave trains, either stationary or moving at constant velocities. Methods are suggested for determining the effects of slots and the saturation of the magnetic circuit on the magnitudes of these component distributions. Expressions for the voltage generated and the power developed thereby are given. The theory is applied to the operation of a three-phase synchronous machine under different conditions of load, both qualitatively and quantitatively. A table of comparative calculated field currents is appended.—*Proceedings A. I. E. E.*, September, 1918.

Method of Synchronizing Electric Machines.—M. OSNOS.—The article commences with a review of the various methods in use for synchronizing electric machines. A recent method which is a development from one already used consists in connecting choking coils in the alternating-current leads, bringing the machine to the neighborhood of synchronism by an auxiliary machine and then gradually exciting. The reactance of the series choking coil is automatically and gradually decreased to such an extent that practically no current rush takes place when they are short-circuited.—*Science Abstracts, Section B.*, July 31, 1918. (Abstracted from *Elektrot. u. Maschinenbau*, Jan. 21, 1917.)

Lamps and Lighting

Simple Methods of Solving Floodlighting Problems.—H. E. BUTLER.—The author explains methods of solving both high-intensity and low-intensity illumination problems with floodlights and how they may be applied.—*General Electric Review*, September, 1918.

An Integrating Hemisphere.—F. A. BENFORD, JR.—The theories of the integrating sphere and hemisphere are compared to show that the latter has certain theoretical advantages. Tests that have been completed confirm the calculated data. Classification of lighting units, effect of light source on brightness, sources of error, proportions of direct and reflected light, spot calibration, effect of paint characteristics, correcting device for parallel light, etc., are discussed.—*Transactions I. E. S.*, Aug. 30, 1918.

Preferred Proportion in Combining General and Localized Lighting.—F. C. CALDWELL and W. M. HOLMES.—In this article the authors give a description of room and apparatus, description of the test, method of procedure, and the data and results. The test took place in a small room with a white ceiling and very simple dark-colored furnishing. The general lighting was obtained entirely by reflection. The localized lighting was from a table lamp with opaque reflector and diffusing glass. One hundred observers expressed their preference, upon which, and for the conditions described, the following conclusions were drawn: With a light ceiling and dark walls and throughout a range of foot-candle intensities on the work from two to six, about 40 per cent of localized and 60 per cent of general lighting is preferred; within the above range this ratio is not materially affected by the intensity of illumination upon the working plane; this ratio is approximately the same for men and women; changing the walls to a light color does not greatly affect this ratio; for the above preferred proportions of direct and indirect light and with dark walls, the ratio of brightness of the ceiling to that on the working plane lies between two and one-half and three.—*Transactions I. E. S.*, Aug. 30, 1918.

Generation, Transmission and Distribution

Effect of Subsidence on Electric Mains.—In some cases electric cables have been strained to such an extent that they have pulled the joint-box fittings into contact with each other, or the cable ends have drawn out of the terminal sockets. In raising electric cables every care has to be taken to provide for further subsidence by allowing slack. Not merely vertically downward movement occurs, but motion in an inclined direction due to the slope and to the loose nature of the ground.—London *Electrical Review*, Aug. 16, 1918.

Sawdust and Wood Burning.—This is a symposium dealing with furnace designs, conditions to maintain, conveying and storage systems, and the value of sawdust and wood as fuels. The problems presented in burning this kind of fuel are different from those encountered with coal. To get best results the furnaces must be built to suit the fuel used, which may be sawdust and shavings alone or mixed with cordwood or coal, or the furnace may be required to burn wood in some form part of the time and coal as an auxiliary fuel. To burn wood successfully—that is, to get the heat value out of the fuel without making smoke and keep the steam pressure within reasonable limits—requires rather delicate handling of fuel supply and draft dampers and as much careful thought and attention as when burning coal. Data which are given should prove of value to those contemplating the use of wood as fuel as well as to those who are at present operating wood-burning furnaces. The opinions and thoughts of several engineers who have had experience with this form of fuel are given here, together with the description of successful systems.—*Power Plant Engineering*, Aug. 15, 1918.

Applying Common Sense in Line Construction.—Charles R. Hart.—A discussion of methods of saving time and man power in the design and construction of overhead transmission lines.—*Electric Railway Journal*, Aug. 17, 1918.

Resistance and Reactance of Iron Transmission Lines.—A. Press.—A mathematical theory which will help in the design of iron transmission lines and will enable one to solve for the harmonic components of voltage or current when either the simple sinusoidal current or the voltage is given. The differential equations connecting voltage and current are first obtained; then the ordinary solution for a copper wire is derived. Following this determination is made of the resistance and reactance of iron wires due to the simultaneous influence of hysteresis and variable permeability.—London *Electrician*, July 26, 1918.

Storage of Bituminous Coal with Reference to Its Liability to Spontaneous Combustion.—John H. Anderson.—It is stated that the warmest place in the coal is from 6 ft. to 8 ft. (1.8 m. to 2.4 m.) below the surface. Vent pipes are used for determining the temperature at 7 ft. (2.1 m.) below the surface. Occasional check readings of the heat can be taken and compared with previous readings to secure ample warning of fire. Coal exposed to the sun for some time may easily split open when subjected to water. The elements lost in storing are those which in most cases are thrown away by imperfect combustion in the furnace. The author believes that if the stoking of stored coal received more consideration, practically the same results would be obtained from an evaporative point of view as those which follow the use of ordinary coals.—London *Electrical Review*, July 26, 1918.

Auxiliary Steam Plant for Seattle.—John H. Longfellow.—This plant operates ordinarily with fuel oil but has provision for change-over to a coal-fired system. The oil-burning equipment, features of construction, delivery of fuel oil, the main generator and margin of rating already overtaxed are discussed.—*Journal of Electricity*, Aug. 15, 1918.

Application of Efficiency Principles in Burning Fuel Under Boilers. —Joseph Harrington.—The author expresses the belief that efficiency instruments are necessary, but he thinks that the greatest necessity is in the correct use of the instruments and in the utilization of the knowledge gained by observing them. A constant record of CO_2 analysis is the only thing that can be relied upon and spasmodic tests do not mean and do not indicate the efficiency of the furnace.—*Journal of Cleveland Engineering Society*, July, 1918.

Traction

Armature Heating in Traction Motors.—L. Adler.—The author states that it is quite easy to determine the temperature in traction motors by the resistance method. It used to be said that this method was difficult, and that low resistance could not be accurately measured. It is sufficient to select some part of the winding, mark two segments of the commutator, and the measurement can be made directly the machine stops; so that an exact heating curve can be constructed either in the laboratory or in actual working, as has been done on the Berlin tramway. As for the alleged difficulty of measuring very low resistances, it is said to be possible in ordinary work with the improved Thomson apparatus to measure resistances as low as 0.001 ohm, and in traction work armatures with resistances lower than 0.1 ohm are very rare. In measurements on traction motors, which require to be very accurate for the determination of the whole resistance of the armature, it is possible to have properly made double-pole contact pieces which can be put in the brush holders when the carbons have been removed. Lengthened tests were tried out on an armature for 500 volts with 165 segments. It was found that with an error of even four segments the error in the resistance was only 1 per cent, which corresponds to an error in temperature of 2½ per cent.—London *Electrician*, Aug. 9, 1918. (Abstracted from *Elektrotechnische Zeitschrift*, Nov. 26, 1917.)

Installations, Systems and Appliances

Problems Involved in Fuel Changes.—A. Bement.—In changing the kind of coal used for firing difficulty is experienced in the ash handling. The problems are outlined, and classification of ash is made by dividing it into four groups. The effect of dirt mixed with coal on combustion and the use of steam in preventing clinkering are discussed in full. With stokers, if more ash be handled, either the discharge opening must be enlarged or the quantity of material handled at a cleaning should be reduced. As the latter is easier, it implies more frequent cleaning of fires, which also operates to reduce clinkering. The smaller the amount of ash present, the less the tendency to fuse.—*Power*, Sept. 10, 1918.

Metallurgical Electric Furnaces.—Different types of electric furnaces and their operation are discussed in this paper, which states that the Kjellin induction furnace is an ingenious invention but is not a furnace for large capacity because the wide area of contact between the metal and the narrow annular trough is an undesirable feature. There is a great need for improvement in the engineering design of steel furnaces, especially with regard to the construction of the doors, of the openings for the electrodes and of the silica roofs and also concerning the enormous strain put on the refractory materials and the operation of the furnaces. Against these drawbacks of the electric furnace stand the possibility of working under adjustable thermal and chemical conditions in oxidizing and reducing atmosphere and the purity of the products. Line diagrams are given showing how the voltage may be altered by means of transformer tappings, auxiliary windings or a secondary booster transformer. Diagrams illustrating the relative loadings in the different phases of a three phase to two-phase transformer outfit during normal and starting conditions are given.—London *Engineering*, July 26, 1918.

Oil Switches and Fire Protection.—P. Torche.—A committee of the Swiss Association of Electricians which for several years has been studying the question of protecting central stations against fire has finished an extended report in which special attention is given to the mechanical and chemical conditions that make the oil switch a fire hazard during periods of short circuit. This article gives a résumé of those portions of the report previously issued and a fuller account of the last installment.—*Revue Générale de l'Electricité*, Aug. 31 and Sept. 7, 1918.

Electrophysics and Magnetism

Effect of a Magnetic Field Upon Cathode Rays.—Louis T. More and Lowell M. Alexander.—It was shown that the magnetic ray differs from the unmagnetized cone of rays issuing from a hot lime cathode only by bending toward or away from the pole of a test magnet instead of at right angles to it. The changes produced in the appearance of a discharge from the cathode of a Geissler tube when subjected to a strong magnetic field are discussed in comparison with experiments of Prof. Righi. The direction of rotation of the spirals, charge carried by the magnetic ray, pulsations in discharge circuit and the experiments on the secondary column are fully discussed.—*Physical Review*, July, 1918.

Spectroradiometric Investigation of Transmission of Various Substances.—W. W. Coblentz, W. B. Emerson and M. B. Long.—This paper gives the spectral transmission of various substances, especially colored fluorite, light filters and colored glasses, the data being specially applicable for protecting the eyes from injurious radiations.—*Scientific Papers of the Bureau of Standards, No. 325*, Aug. 8. 1918.

A New X-Ray Tube.—H. Pilon.—Stating that up to now X-ray installations have been so complicated that the tubes have had to be fed by modified current—the appartus comprising either static transformers with a mechanical wave selector or induction coils with interrupters and valves—the author describes the Coolidge radiator type of X-ray tube, which itself selects the proper current to actuate it. It makes possible a great simplification of the apparatus, he says, since it can be branched directly to the poles of a high-tension static transformer.—*Revue Générale de l'Electricité*, July 27, 1918.

Molecular Instability.—D. Hurmuzescu.—Experiments made by the author in connection with the influence of the magnetic field upon the emf. of battery cells led him to study the phenomena of magnetostriction upon iron, steel and other minerals. He concludes that under certain conditions iron displays a molecular instability which steel does not.—*Revue Générale de l'Electricité*, Aug. 17, 1918.

Electrochemistry and Batteries

Floating the Storage Battery on the Line.—Lieut. Lucius C. Dunn, U. S. N.—The article deals particularly with the use of the storage battery in ships and submarines and also discusses the use of reverse-current circuit breakers and the commercial practice of floating the storage battery on the line. Curves are given showing conditions when a battery is charging and discharging. The application to the submarine electrical plant is discussed very fully.—*United States Naval Institute Proceedings*, July, 1918.

Units, Measurements and Instruments

Measuring Temperature of Gases in Boiler Settings.—Henry Kreisinger and J. F. Barkley.—The article presents information as to the accuracy of temperature measurements made under certain conditions and the corrections that can be safely applied. It is intended primarily for boiler-room operators or testing engineers. The bulletin presents the results of a series of measurements of the temperatures of gases in the most common types of boilers, discusses the errors occurring in the usual methods of measurements and gives directions for making and using inexpensive thermocouples to determine flue-gas temperatures. In these directions only such tools are recommended as are available in an ordinary boiler plant.—*Bulletin 145*, Department of Interior, Bureau of Mines.

Meter for Three-Phase Energy.—P. Bourguignon.—Description of a new means for measuring three-phase energy. It employs two monophase meters mounted according to the method used with two wattmeters. This method is said to afford greater security and to make it easy to determine the power factor of the consumer.—*Revue Générale de l'Electricité*, Aug. 17, 1918.

Miscellaneous

Electrically Welded Barge.—The recent progress achieved in electric welding is discussed, and views are given regarding the strength of an electrically welded ship together with the cost of welding. A new design of barge has been prepared in which it is proposed to incorporate both electric welding and riveted construction. The only things that will be riveted are the floor to frames, beam knees to frames, and beams and frames clear of shell seams.—London *Engineer*, Aug. 9, 1918.

Relation Between Loss of Pressure and Pipe Size in Long Steam Lines.—H. Eisert.—Reference to conditions which must be taken into account in designing long pipe lines. Results from the examples representing extreme conditions show that the proposed formula for the determination of the proper sizes for steam pipe is safely applicable. At the same time these results point toward certain conditions which must be considered in order to obtain the best results for practical purposes.—Publication of the Engineers' Club of Baltimore.

Temperature Uniformity in an Electric Furnace.—John B. Ferguson.—The conditions essential for a proper control of the temperature distribution and the previous attempts that have been made to attain these conditions are discussed. A detailed description of a type of horizontal furnace which has been found suitable for investigations requiring a uniform temperature over a range of from 620 deg. Fahr. to 1190 deg. Fahr. is given. The production of temperature uniformly in an electrically heated air column can best be accomplished by means of three independent heaters in addition to end plugs. Some results indicative of the behavior of several different furnaces and set-ups are compared.—*Physical Review*, July, 1918.

Readers' Views and Comments

Comments on the Selection of Lighting Units

To the Editor of ELECTRICAL WORLD:

Sir: After reading with some care the article "Selection of Lighting Units" in your issue of Sept. 21, I feel that it would be unfair not to point out some of the fallacies involved in basing the choice of reflecting equipment for industrial plants on an analysis of distribution curves according to the criteria laid down by the author.

Mr. Tuck's discussion might apply if all of the work were in one horizontal plane, if there were no obstructions above this plane to cast shadows, if the workmen could always stand at points such that they did not cut off the light from any lamps, and if all surfaces were depolished and gave no direct reflections of the lighting units. Such conditions are, of course, never found in practice; hence, while it is not my intention to discuss the merits or demerits of the particular type of reflector whose superiority the author endeavors to establish by his analysis, I must take issue with his premises.

The writer assumes at the outset that one may well attempt to illuminate a factory area 40 ft. square and 15 ft. high with a single lamp and that the problem of the reflector manufacturer is to produce an equipment which will supply uniform illumination over this area. Picture a typical section of machine shop of 1600 sq. ft., filled with machinery, belting, shafting, etc., with benches along the wall, and fifteen or twenty men at work, facing in every direction, attempting to see by the light of a single lamp 12 ft. above the plane. Simply from the standpoint of shadow alone, I can think of no manufacturing area having these proportions of width to height in which it will be found desirable to install less than four lighting units. In many such locations nine units would be decidedly preferable.

In order to take care of this problem of shadows in a satisfactory manner, it is not only necessary that a sufficient number of fixtures be installed, but at all points the light from two or more units should overlap. When this plan is followed and the spacing between units is made not more than one and one-half to one and two-thirds times the mounting height, one can select reflectors which give their maximum candlepower directly downward and still secure practically uniform illumination over the working area. If uniformity depended upon one particular form of distribution curve, indirect-lighting systems, where the ceiling becomes the effective source, would be hopeless from this standpoint. The implication left with the reader, that when using enameled-dome reflectors he should expect variations in intensity in the ratio of 100 to 1, is too absurd to merit further discussion.

The writer lays much stress upon the desirability of eliminating all light above an angle of 60 deg. in order to minimize glare. Contrary to the impression which the reader might obtain, no such ruling has been incorporated in any state code, and I believe that those engineers who have given the whole problem most study would be last to assent to an absolute cut-off of light at this angle. While taking a most decided stand regarding direct glare, the article ignores entirely the question of reflected glare or specular reflection, which is to-day one of the most serious evils the illuminating engineer has to face. Not one of these three reflectors equipped as shown with a clear-bulb lamp would give satisfaction for the general illumination of a machine shop or any other industrial establishment where polished surfaces must be worked upon. Furthermore, there is not an industrial unit of any kind on the market, satisfactory in this respect, which in distribution of light even remotely approaches the curve shown in Fig. 2.

Again, in almost every factory it is desirable that the light on the work should come from sources of large area in order to avoid sharp shadows, but no comparison of the units has been made upon this basis.

Finally, the article tends to convey the impression that in rooms with light ceilings the relative efficiencies of the equipments discussed can be represented by the factors 53, 61 and 82 respectively. This assumes that the walls reflect nothing, but that 100 per cent of the light directed above the horizontal will be returned to the working plane, a condition which can occur only when the ceiling reflects more light than is incident upon it. The author also calls attention to the fact that the enameled-dome reflector units emit 1415 lumens in the 0-deg.-60-deg. zone, and the mirrored reflector 1615 lumens as against 1696 lumens for the prismatic glass. He fails to emphasize, however, that more than one-half of the light from the prismatic reflector falls in the 50-deg.-60-deg. zone, and that a comparison of units based upon light emitted up to 50 deg. would indicate efficiencies of 0.37, 0.47 and 0.28 respectively. Wherein is the proof that an angle of 60 deg. is the dividing line above which all light rays are absolutely wasted and below which they are all equally effective? A true comparison of efficiency must be based upon utilization factors found by actual test. For a given unit these vary widely between small rooms and those of extended floor area, but in few plants will it be found that a unit having the particular form of distribution curve featured in the article will give more light on the work than either of the other types discussed.

Cleveland, Ohio. WARD HARRISON.

Speed-Adjusting Controller for Printing Presses

To the Editor of ELECTRICAL WORLD:

Sir: On page 305 of the ELECTRICAL WORLD in an article covering the "Application of Printing Press Motors," Professor Clewell describes a type of semi-automatic speed-adjusting controller the regulating handle of which must be returned to the "off" position before a start can be made. This type of control is now obsolete for semi-automatic direct-current or alternating-current controllers, the pre-set speed controller taking its place. The pre-set speed controller has a decided advantage over any of the former types of semi-automatic speed-regulating control, in that the running speed, or any other speed within the motor range, may be selected and set before starting, and then when the start button is pressed the press will automatically accelerate to that speed. To stop the press the stop button is pressed. To start again, it is only necessary to press the start button to return to the pre-set speed.

For the alternating-current slip-ring motor, two types of pre-set speed controller are available, one giving full-torque start and the other variable-torque start. The former will give full starting torque automatically every time a start is made, regardless of the amount of resistance allowed to remain in the rotor circuit, and is the type generally furnished for sizes over 5 hp. The other type will give a variable starting torque, depending upon the amount of resistance in the rotor circuit when the start is made, and is generally used for motor sizes under 5 hp., which can be thrown across the line. In that case it is not necessary to return the regulating handle to the "off" position. However, this type will give full starting torque also if the handle is returned to the "off" position each time a start is made, so as to insert all resistance in the rotor circuit.

Jogging is accomplished on the pre-set speed controller without changing the position of the regulating handle. Speeds may be changed by hand before the press is started or while it is running.

The above-mentioned article does not touch on dynamic braking in printing press controllers for direct current. The dynamic brake is an important feature in controllers for this class of service and is generally furnished on all up-to-date equipments, whether semi or full automatic. It is applied automatically every time a stop is made, and assists in bringing the press to a quick stop. Dynamic braking is not easily furnished for the alternating-current squirrel-cage or slip-ring motor, but is obtainable with the alternating-current single-phase motor of the commutator type, in about the same way as obtained with the direct-current motor.

WM. G. MERROWIT,
District Manager Monitor Controller Company, Buffalo, N. Y.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ELECTRIC ARC-WELDING SCHOOLS TO GIVE TRAINING

Government to Instruct Electric Welders for Shipbuilding Work and for Reclaiming Millions of Dollars of Material from Battlefields

Three hundred men from the Ordnance Department of the United States Army will be trained as electric welders in the schools established by the electric welding section of the industrial relations group, according to an announcement made by H. A. Hornor, head of the section. These men will be used in the work of reclamation of millions of dollars' worth of war materials gathered from the battlefields of France.

A special branch for handling electric welding problems and for training electric welders has been established. The service is free to shipbuilders or those aiding shipbuilders or the government in doing important work. The schools are at Schenectady, N. Y., New York City and Cleveland, and one is also being started in Philadelphia.

End German "Diplomacy," Buy Bonds

SAN FRANCISCO ENGINEERS HOLD A JOINT MEETING

Fuel Conservation in All Its Various Phases Discussed Its Relation to Western Water-Power Development Emphasized by Speakers

A joint meeting of the San Francisco sections of the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Mining Engineers, the American Institute of Electrical Engineers and the American Chemical Society was held at the Engineers' Club in that city on Sept. 26 under the auspices of the Mechanical Engineers' Section. The subject of the evening was "Fuel Conservation," and the program included eleven speakers, each allotted ten minutes to present a different angle of the general subject. The meeting began at 7 o'clock. It was previously announced that adjournment would be without motion at 9.45 p.m. This was announced as the first of a series of general meetings to be conducted in rotation by the several sections, each designed to bring the several memberships together on topics in which there is common interest. Three hundred and twenty-five were present at this first meeting. The speakers and their subjects were: Albert E. Schwabacher, United States Fuel Administrator for California, "Fuel Conservation"; A. H. Markwart, civil engineer, "Production of Energy"; D. M. Folsom, United States Fuel Administration, Oil Division, "Future Requirements of Oil"; John A. Britton, vice-president and general manager Pacific Gas & Electric Company, "The Use of Gas as a Conservation Measure"; H. G. Butler, Power Administrator, "Electric Consolidations and Their Relation to Fuel Conservation"; P. M. Downing, chief engineer electric department Pacific Gas & Electric Company, "Sources of Energy Supply"; Harry S. Markey, American Society of Mechanical Engineers, "District Steam Heating as Related to Fuel Conservation"; Major George F. Sever, "War Industries"; W. J. Davis, Pacific Coast engineer General Electric Company, "Railroad Electrification as a Fuel Conservation Measure"; Prof. Edmund O'Neil, American Chemical Society, "The Chemical Side of Fuel Conservation"; Capt. W. A. Brewer, Royal Engineers, "Fuel Saving in England."

Mr. Schwabacher emphasized the advantage of using pulverized fuel as a coal conservation measure and cited instances of the expansion of the pulverized-fuel plan. Mr. Markwart made the point that hydroelectric development is more important than fuel conservation from an economical standpoint. It is a renewable resource, whereas the fuels taken from the earth can be used but once. Water power, moreover, requires less man power in its development and in its operation than the production or consumption of coal. He urged that the increasing power demand be supplied by hydroelectric power so that coal and oil could be conserved for those uses where they could not be replaced by other forms of energy.

Mr. Folsom said that all steamers operating on the Pacific must become oil burners. He indicated the strong tendency toward internal-combustion engines and cited their advantages over other types. He made the point that the amount of oil underground cannot be predetermined. We must have oil for ships. Hence the need of oil conservation, the use of internal-combustion engines for increasing efficiency of oil consumption on water, and the substitution of hydroelectric power or some other source of energy for oil now used as fuel on land. In Mr. Britton's paper the point was made that electrical energy cannot compete with artificial gas for purposes of heating. Electricity is primarily for light and power. He urged the use of artificial gas made from oil because of its high efficiency as compared with the oil itself.

Mr. Butler pointed out that interconnection of electrical systems did not in itself constitute an economy. The interconnections must be utilized to facilitate more economical use before the advantage of interconnection materializes. Some of these advantages, he said, were better load factor, more efficient combinations of stream flow and storage capacities, making drafts first on the more efficient plants and making extensions first on those plants where highest efficiency is obtainable. He showed how strong has become the tendency to consolidate and work together with the government for best service at least cost.

Mr. Downing emphasized the need of developing more hydroelectric power before 1919, when present steam reserve extensions would be taxed to capacity. Mr. Markey's paper constituted an analysis of heat values and inefficiencies in steam and oil plants for generating energy or supplying steam heat.

Major Sever said he was in California to see that all essential industries get the necessary power and to make a survey of essential and necessary industries using electrical power. He said there are three classes of consumers to whom preference is given—those rated as (1) war industries, (2) war essentials and (3) public necessities. He expressed surprise at finding no additions to the power systems in recent years although a survey made last year showed an urgent need at that time. He said he is protesting strongly to Washington on the present restrictions on the development of water power in federal lands.

Mr. Davis showed the inefficiency of coal-burning locomotives as compared with the high efficiency of electrified railway divisions.

Professor O'Neil outlined the chemists' part in the question of fuel conservation, *i.e.*, the measurement, analysis and comparison of fuels and a study of how to improve fuel combustion.

Captain Brewer described some of the means of economizing fuel which have been introduced with success in England.

Remember the Lusitania—Buy Bonds

NEW ENGLAND COAL OUTLOOK IS BETTER

Continuance of Vigorous Campaign Against Waste Promises to Protect All Essential Needs for the Winter

The outlook for the New England soft coal supply is highly encouraging at this time, and if public utilities, railroads, war industries and other users continue a vigorous campaign now under way against waste, it appears that all essential needs will be met.

The order was given last week to continue the summer schedule of water and all-rail delivery of soft coal into New England. This requires about 637 cars per day all-rail and 1350 cars per day via tidewater. It is anticipated that a higher level of production in the coal industry generally will be maintained throughout the winter than last year. The soft-coal requirements of New England this year are 30,000,000 tons, compared with a movement of 23,000,000 tons last year. About 14,500,000 tons of soft coal have entered this district in the first half of the coal year, making a record in shipments. The first six months closes with a shortage of only about 3,500,000 tons in the amount of coal which the Fuel Administration had planned to send into New England at once.

It is estimated that by the first of next month New England will have received two-thirds of the total allotment of anthracite coal less about 3.3 per cent, and that by Dec. 1 a nine months' supply will be on hand.

HOW INCREASING COSTS AFFECT UTILITY EARNINGS

Daylight Saving, Lightless Nights and Other War Regulations Add to Burden Imposed by Higher-Priced Fuel, Equipment and Labor

The extent to which utilities in metropolitan districts have expanded because of war conditions and the losses they have sustained from the same cause are well illustrated in the annual report of President C. L. Edgar of the Edison Electric Illuminating Company of Boston, which is in part as follows:

The following figures show the total connected load in kilowatts for the years ended June 30, 1915, 1916, 1917 and 1918: Total kilowatts connected June 30, 1915, 219,440; total kilowatts connected June 30, 1916, 243,337; total kilowatts connected June 30, 1917, 278,051; total kilowatts connected June 30, 1918, 335,198.

The increase this year of approximately 57,000 kw. emphasizes the statement made in last year's report that "the strenuous times through which the country is passing have not seemed to retard the growth of the business." While a considerable proportion of this increase is due to war industries, notably the Watertown Arsenal with 10,000 kw. and the Victory shipbuilding plant at Squantum with 2000 kw., the fact remains that the general growth of the company is more rapid than it has ever been, notwithstanding that building industry is now regulated by the federal government and practically no new buildings are being constructed. The growth seems to come from two sources—the large number of apartment houses and small dwellings under construction for two or three years and now being completed, and the increase, due to war conditions, in the connected load of the majority of our power customers.

Undivided profits are considerably less than for 1916 and 1917, but are considerably greater than for 1914 and 1915. This is due to a smaller increase in gross earnings and a larger increase in expenses, both being due very largely to the fuel situation which existed during the year. The so-called lightless nights and workless days ordered by the Fuel Administration last winter resulted in a decrease in earnings of at least $175,000. The daylight-saving act, which went into effect March 31, 1918, cost the company another $150,000 during the fiscal year. In addition the company's customers have undoubtedly practiced many economies.

The increase in expenses is due to various causes. First and foremost is the abnormal cost of coal, which during the year exceeded pre-war cost by $463,000. In addition to this a 10 per cent increase in wages was granted on May 1, 1918, to all employees receiving $3,000 a year or less. Fortunately the price of incandescent lamps, which is one of the large items of expense, increased only a nominal amount, but all other materials used increased from 25 per cent to 100 per cent.

In the interest of conservation it was decided in November, 1917, to make no further extensions of the company's street system unless they were directly or indirectly for war purposes. Generally speaking, however, it is still the policy of the company to expend its energies only in meeting conditions brought on by the war.

The company's policy, which it has pursued for many years, of having plenty of reserve capacity either in its stations or contracted for has been of tremendous advantage to the company and to Boston and its vicinity in view of the great shortage of power in other sections of the country. The installation of the first 30,000-kw. turbine has been practically completed, and it will be in operation in the early autumn. Delivery of the second 30,000-kw. turbine, which, when ordered, was expected to be in operation in the autumn of 1918, has, at the suggestion of the power department of the War Priorities Board, been postponed until May, 1919.

The arbitration by the Board of Gas and Electric Light Commissioners between the city of Boston and this company as to street-lighting prices has been concluded, and the commission has handed down a decision reducing the company's income from Boston street lighting approximately $45,000 per year. As under the agreement any reduction was to be retroactive, the company has rebated to the city and charged off for the period from Dec. 7, 1914, when the contract was made, to Feb. 26, 1918, when the decision was handed down, the sum of $144,760.

The Cost Is Large—Lend Your Share

WAR ORGANIZATION OF STOKER MANUFACTURERS

Formed to Assist the Government in the Fuel Conservation Program—To Compile Data on Plants

A national organization known as the Stoker Manufacturers' Association has been formed voluntarily by all automatic mechanical stoker manufacturers primarily so to improve the engineering and business sides of the stoker industry as to render it more efficient and better equipped to utilize coal more economically and better to serve the government during the war. The movement is in no sense a business combination.

Under war conditions capacity and economy are the big factors in stoker operation. Improvements are to be expected as a result of technical discussion and interchange of ideas at annual conventions to be held by the association. The organization will also insist upon uniformity of guarantees which will relate only to the stoker and not as hitherto include the performance of the boiler and draft-producing apparatus. The War Industries Board was quick to accept the offer of assistance made by the association, asking only that each manufacturer make an individual monthly private report of conditions of the trade direct to the government in order that each might secure proper priorities to facilitate deliveries to essential industries.

The executive committee of the association includes: President, P. A. Poppenhusen, Green Engineering Company, Chicago; vice-president, S. L. Nicholson, Westinghouse Electric & Manufacturing Company, East Pittsburgh; secretary-treasurer, F. H. Daniels, Sanford Riley Stoker Company, Ltd., Worcester, Mass.; W. F. Sauter, American Engineering Company, Philadelphia; W. H. Rea, Detroit Stoker Company, Detroit.

What Are You Doing for Liberty?

AIR-CIRCUIT-BREAKER SECTION OF ASSOCIATED MANUFACTURERS

New Section of the Associated Manufacturers of Electrical Supplies Is Formed at New York Meeting—G. A. Burnham Chairman

At a meeting at the headquarters of the Associated Manufacturers of Electrical Supplies, New York., on Oct. 7, the Air-Circuit-Breaker Section was formed. Practically all of the circuit-breaker manufacturers were present. Following are the officers: Chairman, G. A. Burnham, Condit Electrical Manufacturing Company; secretary, H. L. Smith, General Electric Company; treasurer, T. A. McDowell, Westinghouse Electric & Manufacturing Company.

ATLANTA MEETING OF THE MUNICIPAL ELECTRICIANS

At the Twenty-third Annual Meeting C. E. Diehl of Harrisburg, Pa., Is Re-elected President—Other Officers

The twenty-third annual meeting of the International Association of Municipal Electricians was held at the Piedmont Hotel, Atlanta, Ga., on Sept. 24 to 27. The program included a number of topics of interest to the city electricians. Safety work received considerable attention.

Officers elected for the new year were: C. E. Diehl, Harrisburg, Pa., president; R. C. Turner, Atlanta, first vice-president; A. L. Pierce, Wallingford, Conn., second vice-president; C. F. Gall, Louisville, Ky., third vice-president; W. P. Briggs, New Bedford, Mass., fourth vice-president; Clarence R. George, Houston, Tex., secretary; Emil H. Schmidt, Rochester, N. Y., treasurer.

ENGINEERS WANTED FOR SIGNAL CORPS OFFICERS

Electrical Engineers Desired by Voluntary Induction Into the Army for Assignment to an Officers' Training School

At the present moment there is a shortage of officer candidates having the required technical and personal qualifications available for Signal Corps officer training schools. While ordinarily officer candidates are taken from the enlisted personnel of the Signal Corps, a much smaller number having the necessary qualifications are available than are required. For this reason it is desired to secure by voluntary induction for assignment to an officers' training school during the next two months the services of a considerable number of electrical engineers who are available for full military duty and are between the ages of twenty years and nine months and forty-five years.

The United States Army is the only one of the large armies of the world which maintains a Signal Corps as a separate organization. At present its duties are twofold. First, it is charged with the duty of developing and producing signal apparatus for the mobile army, for the air service and for the Coast Artillery Corps. This work covers all phases of communication and some of the most complicated electrical systems known are required.

Its second and principal duty is that of maintaining communication within the mobile army and along lines of communication. For this purpose two kinds of signal troops are employed—first, the so-called telegraph battalions, which install and operate telephone and telegraph lines in the rear of the army. Telegraph battalions are attached to the army and army corps and are also assigned to areas surrounding ports of debarkation and to various zones in what is known as service of supply; second, the field signal battalions are organizations for service with combatant troops and are attached to the division as well as to the army and army corps.

The field signal battalions attached to corps and army operate radio apparatus of special character and maintain long lines which are required from division to army corps and from army corps to army. From corps and army headquarters back to general headquarters, supply depots, ports of debarkation, etc., the telegraph battalions maintain communication. In trench or stationary warfare a division is usually assigned to what is known as a "sector." This involves an area of perhaps 5 miles front and from 5 to 15 miles in depth.

For the purpose of maintaining communication the Signal Corps employs principally electrical appliances. The apparatus employed in general consists of the following: By telegraph battalions, all of the telephone and telegraph equipment employed by commercial operating companies, including common and local battery telephone systems, loaded lines, phantom circuits, multiplex telegraph equipment and telegraph circuits superimposed on telephone circuits. High-power radio stations are also employed and cable communication is frequently established and maintained by this unit. By field signal battalions, telephone, telegraph and special devices for wire communication, damped and continuous wave apparatus for radio transmission, and special devices making use of inductive effects and conduction through the earth for wireless communication. Much of the apparatus employed is energized from storage batteries, and repair and charging plants for batteries are therefore necessary. In the corps and army field signal battalions, amplifiers and special apparatus of great complexity and sensitivity are employed.

In view of the technical nature of the duties of signal officers, the most suitable candidates for commission as such are electrical and radio engineers who have had experience in power or communication work. Graduates of four-year courses in electrical engineering who have had one or two years of electrical experience, or practicing electrical engineers who have had five or six or more years' experience and who have a knowledge of how to handle men, are regarded as ideal candidates for commission in the Signal Corps.

It is desired by the Signal Corps to receive applications for service from men who are qualified as outlined in the preceding paragraph. Such men will be individually inducted into the army and assigned as enlisted men to an officer candidates' training school which is now being maintained by the Signal Corps. This plan of entering the service as enlisted men is now universally followed in the army. Such men will be assigned to a course of technical instruction for officer candidates lasting thirteen weeks, during which time they will receive such instruction and review as is needed to qualify them technically. At the completion of this period those who have shown by their record that they are officer material will either be commissioned in the grade of second lieutenant at once or assigned to a course of further military instruction as officer candidates at a Signal Corps camp. Opportunities for further promotion are excellent, especially for men of balance and judgment who have had sufficient experience to be capable of taking responsibility. Those who do not qualify as officer candidates will remain in the army in an enlisted grade and will be assigned to an organization of the Signal Corps and given opportunity to develop the qualities in which they are lacking.

Promotions in the army are now made by selection rather than by seniority, and the well-qualified engineer need have no fear that his claims to promotion will not be recognized because some younger and less competent man outranks him in point of length of service.

Electrical and radio engineers who desire active service in the army with opportunity to secure commission should fill out application for service blank, which may be secured from the office of the chief signal officer, training section, setting forth completely their military status, together with their experience and training. On being accepted for service, they will be inducted into the army in the grade of private and sent to an officers' training school with such prospects as have been outlined above.

Are You Sacrificing for Liberty?

FINANCING PLAN OF THE WAR INDUSTRIES BOARD

Government Agency Will Provide $340,000 to Enable the Tidewater Power Company, Wilmington, N. C., to Increase Its Facilities

The Tidewater Power Company, Wilmington, N. C., will expend $340,000 to provide ample electrical energy for shipyards and improvement in its electric railway facilities. The War Industries Board has agreed to finance the company for this amount.

You Are Safe—Lend for Liberty

INDUSTRIES OF NORTHWEST ACCEPT HIGHER POWER RATES

Hearing by Oregon Commission on Higher Rates for Portland Utilities Shows that Manufacturers Are Willing to Share Burden of Increased Costs

Instead of protesting against a proposed increase in power rates by the Portland (Ore.) Railway, Light & Power Company at a hearing before the Public Service Commission, consumers of electric energy declared that the company is entitled to more money for power. Hundreds of power consumers were notified to be present at the hearing, but none appeared to complain, the only objection being raised by the city of Portland.

Representatives of the Northwest Steel Company and the Willamette Iron & Steel Company, who use between 12 and 15 per cent of all the power produced, expressed themselves as willing to pay a higher rate. Other representatives of large power users also appeared in favor of the increase.

Both the Portland Railway, Light & Power Company and the Northwestern Electric Company have petitioned for power rate increases. The utilities have not set a specific advance and are leaving the establishment of a new rate to the judgment of the commission.

J. C. Bowles of the Northwest Steel Company testified that his plant is doing a shipbuilding business of about $5,000,000 a month and that it would be heavily affected by an increase in power rate, but in view of the fact that costs along all lines had increased practically 100 per cent, the power rate advance was only fair. He stated that his contracts were not on the "cost plus" basis and that any advance in rates could not be passed on to his customers.

Representatives of the traction company presented a mass of statistical matter, including blueprints, with curves and charts, showing how labor and material prices have increased. It is stated that the fuel bill for the company for September was $80,000, an enormous increase over the similar period last year.

Lend the Way They Fight

WAR SERVICE REPORTS NEEDED BY GOVERNMENT

General War Service Committee of the Electrical Manufacturing Industry Calls Attention to Importance of Prompt Reports

In a recent bulletin the General War Service Committee of the Electrical Manufacturing Industry calls attention to the fact that many manufacturers have failed to file the reports on forms P. C. 20 and 21 with the electrical and power equipment section of the War Industries Board.

In view of the extreme shortage of steel and other raw materials, these reports, which are used to determine the requirements of the industry for raw materials, are of vital importance, the committee says. Failure to file them will not only result disastrously to the individual, since it will deprive him of priority assistance in precuring his raw materials, but will also react to the serious detriment of the entire industry by causing an inadequate allowance of any material of which such an extreme shortage develops as to demand allocation to the industry. In such event the individual failing to file his report will naturally be deprived of his share of material.

In emphasizing the importance of prompt compliance with all its requests the General War Service Committee says that none are issued except by the request or suggestion of some government department.

"Force to the Utmost"—Buy Bonds

LOAN FROM CONSUMER TO OHIO CENTRAL STATION

State Public Utilities Commission Passes on Advance to Meet Cost of Necessary New Construction

For the purpose of building a high-tension power line between Canton and Akron, the Ohio Public Utilities Commission has authorized the Northern Ohio Traction & Light Company, Akron, to borrow $750,000 from the B. F. Goodrich Company, Akron.

At Canton this line would connect with the Central Power Company line, which was constructed to that city from Windsor, W. Va. Primarily the line is meant to supply the Goodrich company with energy, but it will also serve many other Akron consumers.

The Northern Ohio Traction & Light Company was also authorized to issue $830,000 in bonds and $147,300 of preferred stock to be turned over to the Goodrich company as security for the loan, which will mature in ten years and bear 7½ per cent interest. The Goodrich company recently loaned the Central Power Company $2,000,000 to complete its plant at Windsor and extend its power line to Canton.

RATE INCREASES ARE ASKED IN CALIFORNIA

San Joaquin Light & Power Company, Sierra & San Francisco Power Company and Northern California Power Company Ask Relief

Prior to the rain, which does not seem to have relieved the power situation in California, the San Joaquin Light & Power Company filed a petition with the State Railroad Commission to increase its rates 20 per cent. The company declared that it faced a possible receivership without this relief because its hydroelectric plant had to be supplemented by fuel oil in large quantities and the situation had come up so suddenly that it had not had time to construct its own pipe line to transport the oil.

The Sierra & San Francisco Power Company also filed a petition to increase its rates with the exception of those of its largest customer, the United Railroads of San Francisco.

The Northern California Power Company, which sells electrical energy in Shasta, Tehama, Glenn, Colusa, Butte, Yolo and Trinity Counties, has filed with the California Railroad Commission an application for authority to increase electric rates by adding the following amounts to present rates:

For energy sold for lighting service, metered, including domestic, commercial and municipal metered service, 1 cent a kilowatt-hour.

For energy sold for power service, metered, including heating and cooking, 0.2 cent a kilowatt-hour.

For energy sold for commercial and agricultural service at flat rates, 90 cents a horsepower a month.

For energy sold at special power rates applicable to electrochemical and electrometallurgical processes, 60 cents a kilowatt of maximum demand a month.

For energy sold for lighting at flat rates: Residence lighting, 5 cents a lamp a month; general commercial lighting, 10 cents a lamp a month; all-night rates, 10 cents a lamp a month.

For energy sold for municipal street lighting, 10 per cent of monthly bill.

For energy sold to other power companies (except Pacific Gas & Electric Company under a contract authorized by the commission), 0.1 cent a kilowatt-hour.

The application is based upon the increased cost of generating and distributing electric energy, as a result of the advances in the prices of materials and labor.

CREATE POWER SECTION OF THE DIVISION OF SHIPYARD PLANTS

F. W. Ballard Named Executive Head of the New Activity—Purpose of Establishment of This Office

The Division of Shipyard Plants, of which Rear Admiral H. H. Rousseau is manager, announces the establishment of a power section of the division. F. W. Ballard is named executive head. The jurisdiction of the power section embraces the following activities:

Survey of power conditions in localities in which shipbuilders and other contractors of the Emergency Fleet Corporation are concerned, preparation of reports on power requirements, preparation of proposals and plans for providing adequate power facilities, general jurisdiction in matters pertaining to the power interests of the corporation and its contracting agents.

MITIGATION OF INDUCTIVE INTERFERENCE IN CALIFORNIA

Order of the Railroad Commission Supersedes Previous Order—Rules Laid Down Are Based on the Five-Year Investigation

The Railroad Commission of the State of California issued recently general order No. 52 "in the matter of the construction and operation of power and communication lines for the prevention or mitigation of inductive interference." This order became effective on Aug. 1, 1918, and supersedes general order No. 39, which was issued in 1914.

The rules contained in this order are based on the results of five years' investigation carried on in California by the joint committee on inductive interference and on the recommendations made by this committee in its final report to the Railroad Commission. The principle of coöperation between all parties involved has been strongly emphasized throughout as the means for determining the best methods for the prevention or mitigation of inductive interference.

A number of rules of a precautionary nature are given, not limited to the lines involved in parallels and apparatus connected thereto, but applying to all new installations. The most important points covered by the rules are, in brief, as follows:

General Provisions.—The essential points considered are the applicability of rules, principle of least cost, coöperation and the relation of existing parallels to those rules.

Location of Lines.—Distance between lines, notice of intention and avoidance and length of parallels are considered under this head.

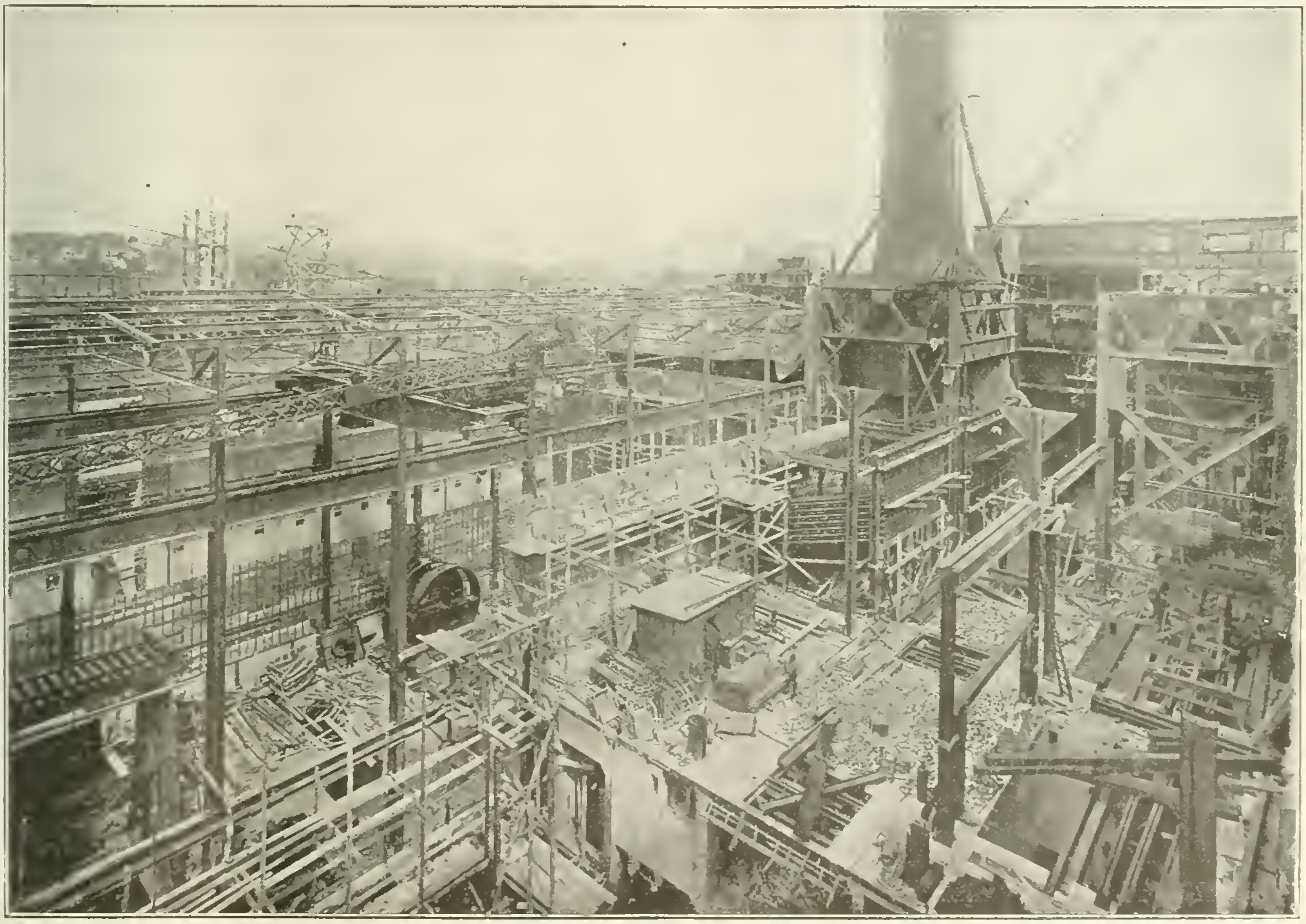
Design and Construction of Lines.—Rules relating to transpositions and to the arrangement and spacing of power conductors are given.

Design, Construction and Arrangement of Apparatus.—Rules under this head consider the design, construction and arrangement of transformers, switches, lightning arresters, rectifiers, fuses, special instruments and communication apparatus.

Operation and Maintenance.—Under this head balance of lines and the operation of transformers and method of switching and charging lightning arresters are the main points considered. Abnormal conditions of the power circuit are also considered.

The Railroad Commission has deemed it inadvisable to make the order retroactive, and on this basis its application is limited generally to new construction, except those rules dealing with maintenance and operation of lines.

Nearly 100 per Cent Increase in the Rating of the Minneapolis Steam Plant



The Riverside station of the Minneapolis General Electric Company is a scene of intense activity. A 25,000-kw. steam turbine and five 1320-hp. boilers are being added to the former 27,000-kw. plant. The addition to the station building is being made large enough to accommodate two 25,000-kw. turbines, so the ultimate rating of the station will be about 80,000 kw. The flour-mill and munitions plant load in the Northwest has been a factor in this growth.

WOULD CONTINUE DAYLIGHT SAVING THROUGHOUT YEAR

Resolution Offered in Senate to Extend Period Indefinitely Has Backing of Power Section of War Industries Board

Indefinite continuation of the daylight-saving time schedule was proposed in a resolution introduced on Monday of this week by Senator Calder of New York. The bill has the indorsement of the power section of the War Industries Board and of Chairman Baruch of the board, who believes daylight saving should continue as a coal conservation measure. Under the present statute all timepieces will be turned back an hour on Oct. 27.

According to Chief Darlington of the power section of the War Industries Board, the chairman of the National Committee on Gas and Electric Service made inquiry of twenty of the largest power producers in the country as to the result of the continuance of this daylight-saving law upon their peak loads. The following cities were included in the request: New York, Philadelphia, Pittsburgh, Dayton, Hartford, San Francisco, Cleveland, Newark, Indianapolis, Cincinnati, St. Louis, Seattle, Niagara Falls, Boston, Detroit and Baltimore. With one exception, Pittsburgh, the reply has been that the action has reduced the peak load between 10 and 15 per cent. It is estimated that in the cities mentioned alone 100,000 tons of coal will be saved this winter by a continuance of the daylight-saving plan.

SEATTLE ELECTRIC UTILITIES AGREE ON INTERCONNECTION

Municipal Plant to Purchase Surplus Energy from Puget Sound Traction, Light & Power Company at Saving to City

The city of Seattle and the Puget Sound Traction, Light & Power Company have reached an agreement whereby the city will during the next three years purchase 36,000,000 kw.-hr. of surplus hydroelectric power produced by the company, paying 0.5 cent a kilowatt-hour. Carrying out the demand of the Capital Issues Committee for the interconnection of the lighting and power systems of the city and the traction company, the physical connection will be undertaken by the city at an estimated cost of $75,000. Work will begin promptly, and it is expected will be completed by the first of the year. It is believed that when the connection is completed the city will be able to dispense with one of its steam units.

The new arrangement will effect a saving of $540,) to the city during the three-year life of the contrac t is stated, as the present cost of manufacturing electi :al energy at the city's steam plant is approximately 1 nt per kilowatt-hour. The traction company will so gain by the contract, since the power to be sold to e city is largely surplus energy produced by the (-pany's hydroelectric plants, much of which has l n going to waste hitherto.

PROGRAM FOR THE CONFERENCE CLUB MEETING AT PITTSBUR H

On Account of the Liberty Loan Campaign the . te Has Been Postponed to Oct. 31 and Nov. 1 and 2

The dates previously set for the next meeting of the Conference Club at Pittsburgh fell on the last three days of the Liberty loan drive. So many of the men whose attendance at the Pittsburgh meeting is considered of importance are actively engaged in the loan campaign and therefore cannot go to Pittsburgh on the dates set that the executive committee has decided to postpone the meeting two weeks. The new dates are Oct. 31 and Nov. 1 and 2.

The program for the Pittsburgh meeting provides for the following discussions:

"Credit and Standard Cost Accounting Systems," by C. E. Pattersen, comptroller General Electric Company.

"Credits," a discussion by Mr. Anderson or Mr. Lyons, of the Westinghouse Electric & Manufacturing Company, of the paper presented by Mr. Ellinger at Schenectady.

"The Conference Club Plan," a digest of the discussions at the Schenectady meeting, with recommendations for further action.

Progress report by the committee appointed to discuss the "plan" with manufacturers and others interested; Mr. Ellinger, chairman.

"Some Reasons Why the Electrical Contractor Should Become a Constructing Engineer," by F. W. Cooper.

"The Need of National Labor Agreements," by J. A. Cole. Discussions of the labor problem by a representative of the United States Department of Labor, Colonel Alexander of the construction division of the army, and Mr. Purcell of the International Brotherhood of Electrical Workers.

"Group Advertising," by E. D. Sickels.

Report of the executive committee containing a recommendation for changes in the constitution which will make possible the granting of full membership to representatives of all groups in the electrical industry, in order that the Conference Club may officially become what it is now unofficially, a central body for the discussion of matters of function, practice, standardization, conservation and ethics, which affect the interests of all groups, including manufacturers, resale distributers, both wholesale and retail, constructing engineers and contractors and consulting engineers.

TO OUR people the expenditure of these Liberty loan billions for the cause of freedom is a proposition so matter of fact and the gaining of a military victory over the Germans is a point so conclusively decided upon that many of us tend to feel the great aims have already been accomplished. Undoubtedly they will be in time, but in order to make them certain every one of us must get into the fray with every bit of energy and material resource possible. Do not let us depend on our neighbors. They will do their share. Every one of us must take more than his supposed share of this loan to make it the tremendous success it should be.—*Theodore N. Vail, President American Telephone & Telegraph Company.*

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

National Electrical Credit Association.—The twenty-third annual meeting of the National Electrical Credit Association will be held in Chicago, probably late in November.

Electric Club of Toronto.—The opening meeting of the Electric Club of Toronto was held Sept. 20. The entertainment of the evening was provided by K. J. Dunstan, president of the club, who described a trip to Europe.

Engineering Society of Buffalo.—It has been announced that E. B. Neil has succeeded F. B. Hubbard as secretary of the Engineering Society of Buffalo. The address of the new secretary is 115 St. James Place, Buffalo, N. Y.

Technical Societies of Chicago.—On Oct. 1 the Technical Societies of Chicago were addressed by Col. Peter Junkersfeld of the Construction Division, U. S. A., on "Emergency Construction for the War Department of the United States."

Electrical Supply and Jobbers' Association.—The Cleveland meeting of the Electrical Supply and Jobbers' Association has been moved forward to Oct. 21. instead of November, for the purpose of discussing as quickly as possible government regulations of the electrical supply industry.

Ontario Association of Electrical Contractors and Dealers.—A meeting of the Ontario Association of Electrical Contractors and Dealers was held at Toronto on Sept. 26. The purpose of the meeting was to consider a resolution advising affiliation with the national association.

A. I. E. E., Seattle Section.—A meeting of the Seattle Section of the American Institute of Electrical Engineers was held Sept. 17 jointly with the Associated Engineering Societies of Seattle and the Pacific Northwest Society of Engineering. A paper was read by Amos Slater on "Coal."

Empire State Gas and Electric Association.—In accordance with an announcement sent out a few days ago, it has been decided to postpone the annual meeting of this association until Oct. 24 in order not to conflict with the Liberty loan campaign. The meeting will be called to order at 10:30 a.m. in the United Engineering Societies Building, New York City. The program of the meeting includes the president's address, reports of officers and committees and a paper by W. P. Capes, secretary New York State Conference of Mayors, on "The Gas and Electric Company from the Standpoint of the City Official." Another paper will be presented by Harlow C. Clark, American Electric Railway Association, on "The Massachusetts 'Service at Cost' Plan."

New York Electrical Society.—The New York Electrical Society will open its work for the year with a meeting Oct. 15 in the Engineering Societies Building, New York. Dr. Schuyler Wheeler will give an address before this society on "War Experiences in France." There will be a speaker on behalf of the Liberty loan and moving pictures from the loan committee.

New York Jovian League.—The New York Jovian League will have its first meeting and luncheon of the new season on Wednesday, Oct. 16, at 12:30 p.m. in the winter garden of the Hotel McAlpin. J. W. Jones, secretary of the advisory committee of the league, announces that at this meeting it will promote the overthrow of the Hun through the medium of the fourth Liberty loan. The speakers at the meeting will be Lieut. John Quinney, a Canadian, and Congressman Charles P. Caldwell of New York.

A. I. E. E., Pittsburgh Section.—A meeting of the Pittsburgh Section of the American Institute of Electrical Engineers was held Oct. 8. The subject of an address by N. W. Storer of the Westinghouse Electric & Manufacturing Company was "New Locomotive and Substation Equipment for Chicago, Milwaukee & St. Paul Railroad." At a meeting held Sept. 17, A. M. Candy of the Westinghouse Electric & Manufacturing Company spoke on "Fundamental Principles of Electric Arc-Welding Apparatus."

A. S. M. E.-Cleveland Engineering Society.—The American Society of Mechanical Engineers has established a section in Cleveland known as the Mechanical Section of the Cleveland Engineering Society. The petition for this section was made jointly by members of the local society and by members of the national society resident in Cleveland. This new section comprises the towns or cities of Akron, Barberton, Bedford, Chardon, Cleveland, Cuyahoga Falls, East Cleveland, Elyria, Hudson, Kent, Lakewood, Lorain, Massillon, Quarryville, Ravenna, Sandusky, South Euclid, Wickliffe, Willoughby and Wooster, totaling a society membership of approximately 260, the sixth largest in the country. The Cleveland Engineering Society was organized in 1891 and has now a membership of about 1000. It is known throughout the country as one of the most active and influential local organizations of engineers. The national societies of civil engineers, electrical engineers and automotive engineers all have organized groups in Cleveland, so that opportunities for coöperation and coördination of activities are manifold. It is hoped that papers presented at the proposed joint meeting in Cleveland may be published simultaneously in the *Journal* of the Cleveland Engineering Society and that of the A. S. M. E.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

War Costs.—Dismissing petitions by the Fort Wayne & Northern Indiana Traction Company against the city of Fort Wayne for discriminatory practices and by the city of Fort Wayne for permission to decrease a primary electric rate, the Indiana Public Service Commission says in part: "No one can to-day forecast the operating conditions during the war period, but every indication is that there will be no return during the war to the operating conditions which on Feb. 23, 1916, may have justified the petition of the Board of Public Works of the city of Fort Wayne in approval of a reduction of the 7 cents primary electric rate to 6 cents. Such a change now might have serious results. This commission and all other state commissions are being called on by the federal government to do nothing that would tend in any way to weaken, either in operating efficiency or in the maintenance of plant, the public utilities of this country. The seriousness of present exigencies is no better shown than in the steps taken by the national government to finance public utilities. These directions as to the national policy have been made and issued subsequent to the declaration last year of the policy of the Public Service Commission of Indiana. Simply stated, it is that this commission, in its efforts to meet the conditions created by war and resulting from the great advance in the price of coal fixed by the national government, will promptly adjust rates in those instances where public utility companies are proved to be in distress, but that in any readjustment public utility companies will not be permitted to capitalize the war and will be called on to bear their part of the war burden. In other words, the Public Service Commission is not underwriting normal earnings on public utilities, but is intent on keeping them solvent, in good operating condition and able to command needed capital. The Public Service Commission, furthermore, with few exceptions, in giving relief that was needed, has been able to keep the burden from falling on the great mass of consumers already burdened to the limit of their abilities. This has generally been accomplished by increases in power rates. These rates, as a rule, are very low, and are generally enjoyed only by the large consumers, who, as a rule, are able to spread the burden out over the broad field of war-price sale of their commodities." The commission adds that many of these consumers also profit by war contracts.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Rate Increase in Minneapolis.—The Minneapolis General Electric Company has placed in effect an increase in electric rates amounting to approximately 10 per cent.

Illinois Associations Establish Active Office.—The joint office of the Illinois State Electric Association and the Illinois Electric Railway Association, recently established at Springfield, Ill., is undertaking active organization work. R. V. Prather, who is in charge of the work, is issuing weekly bulletins to members giving concise reviews of court decisions and commission rulings affecting utilities companies. It is the plan that the bulletin shall also include inter-company news items of local interest and value. Executive committees of both associations will also be kept advised on all legislative activities affecting their particular branch of the business.

Change in Middle West Scrip Dividend Policy.—Stockholders of the Middle West Utilities Company, Chicago, have received the following notice of change in dividend policy signed by President Samuel Insull: "Public discussion indicates quite clearly that the normal tax on incomes will be very considerably increased. While it is not altogether clear that the interest-bearing certificates heretofore issued in lieu of cash dividends upon preferred stock will not be taxable as income, the board of directors, having due regard to the wishes of stockholders from whom they have heard, are persuaded that it is to the best interest of the stockholders for the time being to defer the declaration of preferred dividends in certificates and allow such dividends to accumulate."

War Education at the Dunwoody Institute.—The William Hood Dunwoody Industrial Institute, Minneapolis, is now training a large number of men under contract with the government for both army and navy. One of the interesting departments in connection with this training is the radio department, in which at present there are under training over 200 navy radio students and fifty army radio students. The men enlisted in the navy or inducted into the army or navy are sent to the institute for an eight to ten weeks' course of instruction in both operating and theory. The institute is now considering a material increase in the quota of radio students under training for the government and needs additional instructors for class theory and laboratory as well as for operating.

Increased Rates at Mount Vernon, Ill.—The Illinois Public Utilities Commission has entered an order increasing the rates for electric lighting service in residences and business houses, making the charge for the first 30 kw.-hr. 15 cents net, for the next 30 kw.-hr. 13 cents net, and for all over 60 kw-hr. 10 cents net. The minimum bill is $1 per month. The increased power schedule which went into effect at the same time is arranged on a sliding scale from 10 cents gross to 3¼ cents net, with a minimum bill of 50 cents per month per horsepower up to 5 hp. and 35 cents per month per horsepower on all above 5 hp. The minimum bill is $1 for power.

Fuel-Oil Contracts of Byllesby Companies.—Otto E. Osthoff, vice-president of H. M. Byllesby & Company, returned to Chicago recently from a several weeks' visit to the Byllesby California properties in connection with financing matters for the Western States Gas & Electric Company and the San Diego Consolidated Gas & Electric Company. "We have closed fuel-oil contracts for 1919 for both the Western States and San Diego companies," says Mr. Osthoff, "at a nominal increase in price over 1918. The oil situation on the coast has taken a decided turn for the better as the production has lately caught up with the demand and a better feeling exists."

Rate Increase Forecast in Norwalk Plant.—The Board of Electrical Commissioners of the second taxing district of Norwalk, Conn., in reporting for the fiscal year ended July 31, speaks of the higher cost of operation and the necessity of increased rates as follows: "When it is remembered that the plant's rates for service were liberally reduced late in 1915, with no advance in the meantime, and that the war restrictions in the use of electricity for lighting and the daylight-saving law of this year have very seriously reduced the plant's income, then the fact that it has realized any gross profit at all under the circumstances becomes a matter of wonder and rejoicing. Had the plant's rates been raised, as long since became necessary and general throughout this country and most of the world, for such service, it could have maintained its former fine profit record at the expense of its patrons. While touching upon the subject of operation cost increase and decline, it must have become clear that the plant's progress under such abnormal conditions may suffer actual embarrassment unless its operation costs go down or its rates go up. As the hopeful prospect of lower costs is rather grim just now, therefore, after long consideration, with dreaded action deferred from time to time, the date of submitting this report finds us reluctantly preparing to increase the electrical rates as soon as practicable. As this step will only be taken as an expedient, its continuation will only endure during the period of necessity."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Proceeding to Enforce Orders.—Under the Public Service Commissions law, the Supreme Court is afforded a direct and summary visitorial power over corporations whenever the commission shall be of opinion that they have violated or are threatening to violate the law. Such a proceeding is paramount to any other proceeding before the court, and judgment cannot be entered in any other proceeding in violation of an order in such summary proceeding, the New York Supreme Court held (171 N. Y. S. 937).

Rates Fixed by Commission Supersede Old Rates Fixed by Contract.—Rates fixed by contract between plaintiff and defendant public service corporation's predecessor for electricity to be supplied to the former would be superseded by rates fixed by the Public Service Commission, since under the constitution the police power of the state cannot be abridged by contract, it was held by the Supreme Court of Missouri in Kansas City Bolt & Nut Company versus Kansas City Light & Power Company (204 S. W. 1074).

Determination of Questions of Jurisdiction of Commissions.—The question of whether the Public Service Commission has jurisdiction is determined by the nature of the proceeding, and not by the anticipated decision which it is said it is about to render, according to the Supreme Court of New York (171 N. Y. S. 830). An error by the Public Service Commission in law or procedure must be corrected by appeal, or by writ of certiorari or such other review as the law provides, and cannot be restrained by writ of prohibition. Under the Public Service Commission act, which authorizes the commission to fix the price of gas and provides that the price so fixed shall be the maximum price to be charged for a period not exceeding three years and thereafter until the commission shall upon its own motion fix a higher or lower maximum price for gas to be thereafter charged, the Public Service Commission has jurisdiction to reopen a case upon its own motion. On application for writ of prohibition to prevent the Public Service Commission from reopening a case on its own motion, the writ will not lie to restrain the commission from making an erroneous decision, although it appears from brief that such decision is being contemplated, nor will the court decide the question of whether the commission has power to abrogate its former order and make new order retroactive.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Lieut. Robert Montgomery of the Eighty-fourth Division, formerly manager of the commercial department of the Louisville (Ky.) Gas & Electric Company, has arrived in France.

James W. Ferris, formerly vice-president and general manager of the Watertown (S. D.) Light & Power Company, has recently been commissioned captain in the Quartermasters' Department and is now on duty at Fort Dodge, Iowa.

Frank P. Fahy, consulting magnetic engineer, New York City, has been awarded by the city of Philadelphia, on recommendation of the Franklin Institute, the John Scott legacy medal and premium for the development of the Fahy permeameter.

John S. Wise, Jr., formerly manager of the Hawood Electric Company and the Lehigh Navigation Electric Company, has been chosen to assist H. R. Fehr in the management of several electric light and power and gas properties the headquarters of which are in Allentown, Pa.

H. R. Fehr, president of the Lehigh Valley Transit Company, the Easton Transit Company and the Lehigh Valley Light & Power Company, has been given additional responsibilities, having been placed in charge of the several electric light and power and gas companies the headquarters of which are in Allentown. The gas and electric interests now under the management of Mr. Fehr are the Valley Light & Power Company, operating throughout the Allentown-Bethlehem district; the Northumberland County Gas & Electric Company, operating in Sunbury, Milton and Northumberland; the Columbia & Montour Electric Company, which supplies gas as well as electric light and power, operating in Berwick, Bloomsburg and Danville; the Harwood Electric Company, operating in Freeland, McAdoo and Hazleton; the Stroudsburg Electric Company; the Schuylkill Gas & Electric Company, operating in Shenandoah and Mahonoy City; the Lehigh Navigation Electric Company; the Northern Central Gas Company, operating at Williamsport, and the Hagerstown Light & Heat Company, which operates at Hagerstown, Md.

Philip Cabot, whose paper upon power systems (printed elsewhere in this issue) brought the question of government control strikingly before the New England Section convention of the N. E. L. A. at Springfield, Mass., last week, is one of the foremost figures in the New England public utility field. He was graduated from Harvard College in 1894 and has been identified with prominent Boston business and banking interests for many years. Mr. Cabot is a member of the banking firm of White, Weld & Company, Boston, and is president of the Turners Falls Power & Electric Company, Newburyport Gas & Electric Company, Easthampton Gas Company, Amherst Gas Company and Combined Heat & Sprinkler Company. He is vice-president of the Fall River Electric Light Company and the Greenfield Electric Light & Power Company, besides being a director in various industrial and financial corporations and a trustee of the Provident Institution for Savings. Perhaps his most notable achievements in the electrical field are associated with the development of the generating and transmission system now comprised in the Turner Falls electric property, including the large hydroelectric generating plant at Montague City, on the Connecticut River, and the main steam plant of the system, the first unit of which has just been placed in operation at Chicopee Junction, Mass., in the so-called Hampden station. This system has been expanded to be the second largest hydroelectric property in point of capacity in New England. Its lines connect the water-power plants in the Turner Falls section with the industrial and public utility plants and systems in the Springfield and Chicopee district, interconnecting these and also forming a junction with the lines of the New England Power Company. To Mr. Cabot's prophetic vision is due in large measure the readiness of his system to meet the demands of many important war industries for power in the territory traversed by these lines. Mr. Cabot makes a point of appearing personally on behalf of his companies in important commission matters, and his mastery of detail and breadth of view have often been reflected in the ELECTRICAL WORLD's accounts of hearings. For a long period he has been greatly interested in the larger problems of hydroelectric power economics and water conservation, including questions of interstate coöperation with regard to storage development.

PHILIP CABOT

Obituary

Raymond J. Kennedy, illuminating specialist of the new-business department of the Doherty Organization, died at his home in Roxbury, Mass., on Sept. 24, of pneumonia, caused by the prevalent Spanish influenza.

Lieut. Benjamin F. Sprague of the Quartermasters' Corps, stationed at Merritt, Tenafly, N. J., was thrown from a horse in camp last week and died shortly afterward. Lieutenant Sprague was formerly secretary of the New Jersey branch of the National Association of Electrical Contractors and Dealers.

Charles G. Roebling, president of John A. Roebling's Sons, wire manufacturers, died at his home in Trenton, N. J., Oct. 5, at the age of sixty-nine years. Mr. Roebling was graduated from the Rensselaer Polytechnic Institute, Troy, N. Y., with the degree of civil engineer in 1871. For a number of years he was mechanical engineer of the wire works. He was best known, perhaps, in connection with the construction of the Brooklyn Bridge, which he with his brother, Washington A. Roebling, completed on the death of their father, John A. Roebling.

Prof. William Leslie Hooper, head of the department of electrical engineering at Tufts College, Massachusetts, died at his home in Somerville on Oct. 3. Professor Hooper had been a member of the faculty at Tufts for thirty-five years and was acting president in 1912 and 1913. He was born at Halifax, N. S., in 1855 and was educated at Tufts, from which he received the degrees of A.B., A.M., honorary Ph.D. and honorary LL.D., in the course of his long association with the institution. He became instructor in mathematics in 1878 and from 1883 to 1890 was assistant professor of physics. Professor Hooper was assistant to the late Prof. A. E. Dolbear, and as the latter founded the strong department of electrical engineering at Tufts, Professor Hooper was closely identified with its development from the first. In 1890 Professor Hooper was made head of the electrical engineering department. He was a fellow of the American Academy of Arts and Sciences, member of the American Institute of Electrical Engineers and past-chairman of the Boston branch. In the development of the West End Street Railway at Boston Professor Hooper was prominent as a consulting engineer, and he was called upon at various times for expert services in the industrial world. Advancing years had little effect upon his interest in engineering society meetings at Boston, and he was an able teacher, whose executive ability, rugged, kindly personality and modest bearing won him a host of friends.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

EFFECTING CO-OPERATION IN HANDLING ESSENTIAL ORDERS

New Orleans Trade May Commandeer Each Other's Stocks and Labor to Complete Emergency Work

Every day brings fresh evidence of the efforts being made by members of the electrical industry to uphold the hands of the government by presenting the use of electrical equipment except where it will serve an essential need. Manufacturers, jobbers and dealers have given their pledge. It has been hard at times to explain to old customers why orders could not be filled.

One of the most recent examples of carrying out the requirements and recommendations of the government to the full extent comes from New Orleans.

There a couple of weeks ago the firms represented on the New Orleans Electrical Exchange held a special meeting at which the members pledged themselves to co-operate with each other in all war work.

To facilitate emergency war work and combat the shortage of skilled labor and electrical supplies, the dealers arranged a plan whereby any dealer in the city may commandeer supplies and labor from the remaining dealers to complete emergency work for the government.

Resolutions were passed discouraging all but the most essential war work. Many New Orleans concerns are refusing to do electrical work unless it can be shown to be essential. A general meeting of all the men in the industry will be called soon in an effort to bring about unity and coöperation in carrying on war work.

Strafe the Germans—Buy Bonds

STANDARDIZATION RESULTING FROM WAR CONDITIONS

Large Numbers of Types and Sizes Now Being Eliminated Not Without Benefit to Manufacturers and Jobbers

In many ways the entrance of the United States into the war has been a blessing in disguise. Not the least of these pertains to the standardization of electrical supplies. It has in the past been more the rule than the exception to hunt for something special when a new use arose rather than to employ a standard article. In certain lines it was felt to be almost necessary to add every so often new devices to an already large number that would do equally well.

In some lines that have been closely controlled standardization of product has progressed far. In lines less closely controlled it has been difficult to get the manufacturers to agree on standards. The Associated Manufacturers of Electrical Supplies has done considerable in the different sections. By a free exchange of ideas and opinions a number of standards have resulted and many special designs have been removed from catalogs.

Now, however, that raw materials are so necessary for purely war purposes, standardization is virtually forced on a willing industry. By a sweeping curtailment in the number of types and sizes of appliances and supplies, almost all of the special equipment is put aside. Those styles and sizes that remain it would be natural to suppose will be those for which the greatest demand exists and which satisfy and can be used in the greatest number of instances. In other words, they will virtually become the standards.

The manufacturer has had to take such action, but the benefits that will result so far as he is concerned are apparent. By being reduced to a standard output he will under normal conditions be able to produce more cheaply and his operation should show less waste in material. He will have no worry about a competitor getting out a special product. He will be able to save in his catalog and in his sales expenses. Besides these benefits, there are others.

The jobber, however, is in a far better position. He can, first of all, reduce the volume of stock that he must carry by reducing the number of styles. In this way he can release capital for other employment, reduce warehouse space, get better deliveries, reduce sales expense, cut catalog size, get along better with less help, and generally benefit in a number of other ways.

The only question that arises is to what extent the styles and sizes that have been eliminated will again be placed on the market when the supply of raw material becomes easier. It is doubtful if they will all come back under any circumstances.

Kultur Is Inhumanity—Buy Bonds

RAW MATERIALS CONTROLLING FACTOR IN PRODUCTION

The War Requirements Are Now Sufficient to Absorb All the Production of Steel Products and Copper

Raw materials for some time have been the governing factor in the production of electrical goods. To-day this condition exists in a still more aggravated form and is daily becoming worse. Production, great as it is, is limited and by no means large enough to supply fully all of the demand being made upon it.

It is daily becoming more evident that everything not absolutely essential to the winning of the war must be greatly curtailed in production. In fact, it would not be surprising if industries that have received priority classification of B or lower obtained only just as much steel, copper, brass or lead as is necessary to take care of actual war orders. That an industry receives a classification in the preference list by no means insures that industry that it will obtain the raw materials required.

The war requirements for steel, it is well known, are greater than the mills can supply. The same is true of copper. Production of copper has suffered considerably of late, largely through labor trouble. Lead supply also is low.

Consumers of copper must have permits the same as for iron and steel. Only this week Everett Morss, chief of the brass section, War Industries Board, issued the following instructions to brass manufacturers:

1. Because of the shortage in the supply of copper and copper base alloy products, public interest requires that the production and distribution thereof be regulated.

2. Effective immediately, please make the acceptance of each and every order conditional on receipt of a permit from the brass section of the War Industries Board, unless such order be placed with you direct by the army, navy or emergency fleet, which orders require no permit.

3. This request covers all brass and copper mill products except bare and insulated copper wire, but does not cover brass foundry products.

4. The notice of June 26, 1918, to manufacturers of brass and copper tube will continue in force on all tube orders. This notice supersedes previous notice on future orders.

5. Except tube, existing orders now covered by definite specifications may be shipped, without permit, until further notice, but in no case after Nov. 30, 1918.

The government has the brass industry completely under control. Not a pound of new business can be accepted without first obtaining the sanction of the War Industries Board.

Make the World Clean--Buy Bonds

METAL MARKET SITUATION

Copper Imports Heavier—Brass Under Control—Pig-Tin Prices to Be Fixed

Quietness prevails in the various metal markets this week. Copper producers are marking time until the coming meeting at Washington relative to fixing the price of copper after Nov. 1, although there is small reason to anticipate any change in the present selling price. Importations of copper are increasing, and it is reported that the imports in August were the largest of any month this year. Dealers report a good demand for war purposes, with all their available supplies for the next month or two taken care of. The recent ruling of the War Trade Board made on Oct. 4 affecting the importation of copper has been so far modified by a new ruling as to permit the importation of copper concentrates containing 50 per cent or more of copper from non-enemy countries, instead of 60 per cent or more as in the former ruling. The previous restriction of ore, except from Cuba, Canada or Mexico, and of copper concentrates containing less than 50 per cent of copper, except from the above countries, remains in force. There is no restriction upon the importation from any non-enemy country of copper matte, blister copper or copper concentrates containing 50 per cent or more of copper.

The brass industry is exceedingly busy, and there is a shortage of brass in the country. Practically every pound of brass now manufactured in the United States goes into government use. To all intents and purposes the entire industry has been commandeered. Labor shortage has had its effect on the output, but the absolute necessity for brass in various forms for war purposes has made its importance second to none at the present time.

The War Industries Board will establish prices on pig tin for American consumers at actual cost delivered in this country. The inter-allied tin executives in London, composed of English, French, Italian and American representatives, will control the buying price in the producing market.

NEW YORK METAL MARKET PRICES

	Oct. 1	Oct. 8
Copper:	£ s d	£ s d
London, standard spot....	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26.00
Casting	Govt. price 26.00	Govt. price 26.00
Wire base	29.25	28.75
Lead, trust price	8.05	8.05
Antimony	14.00 to 14.12½	14.00
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	15.00	15.00
Spelter, spot	9.40	9.10
Tin, Chinese *	No quotations	No quotations
Aluminum, 98 to 99 per cent....	Govt. price †33.10	Govt. price †33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire.............	23.50 to 24.50	23.50 to 24.00
Brass, heavy.....................	14.00 to 14.25	14.00 to 14.25
Brass, light.....................	11.50 to 12.00	11.50 to 12.00
Lead, heavy......................	7.50 to 8.00	7.50 to 8.00
Zinc, old scrap..................	6.50 to 6.75	6.50 to 6.75

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*No Straits offering. † In 50-ton lots or more; carload, 33.10 cents per lb.; 0-ton to 14-ton lots, 33.20 cents per lb.

THE WEEK
IN TRADE

ALL the week the trade has been deeply engaged in getting at the bottom of the priority classification. The situation is a new one, and it is difficult to conduct business properly and quickly according to the latest rulings. Jobbers are expecting their official certification this week, upon receipt of which they can go ahead ordering stock on the basis of their B-4 classification.

Evidences of weaker stocks are beginning to come to light. With the government taking such quantities of supplies, this has been expected for some time. Deliveries, if anything, are poorer then they have been, without much prospect for any material improvement. In lines produced in large measure from steel and copper stocks are particularly hard to get. As merely showing the condition of the market, there is a report this week that the National Conduit & Cable Company has unfilled orders on its books involving 30,000,000 lb. of material.

The epidemic of influenza has proved a considerable handicap to business on the Eastern seaboard this week, especially in New England and the Middle Atlantic States.

No new price changes of any great importance were reported during the past week. Business continues the same week by week. The war trade is virtually all that there is. What commercial trade exists is dwinding steadily. The pledge of the trade should still further curtail such buying.

Labor appears to be much quieter then it was earlier in the fall. Fewer labor disturbances are reported in the papers. There continues, however, to be a serious shortage of labor, both skilled and unskilled.

NEW YORK

Local stocks are beginning to feel the effect of strict adherence to priority distribution. It is continually becoming harder to obtain material for stocks. In conduit, for instance, one manufacturer stated that his factory was running behind on AA and A priorities. He could not therefore ship, and was not shipping, to any one in class B or lower. Jobbers with A priority orders could get factory shipment to the job but not to stock. Small wire is also getting alarmingly short. Other metal stocks are getting lower. In fact, no surplus stocks of any kind are now being reported locally. Two months ago, however, a surplus stock could be discovered somewhere in the city in almost any line of supplies.

Local jobbers have adopted standard forms, (1) for forwarding to manufacturers their numbered jobbing priority certificate, (2) for obtaining signed pledges from contractors who purchase for resale, and (3) for use with orders from contractors for material for non-essential work.

The influenza epidemic has gained great headway in the Atlantic States and is curtailing business. One jobbing house in New York was found Monday to be guarded by the office boy only—the other employees being home with the disease.

A statement from the New York superintendent of the United States Employment Service is to the effect that 350,000 more men are needed in government war work in the East, and that the need is constantly increasing.

Prices have been remarkably quiet during the past week, no price changes of any importance having been reported.

PORCELAIN.—There has been practically no change in list prices of porcelain knobs, tubes, cleats, etc., for a couple of months. Discounts have shortened slightly, and deliveries are very slow owing to the difficulty of obtaining shipments and material.

CONDUIT.—The situation in iron conduit remains the same. There has been no recent price change. The jobbing trade reports that it is practically impossible to obtain shipments for stock. One manufacturer has shipped no iron conduit to local jobbers for some time. All shipments are on AA and A priorities, and if a jobber wants conduit for such work the necessary material is shipped direct to the job under way.

NON-METALLIC CONDUIT.—There has been a brisk demand for this material. One manufacturer reports that his prices have not changed since August, when an advance of 20 per cent took place, owing principally to the price of cotton.

WIRE.—Manufacturers are marking time so to speak until the meeting of copper men is called on Oct. 15. Other influences which may bear upon the future trend of the market are cotton and rubber.

LAMPS.—Independent lamp manufacturers on Oct. 1, advanced the prices of all tungsten lamps approximately 15 per cent. All 25-50 watt vacuum-type tungsten lamps are now listed at 35 cents.

ELECTRIC RADIATORS.—Owing to the continued cool weather with frosts in many sections, the demand for electric radiators is good and increasing. As far as could be learned the local stocks are in good shape. Jobbers were largely sold out of this class of equipment last winter during the severe weather and, anticipating a fall demand, owing to later starting of furnaces, they took measures to prepare.

FANS.—Manufacturers have made recommendations to the War Industries Board involving a considerable curtailment in numbers of sizes and types of fans. This action was taken preliminary to securing a classification for the industry in the priority scale. This past year, it is well known, a considerable number of fans were taken by the government for military and allied uses.

CHICAGO

Jobbers are doing their level best to interpret and apply Circular 23 properly and fairly. There are difficulties in carrying out the pledge system, however, which are demanding close attention. Moreover, certain suggestions for changes to make the plan easier to operate are heard. For instance, one jobber has a very large industrial customer whose factory is working 100 per cent on war contracts. The concern cannot, however, be called a munitions plant. Under the ruling as the jobber now interprets it he must ask this concern to sign a pledge with each order. It is suggested that the bookkeeping involved might be simplified in such cases by taking a blanket pledge from such customers covering all orders given to the particular jobber. The jobbers' convention in Cleveland on Oct. 21, 22 and 23 is being anxiously looked forward to, since it is expected that discussions on these topics will clear up clouded points.

No definite action has as yet been announced in connection with the Chicago aeroplane plant mentioned in last week's issue. The committee on farm lighting is still collecting data to present to the War Industries Board.

Prices still show an upward trend.

LAMPS.—Prices have advanced in some cases 10 per cent and in some cases 15 per cent, depending on the dating of contracts. Lamp men in the field seem to expect little in the way of reduction in sizes in the common 50-watt, 60-watt and kindred lamps. They do expect marked changes, however, in the demands of customers now using sizes above 200 watts. The size of the bulb on 25-watt lamps is being reduced.

FLASHLAMPS.—There has been another increase in flashlamp prices. This is the second increase within a few months.

FARM-LIGHTING PLANTS.—Some manufacturers claim that the fall market is not as active as was expected, although they agree business is good. Iowa is said to be the best market in the Middle West this fall for farm-lighting plants.

FIXTURES. — Lighting-fixture manufacturers who are not making industrial types are in an unenviable state of mind. They feel the tightening of the material situation and do not see a way to aid themselves. They possess little machinery that can be used in producing government goods. This is especially true of the smaller concerns.

BOSTON

Business continues very active. The influenza epidemic has cut into retail commerce to considerable degree and has handicapped all branches of the industry. Public meetings have been put under the ban for the present, and a general closing of places of amusement, soda fountains, saloons and churches is in effect. Necessary mercantile and factory work is being pushed hard, but the depleted staffs of many establishments are carrying heavy burdens. It is increasingly difficult to fill even stock orders quickly, but this condition is regarded as temporary. Renewed efforts to raise the necessary funds for the fourth Liberty loan are being made, and this activity tends to slow down collections somewhat except from the government. Fundamentally, however, conditions are very satisfactory, barring extra high prices in the commodity and labor market. The electrical industry is in a strong position, and while some adjustments will have to be made as conditions of world import force them, the future looks most encouraging.

Some jobbers are hesitating a little in buying on account of the apparent progress of the war toward a victorious through deferred conclusion. There is to be seen a marked tendency toward husbanding stocks of wire, conduit and other material which cannot be replaced in normal quantities at normal rates of delivery. Priorities rule most transactions now. Deliveries are rather slow at present. Prices hold up firmly, and here and there stiffen in face of the demands of an unsaturated market.

VACUUM CLEANERS.—The demand is vigorous and increasing shortage of labor for domestic service is stimulating sales. Factories are able to accumulate only small stocks, if any. The M. S. Wright Company, Worcester, Mass., announces an advance in the price of its model "MD" cleaners from $45 to $49.50 retail. Labor is getting scarcer.

WASHING MACHINES.—Jobbers cannot obtain enough machines to meet the present market requirements, according to recent investigations. The price advances which went into effect a while since appear to have had little effect on sales. The flow of machines into New England is closely restricted, and if this keeps up long, it looks as though a waiting list would be forthcoming.

RADIATORS.—Jobbers' stocks are very low, and the demand for such units has already exceeded estimates of its magnitude for early fall. The outlook for a replenishment of stocks in the near future is decidedly poor.

RANGES.—The domestic demand is falling off a little. The government's restrictive sales ruling makes the outlook for expansion in this branch of trade rather uncertain at present. Existing gas and coal ranges are being displaced here and there, but no real campaign can be carried on satisfactorily at present, apparently.

MOTORS.—Inquiries are running fewer for the time being and prices do not show much change. Second-hand motors command as good prices as, or better ones than, new factory products, thanks to delivery conditions. Recent sales have included many motors for driving generators in radio sets. Stocks remain about as full as last week, with a slight tendency toward an increased supply.

FIXTURES.—The government housing program is absorbing fixtures in fair quantities for the time being. Little ordinary residential work is now being done, either new construction or refurnishing.

WIRE.—A decided shortage has arisen in New England with respect to No. 14 wire. Distributers have been obliged to cut down orders in several cases to a 5000-ft. limit. Stocks are being nursed along carefully. A factor in this situation is a recent order of the government commandeering the use of insulating machinery used in producing this size of conductor. Overseas supplies must come first, and the local market will have to get along for a time with less than normal shipments.

SCHEDULE MATERIAL.—Stocks are fairly large at present.

DRY CELLS.—Stocks of these units are running lower, and replacement is not being accomplished at the speed which distributers desire. Sales are very brisk.

ELECTRIC IRONS.—Dealers report excellent business. Prices appear to cut little figure in iron sales. Unquestionably the workingman's high wages are exercising their purchasing power with respect to these most important household utilities. One dealer in central Massachusetts states that he is selling more irons to-day at $8 each than he formerly could dispose of at $5.

OZONATORS.—It is reported that electric ozonators loaned the navy medical authorities have saved a number of lives in the influenza-pneumonia epidemic. Appliance dealers believe that if the indorsement of the medical profession could be obtained for the general use of these equipments at this time, much good would result.

SEATTLE—PORTLAND

The beginning of October finds conditions in nearly all electrical lines exceptionally good. This is, of course, due largely to the shipbuilding industry and other lines of war work. However, a considerable portion of sales volume can be credited to the government, which is buying heavily for the Puget Sound Navy Yard housing program and to supply demands of the Puget Sound artillery district. Little change can be seen in this week's volume of sales as compared with the past several weeks. Jobbers' stocks are being maintained with increasing difficulty, owing to pressing demands of government and war industries. Labor unrest is not so much in evidence at present, but man power is getting more scarce than ever. Women are being called on in increasing numbers for every form of industrial work, and one of the large shipbuilding concerns is making special housing arrangements for its women employees, looking to the near future when the number employed must be greatly augmented.

The Portland district reports that September was a first-class business month, and the first week in October indicates that this month will be even better. The spruce division of the Signal Corps in Portland territory closed contracts for the purchase of approximately 700 hp. in motors of varying sizes to be used in spruce mills, besides a contract for 1000 kw. in transformers for use in a cut-up plant. Sales of odd motors to shipyards in the Portland district were heavy.

The Pacific Forging and Machinery Company of Portland has begun the erection of an industrial plant which will specialize in shipyard and allied war work. The Willamette Iron & Steel Works, Portland, closed contracts for fifty-one Scotch marine boilers, to be installed in freighters being constructed for the Emergency Fleet Corporation. This order has no bearing on an inquiry received recently from the Emergency Fleet Corporation to manufacture fifty boilers for vessels building on the Atlantic coast. The value of contracts let is approximately $1,120,000, and there are about 150 other boilers under contract that the plant is either building or providing for. The West Kootenay Power & Light Company of Rossland, B. C., has awarded the contract for 300,000 lb. copper cable to be used in the construction of a transmission line from Grand Forks to Princeton.

Beginning Oct. 7, Seattle will build new homes at a minimum rate of 250 per month. Priority certificates for materials for the first 1500 houses of Seattle's homebuilding program have been made available. Certificates are obtainable for lumber, brick, hardware, electrical supplies, etc., assuring builders that construction will not be delayed. Portland reports building steadily increasing and Tacoma reports unprecedented residence construction.

Satisfactory progress is being made, in Seattle particularly, regarding tracing, classification and delivery of loaded cars which contain exports and imports and domestic freight. Centralization of the work has gradually reduced the number of unidentified loads 60 to 80 per cent. The first block of Skagit River power site bonds, amounting to $1,500,000, has been sold, with the understanding that brokers will not put the bonds on the market until after the fourth Liberty loan drive is over. Collections are in a satisfactory condition despite enormous drain on finances from the flotation of the fourth Liberty loan Heating equipment, according to local dealers, has not shown any activity this fall, but with the threatened bad weather of the past week inquiries are materializing. In Seattle one large shipyard has under consideration the installation of a considerable number of socket device heaters in private offices, replacing steam equipment heretofore used.

SAN FRANCISCO

It has been decided that all new buildings, repair or reconstruction work in interior California that totals over $1,000 per job must receive the approval of the State Council of Defense and that any job, great or small, in the larger cities must receive such approval. This is in accordance with the government's desire to aid agriculturists and orchardists, but modifications will no doubt be made from time to time to the best interests of essential use of electrical material. Already there can be observed a big decrease in the number of even the small jobs that were the rule, and many electrical contractors who are out of industrial or agricultural districts or who have not or cannot construct a profitable appliance business are automatically being retired from the field. Few new large essential jobs are noted. The medical supply depot of Mare Island is asking for an appropriation of $5,000,000, and new barracks for housing aviation students are being constructed at Redlands and Berkeley, Cal. Jobbers' salesmen in the cities of San Francisco, Oakland and Los Angeles have been active during the first week of the Liberty loan, and as they have practically put all their time in this work, very few shelf-stock or appliance orders are to be observed. thus rounding out what is altogether a week of temporary slump.

The government housing bureau is now busy on Oakland, San Francisco and Mare Island projects. The situation is acute, so much so that a door-to-door canvass has been made and cards distributed on which apartments, flats and even rooms have been noted and tabulated. Thirteen thousand additional quarters have been uncovered in San Francisco, but it is figured that 40,000 more are needed, so that the winter and early spring will see some huge construction of this nature.

New construction now includes a government appropriation of $1,600,000 for a thousand-bed turberculosis hospital at Whipple Barracks, Arizona; the enlarging of the Santa Fé-Fresno yard, a machine shop for the Moore Shipbuilding Company in Oakland, and fourteen large rooming houses for the Harbor Housing Corporation of San Pedro. It is significant that the jury that selected the plans for the new state building at Sacramento, to cost $3,000,000, announced that its completion will be deferred until after the war.

New prices on B lamps are now effective, standard 25-watt and 40-watt lamps now listing at 35 cents instead of 30 cents each. An elimination of certain wattages to standardize production, at the government's request, is noted. There has been no change in prices of C lamps. Fairly prompt deliveries are now being made from well-assorted local stocks, although as allotments of future shipments have been cut down the usual winter increase may yet work a hardship.

Single-fare trans-bay rates have been raised between San Francisco and East Bay cities from 1 cent to 10 cents per trip, and East Bay railway systems are now charging 6 cents per trip for local trips. So far this increase has not spread to San Francisco. In the latter city, by the way, jitneys have been compelled to raise their trip prices to 10 cents because of the big increase in the cost of tires and gasoline, and it is reported that the number operating in San Francisco has decreased from 700 to 300.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61 00
No. 12 solid	71 00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145 00
No. 10 stranded	95 00
No. 8 stranded	115 00
No. 6 stranded	160 00
No. 4 stranded	205 00
No. 2 stranded	266 00
No. 1 stranded	315 00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135 00
No. 10 solid	185 00
No. 8 stranded	235 00
No. 6 stranded	370 00
No. 4 stranded	575 00

NET PRICE AND DISCOUNT PER 1000 FT—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10%
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10%

Twin-Conductor

	No. 14 Solid
Less than coil	$105 00 to list
Coil to 1000 ft	90.00—10%
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20% to $73 20
Coil to 1000 ft	List
	No. 12 Solid
Less than coil	+20% to $85 20
Coil to 1000 ft	List

Twin-Conductor

	No. 14 Solid
Less than coil	$115.00
Coil to 1000 ft	100.00
	No. 12 Solid
Less than coil	+20% to $162 00
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	12%
1/5 to std. pkg	20%
Std pkg.	44%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to 12%
1/5 to std. pkg	+5% to 20%
Std. pkg	18% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 45—$0.46	$0 45—$0.47
12 to 50	40	.40— .41
50 to barrel	35— 36	36— 37
Barrel lots	32- 329	33— 329

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40 to $0 45	$0 40 to $0 45
12 to 50	35 to 39	35 to 39
50 to barrel	319 to 362	329 to 382
Barrel lots	289 to 332	299 to 342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5 00
⅜	250	7 50
½	100	10 00
¾	50	13 00
1	50	21 00
1¼	50	26.00
1½	25-50	35 00
2	25-50	45 00
2½	25-50	52 00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip.	$75 00	$63 75— 69 75
⅜-in. double strip	75 00— 82 50	72.00— 75.00
½-in. single strip	100 00	85 00— 93.00
½-in. double strip	100.00—110.00	96 00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75 00	$63 75 to $64 25
⅜-in. double strip	78.25 to $90 00	71 25 to 75 00
½-in. single strip	100 00	75 00 to 85 00
½-in. double strip	105.00 to 120 00	93 00 to 100.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In	List per Foot	Size, In.	List per Foot
7/32	$0 05½	1	$0 25
¼	06	1¼	.33
⅜	09	1½	40
½	12	1¾	47
⅝	15	2	55
¾	18	2¼	65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.	$35.00-55.00	$32 00-35 20	$29.00-30 25
¼-in.	40.00-60 00	35 00-38 40	32 00-33.00

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.	$44 00-60 00	$30 00-33 00	$26 50-29 15
¼-in.—	48 00-65 00	32 50-36 00	29 00-31.80

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
¼	$0 08½
⅜	08½
½	08½
¾	11½
1	17
1¼	23
1½	27½
2	.37½
2½	.58½
3	76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0 05	$0 19
⅜	06	.19
½	07	19
¾	10	.25
1	13	37
1¼	17	45
1½	21	50
2	28	1 10
2½	40	1 80
3	60	4 80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in
Less than 2500 lb.	7% to 12%	9% to 14%
2500 to 5000 lb.	10% to 15%	12% to 17%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+4% to 6.8%	+2% to 8 8%
2500 to 5000 lb.	+1% to 10.7%	+1% to 12 7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5 00 to $6 00
Discount	30%

CHICAGO

List price	$6 00 to $7 00
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp	100	$0 25
35-amp. to 60-amp	100	35
65-amp. to 100-amp	50	90
110-amp. to 200-amp	25	2 00
225-amp. to 400-amp	25	3 60
450-amp. to 600-amp	10	5 50
600-Volt		
3-amp. to 30-amp	100	$0.40
35-amp. to 60-amp	100	60
65-amp. to 100-amp	50	1 50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5 50
450-amp to 600-amp	10	8 00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	30%
1/5 to std pkg.	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	30% to 31%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6 00 to $8.75
1/5 to std. pkg.	5.25 to 7 00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8.00
1/5 to std. pkg	7 00

Standard packages, 500. List, each, $0 07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	40
100-watt—B	24	85
75-watt—C	50	70
100-watt—C	24	1 10
200-watt—C	24	2 20
300-watt—C	24	3 25
Round Bulbs, 3½-in., Frosted:		
15-watt—G 25	50	60
25-watt—G 25	50	60
40-watt—G 25	50	60
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30	24	82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1 15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$20.20—$35 90
Coil to 1000 ft	27.18

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$38 00
Coil to 1000 ft	28 00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24 00

CHICAGO

Net per 100	$21 75 to $30 00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30 00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30 00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20 00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%	20%
$10.00 to $50.00 list	36%	36%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20% to 30%	10% to 20%
$10.00 to $50.00 list	30% to 40%	20% to 30%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	5%
1/5 to std. pkg	15%
Std. pkg	25%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$21 00 to $38 00
1/5 to std. pkg	17 85 to 19 00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$16 80–24 15
1/5 to std. pkg	15 80–21 00

Standard package, 2200. List per 1000, $20.00–21 00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.—Solid Nail-it	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg	$16 00 to $20 20	$32 00
1/5 to std. pkg	13 60 to 15 60	27 20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid Nail-it	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg	$11.70–$24 00	$33 85–$35 80
1/5 to std. pkg	10.15 20.00	26 60–32 00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0 33
½-in. cap keyless socket	500	30
½-in. cap pull socket	250	60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+10%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List
1/5 std. pkg	10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0 80
60-amp. S. P. S. T	1 20
100-amp. S. P. S. T	2.25
200-amp. S. P. S. T	3.48
300-amp. S. P. S. T	5.34
30-amp. D. P. S. T	1 20
60-amp. D. P. S. T	1 78
100-amp. D. P. S. T	3.38
200-amp. D. P. S. T	5 20
300-amp. D. P. S. T	8.00
30-amp. 3 P. S. T	1 80
60-amp. 3 P. S. T	2 68
100-amp. 3 P. S. T	5.08
200-amp. 3 P. S. T	7 80
300-amp. 3 P. S. T	12 00
Low Grade:	
30-amp. S. P. S. T	$0.42
60-amp. S. P. S. T	74
100-amp. S. P. S. T	1 50
200-amp. S. P. S. T	2 70
30-amp. D. P. S. T	68
60-amp. D. P. S. T	1 22
100-amp. D. P. S. T	2 50
200-amp. D. P. S. T	4 50
30-amp. 3 P. S. T	1 02
60-amp. 3 P. S. T	1 84
100-amp. 3 P. S. T	3 76
200-amp. 3 P. S. T	6 76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+5% to Net
$10 to $25 list	11% to 15%
$25 to $50 list	14% to 20%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16% to 25%
$15 to $50 list	24% to 28%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 15%
$10 to $25 list	List to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15% to 16%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0 28
5-amp. single-pole, ind	250	32
10-amp. single-pole	100	48
10-amp. single-pole, ind	100	54
5-amp. three-point	100	54
10-amp. three-point	50	76
10-amp., 250-volt, D. P	100	66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0 45
10-amp. three-way	50	.70
10-amp. double-pole	50	70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to 10%
1/5 to std. pkg	5% to 16 %
Std. pkg	18% to 25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0 34
No. 160	60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 40%	Net to 30%
$2.00 to $10.00 list	10% to 50%	5% to 40%
$10.00 to $50.00 list.	20% to 60%	10% to 52%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10 00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 50%

TOASTERS, UPRIGHT

NEW YORK

List price	$6 00
Discount	30%

CHICAGO

List price.	$6 35 to $7 00
Discount	20% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools.	$0.454–$0 51
No. 18, full spools	404– 49

CHICAGO

	Per Lb. Net
No. 18, less than full spools.	$0 65 to $0 72
No. 18, full spools	55 to 605

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

No.	Price per 1000 Ft. Net Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15 00–$20 00	$13 50–$15 00	$13 00–$14 00
12	23 58– 27 10	21 62– 23 20	17 05– 17 68
10	30 20– 39 80	27 45– 32 40	23 47– 23 75
8	42 74– 53.35	38 85– 45 70	33 21– 33 35
6	61 50– 84 40	55.35– 72 35	52 58– 53 05

CHICAGO

No.	Price per 1000 Ft. Net Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$22 00–$25 00	$18 00–$22 00	$15 50–$16.50
12	29 46– 31 44	29 46– 31 44	25 54– 31 44
10	41 10– 43 84	41 10– 43 84	34 62– 38.36
8	59 90– 61 76	57 90– 61 76	50 18– 54 04
6	85 31– 97 68	85 31– 85 47	72 21– 85 47

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$37 75 to $40 40
25 to 50 lb.	37 75 to 38 40
50 to 100 lb	34 40 to 36 75

CHICAGO

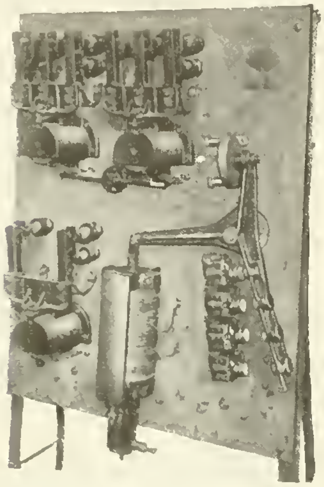
	Per 100 Lb. Net
Less than 25 lb	$37 00 to $41 75
25 to 50 lb	36 00 to 39 75
50 to 100 lb	35 00 to 38 75

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Car-Switch Direct-Current Elevator Control

Single-speed passenger and freight elevator service requiring car speeds up to 150 ft. per minute can be successfully handled by Westinghouse type E elevator control, which is used with compound-wound direct-current elevator motors.



CAR-SWITCH CONTROL FORCE FOR DIRECT CURRENT

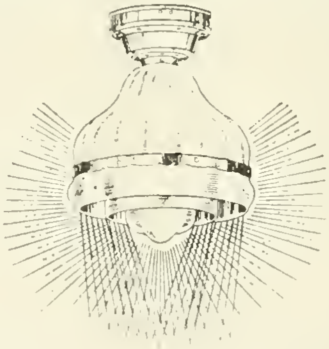
The control is quiet and acceleration is smooth and uniform. Being operated automatically and thus entirely independent of the operator, it is impossible to injure the electrical apparatus by careless or ignorant manipulation of a car switch. The equipment is designed for time-limit acceleration with capacity for handling 10-hp., 115-volt, or 20-hp., 230-550-volt, direct-current motors. The apparatus is very simple, consisting of a control panel, a car switch and such elevator safety devices as may be desired.

A black marine-finished slate panel is furnished with a pipe frame or floor mounting and carries a main-line contactor, two directional contactors, which are mechanically interlocked, and an acaccelerating contactor, controlled by a large air dash-pot for cutting out the starting resistance and series field. The resistors are mounted on the rear of the panel, making the control apparatus a complete unit which can be mounted in any convenient place near the elevator motor and rendering all parts easily accessible for inspection at any time. Provision is made on the directional and line contactors for a shunt brake circuit, which, when the control circuit is completed, energizes the brake magnet and releases the brake. The contacts are graphite to graphite of the butt type (no sliding contacts used) and are easily renewed. All contacts, with the exception of those for the interlock, are interchangeable for alternating-current and direct-current type E controllers, for both car-switch and push-button operation. A one-point car switch mounted in the elevator car furnishes the means by which the operator controls the movement of the car.

Safety devices may be connected in the control circuit so that the opening of any switch will bring the car to rest. Those most commonly used are the emergency switches, to be used by the operator in case of accident or failure of the car switch; machine-limit and hatchway-limit switches, which operate automatically to prevent accidents from over-travel, should the operator for any reason fail to release the car switch, and door switches, which prevent the starting of the car until the door is properly closed. This control is made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Commercial and Industrial Lighting Fixture

As features of the inclosed lighting unit manufactured by the National Diffused Light Company, 136 West Lake Street, Chicago, especially high efficiency and absence of glare are claimed. The fixture is made in several styles for mounting on the ceiling and for single or multiple chain suspension. In some cases the top section of the unit is constructed of metal and opalescent glass is used. The lower section of the fixture is corrugated, that portion of the corrugation which is visible to the eye being frosted and that which is not visible to the eye being of clear glass. This, the manufacturer has stated, combines effectively the use of the principle of direct lighting with that of diffused lighting to get high efficiency without exposing the filament to the naked eye.



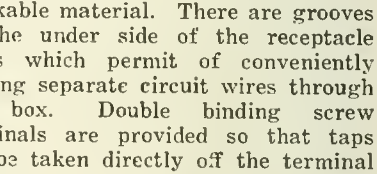
EFFICIENT UNIT WITHOUT GLARE

Electrical Devices for Marine Service

One of the inherent conditions under which electrical installations must operate in marine service is the constant heavy vibration caused by the machinery operating the ship. After an exhaustive study of the specific requirements of the service, the Bryant Electric Company of Bridgeport, Conn., has developed a line of sockets, switches, connecting blocks and other devices which have been approved by the Emergency Fleet Corporation and which are also approved by the National Electrical Code.

The bases of lamp receptacles are made of molded composition of liberal dimensions and of comparatively unbreakable material. There are grooves on the under side of the receptacle bases which permit of conveniently passing separate circuit wires through the box. Double binding screw terminals are provided so that taps can be taken directly off the terminal plate without requiring the usual soldered connections in the box.

A feature of importance to the wiring contractor is the fact that all screw spacings for attaching the receptacles in the box are uniform that is, 1⅜ in. (3.64 cm.) on centers. The diameter of the receptacles is 1¾ in. (4.45 cm.), and two of them can be mounted side by side in a 4-in. (10-cm.) round box if desired. The lamp receptacle shell insulator is designed to eliminate the danger of exposed metal parts where the requirements of the service necessitate. It is listed and furnished as a separate piece. All metal parts are of brass or bronze with the exception of those elements which must necessarily be made of steel. These types of devices were specified as standard and are being used on the 3500-ton Ferris type of wooden ships for which the government has contracted with various shipyards throughout the country.



KEY-LAMP RECEPTACLE WITH DOUBLE TERMINALS AND SHELL INSULATOR

Desk and Table Push-Buttons

Reliability, durability and quick action are the claims for the weighted desk and table bush-buttons manufactured by the Minerallac Electric Company, Chicago. These are made of dark oak or mahogany and will harmonize with the average color schemes of offices, stores, banks, hotels, residences, etc. Cemented to each base is a piece of dark green felt of generous thickness. Consequently no matter how rich in color or highly polished the surface on which the "Altman push" reposes is, it cannot possibly be scratched or marked.

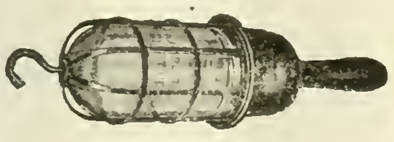
WILL NOT DISFIGURE DESK

Motor-Driven Proportional Mixer

A motor-driven proportional gas mixer of many uses being manufactured by the Eclipse Fuel Engineering Company of Rockford, Ill., will mix air and gas at any predetermined proportions. The advantages claimed for the McKee mixer are that it effects an enormous saving in power over any of the blast methods of burning gas, greatly reduces fuel consumption, reduces investment in piping, gives any type of flame desired, is automatic, and makes the quality of the flame self-adjusting on a turn-down. The mixer may be used for candy furnaces, rivet heaters, electrotype furnaces, temperature controllers, high-pressure boilers and low-pressure boilers, blow pipes, etc.

Hand Lamp

Hand lamps that have been designed for use where a portable extension is required are now being made by the Appleton Electric Company of Chicago. These lamps are particularly well suited for garages, refineries and flour mills, for marine work and wherever there is vapor, gas, fine dust or moisture. The guard is furnished with a hook so that the lamp may be hung up while the workman is making an installation. Brass guards are regularly furnished with the lamps, but steel guards can be supplied if specified by the purchaser.

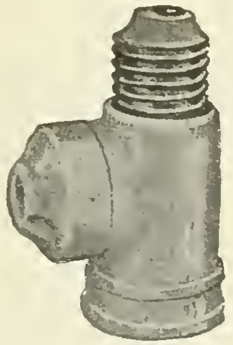

MOISTURE-PROOF AND VAPOR-PROOF HAND LAMP

Renewable Fuses

One of the main features claimed for the renewable fuses manufactured by the Volk Manufacturing Company, Westport, Conn., is that the size of the fuse is always in plain sight. This eliminates all danger of placing a wrong fuse link in the fuse and allows inspection without the necessity of opening the case. In the ferrule type manufactured by this company no tools are necessary to replace renewals, and in the knife-blade type only a screwdriver is needed. The manufacturers claim that all these fuses are accurately tested and rated and are free from mechanical defects. In fact, the manufacturers of the fuses guarantee this to be the case.

Current Tap

For use where an extra outlet is needed near ordinary sockets, a current tap manufactured by the Duncan Electrical Company, Ltd., Montreal, Canada, makes a very neat appearance. The current tap, which is multiple-wired, is rated at 600 watts and 250 volts. It has a shade-holder groove which allows an easy adjustment for the shade without interfering in any degree with the current tap.


NEAT-APPEARING CURRENT TAP

Electric Coffee Grinder for Stores

For use on store counters a coffee grinder has recently been brought out by the Master Cutter Machine Company, Grand Central Terminal Building, New York City, which may be attached to the ordinary lamp socket. The electric cutter of this machine is fitted with a set of hardened tooth burrs that work in positive alignment by radial and thrust ball bearings. This method of driving burrs of an interlocking tooth type makes possible any grade of pulverizing or granulating on the one set of teeth. The coffee when introduced into the hopper is broken just enough to release the chaff, which is carried away by an air blast and deposited in the drawer of a display deck. An electric light that flashes up as the current is turned on shows that this chaff removal is good for advertising purposes.

Conduit Clamps and Hangers

One-screw conduit clamps made from steel, light in weight and substantial, are being manufactured by the Appleton Electric Company of Chicago. As shown in the accompanying illustration, only one screw or bolt is required to fasten the clamp and hold it securely to the conduit. The sharp edges on that part of the clamp which fits over the conduit serve to hold the conduit very rigid.

The conduit hanger illustrated herewith consists of two parts, a base and a clip. The clip is fastened on over the conduit and slipped into the base, after which the screw on the side is tightened and a firm grip made on the conduit. These hangers are light in weight, very durable, and add greatly to the appearance of the installation on which they are used.

LIGHT-WEIGHT AND DURABLE

Electrical Mail Indicator

To inform the housewife whether or not the postman has left mail in the mail box, the Elec-Mi Manufacturing Company, Inc., of Bloomfield, Neb., is marketing an electrical mail indicator under the trade name "Elec-Mi." The device is operated without batteries and can be attached to any mail box, but is more especially adapted to the standard box.

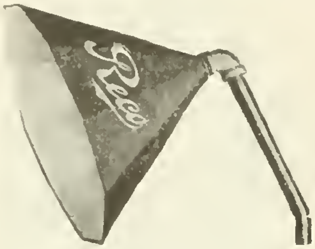
Wall Bracket Fixtures

Time and labor are the two main savings claimed for a wall bracket being manufactured by the Lightolier Company, 569 Broadway, New York. The bracket consists of a crowfoot joint attached to the wall, in which is set a long rod or a threaded wire. The bracket is slipped over this wire and the brass nut at the protruding end is tightened.

FIXTURE EASILY AND QUICKLY INSTALLED

Protective Lighting Reflectors

Reflectors for inside or outside lighting are now being manufactured by the Reynolds Electric Company, 422 South Talman Avenue, Chicago, Ill. These reflectors are suitable for lighting buildings, trenches, yards, subways, interiors and exteriors wherever concentrated lighting is required. They are made of steel, porcelain-enameled, are weatherproof, decagon in shape and easily put up and wired.

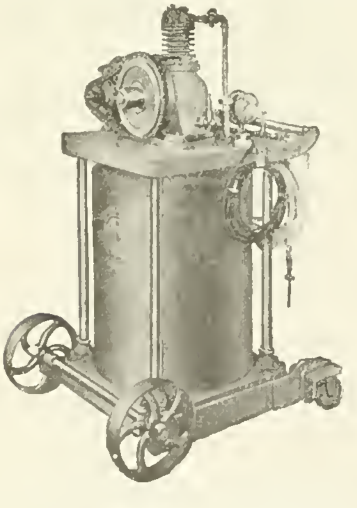


PIPE IS BENT TO DIRECT LIGHT PROPERLY

The manufacturers maintain that these reflectors are scientifically designed for even and economical distribution of light and that they possess the advantage of casting no shadows or high spots.

Chain-Drive Portable Air Compressor

For cleaning dust and dirt out of electric motors and other machinery in factories, cotton mills, etc., the A-F-S Machine Company, Toledo, Ohio, is manufacturing a portable plant shown in the accompanying illustration. The compressor is operated with an electric motor by means of a standard high-speed chain drive, the compressor and motor being mounted above the vertical tanks, which makes a very compact arrangement, and can be conveniently wheeled around machinery, through narrow aisles and passages. When it is required to recharge the tank the socket can be attached to an ordinary lamp socket.



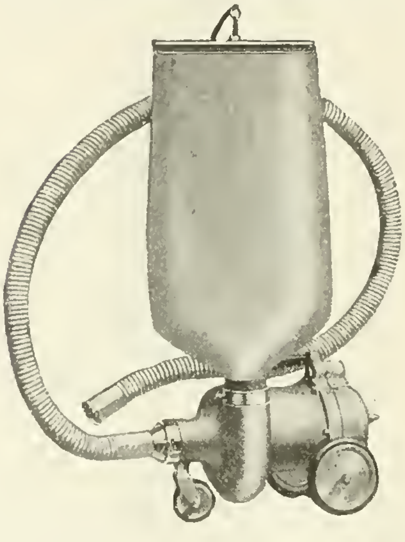
UNIT MAY BE USED IN PLACES WHERE SMALL SPACE IS AVAILABLE

Watertight Angle Marine Fixture

Simplicity of construction is the main feature of the watertight angle bulkhead or wall fixture now being manufactured by the Benjamin Electric Manufacturing Company, 806 West Washington Boulevard, Chicago, Ill. This device is made with a one-piece, 90-deg. angle bracket and accommodates the Navy standard globe and guard. The metal parts are cast in the electrical device, either key or keyless type, and made of rugged material throughout, the insulated portions being of molded material.

Vacuum Cleaner With Aluminum Frame

An aluminum frame now a part of the vacuum cleaner manufactured by the F. Bissell Company of Toledo, Ohio, allows a reduction of 11 lb. (5 kg.) in weight, although the same power is retained. Thus the new cleaner weighs only 22 lb. (10 kg.) and is known as model D. Also, instead of a snap switch this cleaner is provided with a push switch placed conveniently on top of the frame back of the handle. It is inclosed in a casing for protection from possible accidents. The unit also has three wheels instead of four, two in the rear and a swiveled wheel in front. They are higher and ride easily over thick obstructions without lifting the cleaner. The electrical features are the same as in the model C manufactured by this company.



SNAP SWITCH PLACED CONVENIENTLY ON TOP OF FRAME

Screw Cabinet

The "Universal" screw cabinet made by the Hobart Brothers Company, Troy, Ohio, provides a convenient, serviceable and economical cabinet for screws, brads, nails, nuts, bolts, automobile accessories and other small articles. It keeps shelves clean and prevents duplication of stock. It is substantially built of oak and steel. The back panel is of sheet steel, making the cabinet proof against dust and vermin. The back and front of each drawer are wood, making an extremely light and strong drawer that will not stick or bind. Drawers are 8 in. by 3 in. by 2½ in. (20.3 cm. by 7.6 cm. by 6.3 cm.) inside measurement.

Linemen's Gloves

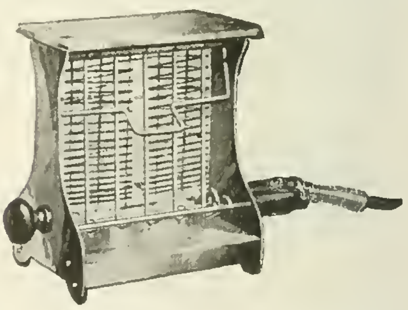
For the use of linemen, arc inspectors, station attendants, repairmen, trouble shooters and all handlers of dangerous voltages, the Pittsburgh Glove Manufacturing Company, 413 South Main Street, Pittsburgh, Pa., has developed and is marketing an extra-flexible pure rubber glove of great tensile strength and high dielectric properties, protected by a horsehide glove—the two permitting free and unrestricted use of the hands and fingers. These gloves are claimed to be made of pure rubber and contain no foreign compounds so they will not grow limp, lifeless and sticky after a brief term of service. It is said further that the pure rubber has a high dielectric strength, and a great electrical protection can be obtained with thin rubber gloves which are as flexible as those worn by surgeons.

These "Free Flex" gloves are formed and are shaped as nearly like the human hand as possible. There is no binding between the thumb and forefinger, say the makers, there being a generous length to permit unrestricted gripping of the tools. Every glove is subjected to a strain of 10,000 volts for five minutes before shipment. The average breakdown voltage is over 18,000.

The gloves are made in one length of 14 in. (35.5 cm.) from the tip of the middle finger to the end of the gauntlet and are made in three sizes. The horsehide leather protector is durable, flexible, tough and hard to snag and will remain soft and pliable in all weather.

Pressed-Steel Electric Toaster

Minimum cost of operation is one of the features of a pressed-steel electric toaster which is being manufactured by the National Electric Heating Company, Ltd., Toronto, Can. This toaster is light and neat in appearance and is plated with highly polished nickel. The heater is supplied with 6 ft. (1.8 m.) of heater coil and attachment plug complete.



WARMING PLATE AT TOP OF TOASTER PROVES CONVENIENT

Trade Notes

Western Electric Sales Organization Changes

G. F. HEFFLER has been chosen to succeed Mr. Curran as manager of the line-material department.

W. W. TEMPLIN, specialty sales manager, has taken up special work in the government department, reporting to H. L. Grant.

W. A. CURRAN, until recently general credit manager, when he became manager of the line-material department, has been appointed assistant manager of the Philadelphia house.

W. D. LINDSEY has been placed in charge of the specialty sales department, succeeding Mr. Templin. Mr. Lindsey will in addition continue to be assistant advertising manager.

TRADING WITH THE ENEMY.—Cumulative Supplement No. 11 to the Enemy Trading List, containing additions, removals and corrections from March 15, 1918, to Sept. 6, 1918, has just been issued by the War Trade Board.

PEACH STONES SAVED AT HYGRADE FACTORY.—A vigorous campaign to save peach, plum and prune stones for gas-mask service is on at the factory of the Hygrade Lamp Company, Salem, Mass. Receptacles in charge of a particular employee have been placed on the different floors, and a strikingly interesting article on the subject has been published in the company's house organ, the *Hygrade Triangle*.

CONTINUE RATE OF RUBBER IMPORTS.—The previous rate of permitted importations of crude rubber, effective up to Oct. 1, 1918, has been continued by the War Trade Board in a new ruling for the final quarter of the year. Importations of crude rubber from overseas during the months of October, November and December, 1918, will therefore be limited to 25,000 tons, or at the rate of 100,000 tons a year. One-fourth of this amount will be licensed only from Central and South America.

PITTSFIELD GENERAL ELECTRIC STRIKE VOTE RESCINDED.—One hundred cranemen, wiremen and electricians employed at the Pittsfield (Mass.) works of the General Electric Company voted Oct. 2 to rescind a strike ballot taken the week before which was to go into effect Oct. 3. Capt. C. E. Fitzpatrick of the Ordnance Department, U. S. A., Washington, conferred with the president of the union at Pittsfield on Tuesday and emphasized the serious results which curtailment of production threatens at this time. W. L. Stoddard, examiner of the War Labor Board, also attended the conference and stated that the board would consider no wage appeal of the cranemen while they were on strike. A unanimous vote to stand by the country's needs by continuing at work followed.

REVISED REGULATIONS GOVERNING THE EXPIRATION DATE OF EXPORT LICENSES.—The War Trade Board announces that on and after Sept. 30, 1918, export licenses shall be deemed to have been used within the period of their validity, (a) if the through export bill of lading is issued and signed on or before the expiration date of the license and subsequent to Oct. 9, 1917; or (b) if the ocean bill of lading is dated on or before the expiration date of the license; or (c) if the dock receipt is dated on or before the expiration date of the license and the ocean bill of lading covering the same shipment is dated not later than thirty days after the expiration date of the license; or (d) if the railroad notice of arrival issued at the port of exportation is dated on or before the expiration date of the license and if the ocean bill of lading covering the same shipment is dated not later than ten days after the expiration date of the license, provided that the provisions of this paragraph (d) shall apply only when the merchandise is exported on vessels loaded at railroad docks, where dock receipts as provided in paragraph (b) cannot be issued by the vessel or its agents; or (e) if the shipment is on a lighter which arrives on or before the expiration date of the license alongside the vessel upon which the shipment is to be loaded and if the shipment is in fact loaded on that vessel and ocean bill of lading is signed not later than thirty days after the expiration date of the license.

THE INTERMOUNTAIN ELECTRIC COMPANY'S representatives recently held a three-day convention which began with a banquet at the Commercial Club, Salt Lake City, Utah. The convention was under the direction of E. E. Brazier, sales manager.

THE LITSCHER LITE CORPORATION has been organized in Grand Rapids, Mich., with $100,000 capital stock to manufacture farm-lighting plants. The company has acquired large interests in the Michigan Wheel Company and in the Monarch Storage Battery Company and will manufacture the engines at the former plant and the generators at the latter, employing in all about seventy-five skilled mechanics. The officers of the company are: President and treasurer, Christopher J. Litscher; vice-president, Fred N. Rowe; secretary and sales manager, W. Russell Patton, Milwaukee.

ROBERT C. BYLER, for nearly four years advertising production man for the S K F Ball Bearing Company of Hartford, Conn., has been appointed advertising manager of the S K F Administrative Company of New York City and will direct the advertising of the S K F Ball Bearing Company of Hartford and the Hess-Bright Manufacturing Company of the same city, both of which are controlled by the S K F Administrative Company. Until arrangements are made in New York City Mr. Byler will remain with the S K F Ball Bearing Company of Hartford.

THE WHITELIGHT ELECTRIC COMPANY, New York City, is lending some impetus to the fourth Liberty loan by the distribution of a series of sketches of the most famous cathedrals and other public buildings in France and Belgium, some of them now pulverized by Hun shells. The sketches were originally contributed to a French fund by Prof. D. Varon, a noted Franco-American artist and writer and lecturer on art. These sketches comprise views of the Cathedrals of Rheims, Amiens and Soissons; the market and belfry of Bruges and hôtels de ville of Compiègne and Arras. They are printed on India-tinted post cards, space being left on the address side for correspondence, with the printed line at the bottom "Yours for the fourth Liberty loan."

THE ELLIOTT ELECTRIC COMPANY, Cleveland, Ohio, announces its removal from 322-323 Champlain Avenue to 813-315 Superior Avenue, N. W., where it occupies the entire five floors and basement. The first floor is occupied by the retail store and supply department office. The second floor is devoted to the general office and the machinery department office. The repair shop for the repairing of motors is on the fourth floor. The remaining floors and basement are utilized to accommodate the large stock of motors and electrical supplies. The retail store is being remodeled. The new location is very desirable because of its central location, which is just west of the Public Square. Plans are being put into effect to care for the increased business which made the removal to larger quarters necessary. The company does an electrical jobbing, motor sale, repair and rental business.

THE HOTPOINT DIVISION OF THE EDISON ELECTRIC APPLIANCE COMPANY, Inc., of Chicago, has sent out a circular letter to the trade dated Sept. 1 outlining the company's position in regard to conservation as follows: "To assist the government further in conserving the supply of aluminum, we have decided to discontinue for the period of the war the manufacture of the model M aluminum cleaner and attachments. We will fill orders as long as present stocks last, proportioning them as equitably as possible among our customers who have placed their orders with us. Effective immediately, we will withdraw our exchange proposition for the period of the war. We urgently request our distributers to coöperate with the wish of our government to repair defective heating devices and thus keep them in active service rather than replace them by exchanging for new equipment. Owing to the extreme urgency which presents itself because of the very unusual conditions in the raw-material market, it becomes necessary that we discontinue our practice of giving the trade advance notice of changes in list prices and discounts. Beginning immediately, therefore, changes in list prices and discounts will become effective on the date as issued. It is therefore absolutely necessary, effective immediately, that orders received by us shall be accepted at the present list price and discount with the specific understanding that shipments will be made at the earliest possible date, also that billing will be rendered on the basis of the list price and discount in effect on the date of shipment."

Trade Publications

PUSH-BUTTONS.—A leaflet has been received from the Minerallac Electric Company, Chicago, describing standard push-button combinations made by this company, with prices.

LAMP GUARDS.—A leaflet has been received from Harvey Hubbell, Inc., Bridgeport, Conn., describing lamp guards for various kinds of lamps and different kinds of service. Prices are given.

ELECTRIC CRANES.—A catalog issued by the Alliance Machine Company, Alliance, Ohio, describes in considerable detail electric cranes of many varieties for use particularly about steel mills and power plants. The catalog is well illustrated and printed in fairly permanent form.

STORAGE-BATTERY TRUCKS.—Storage-battery trucks for all kinds of industrial plants are illustrated and specified in bulletin No. 18-2, which has been received from C. W. Hunt Company, Inc., 501 Fifth Avenue, New York City. Tractors and trailers are also illustrated in this bulletin.

STORAGE BATTERIES.—Bulletin No. 171, dated June, 1918, is being distributed by the Electric Storage Battery Company, Allegheny Avenue and Nineteenth Street, Philadelphia. This bulletin is devoted to the constructional and electrical features of portable batteries. The application of these batteries to the testing of meters, generator armatures and series coils, and also for high-current laboratory work, is pointed out.

OIL ENGINES.—Snow four-stroke-cycle oil engines are described in bulletin No. S-160 recently sent out by the Worthington Pump & Machinery Corporation, 115 Broadway, New York. This bulletin contains a general explanation of the Diesel cycle upon which these engines operate and also gives the theoretical fuel economy possible with such engines. There is a discussion of fuel oils which may be burned in the Snow oil engines. Then follow details of construction and a table of dimensional data for each of the standard sizes of engines built.

New Incorporations

THE EASTLAND (TEX.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $150,000 by W. B. Monson, P. A. Rogers and R. Van Campen.

THE JOHN HOENY ELECTRICAL COMPANY of Chicago, Ill., has been incorporated with a capital stock of $5000 by John Hoeny, F. B. Hoeny and E. R. Odle.

THE T. S. ELECTRIC SYSTEM, 79 Orange Street, Newark, N. J., has been organized to manufacture electrical goods. J. Steinharter is interested in the company.

THE P. J. MURPHY BATTERY CORPORATION of Niagara Falls, N. Y., has been incorporated by C. R. Evans, N. and P. J. Murphy of Niagara Falls, N. Y. The company is capitalized at $10,000 and proposes to manufacture batteries, etc.

THE CLAY (W. VA.) UTILITY COMPANY has been chartered by O. L. Hall, S. W. Bryant, S. H. McLane, W. S. Pierson and B. G. Blake, all of Clay. The company is capitalized at $10,000 and proposes to maintain and operate an electric power plant

THE NEWBURG (IND.) LIGHT & WATER COMPANY has been incorporated with a capital stock of $20,000 by Eugene Sargeant, Maurice H. Sargeant and Herman Schumacher. The company proposes to supply water, light, heat and power in Newburg.

THE UNION ELECTRIC COMPANY of Trenton, N. J., has been incorporated by William I. Peacock, Thomas A., John D. and Duncan Mackenzie. The company is capitalized at $100,000 and proposes to operate to manufacture electrical porcelain specialties.

THE ACASON FLEET, INC., of New York, N. Y., has been chartered with a capital stock of $10,000 to manufacture motors, electrical machinery and engines. The incorporators are C. W. and E. P. Decker and H. A. Kiep, Jr., 339 Pearl Street, New York City.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

BURLINGTON, VT.—The Board of Aldermen has signed a contract with the Burlington Light & Power Company whereby the latter will supply electricity generated at the hydroelectric plant on the Winooski River for operating the municipal electric light and power system for a period of five years from Oct. 1, 1918. The municipal electric generating plant (which is operated by steam) will be closed down.

BROCKTON, MASS.—The Walkover Shoe Company is planning to erect a power plant, to cost about $56,000. Bids for the proposed building, it is understood, will be received about Jan. 1. Jenks & Ballou, Grosvenor Building, Providence, R. I., are engineers.

WESTFIELD, MASS.—The New York, New Haven & Hartford Company has petitioned the Municipal Light Board for an extension of the municipal lighting system to the roundhouse and the upper end of its freight yard, and also to extend its lines into the yards in order to illuminate the yards for night work. The officials of the Russ Gelatin Company have petitioned the board to extend its power services to the plant of the company in Springdale.

EAST NORWALK, CONN.—The Commissioners of the Third District are considering the advisability of entering into a contract with the Connecticut Power & Light Company for the permanent purchase of electricity.

NEW HAVEN, CONN.—The New York, New Haven & Hartford Railroad Company, it is reported, will soon ask for bids for the construction of a one-story building, 75 ft. by 151 ft., at the Cedar Hill yards, to be used for electrical department. E. Gagel is chief engineer.

Middle Atlantic States

BALDWINS, N. Y.—Contracts have been awarded by the War Department for the erection of a new boiler plant at the local government station to the Austin Company, 217 Broadway, New York City. A number of other buildings will also be erected.

BROOKLYN, N. Y.—A large quantity of electrical equipment, it is understood, will be required in connection with the new factory to be erected by H. W. Cotton, Inc., at Thirty-eighth Street and Third Avenue.

BROOKLYN, N. Y.—Plans have been prepared by H. Y. Kolb, 1083 Fox Street, New York City, for the erection of a new boiler plant at the works of the Morse Dry Dock & Repair Company, 39 Plaza Street, at First Avenue and Fifty-eighth Street.

BROOKLYN, N. Y.—Plans are being prepared by H. W. Cotton, Inc., Thirty-fourth and Thirty-fifth Streets, Brooklyn, for the erection of a six-story building, 200 ft. by 600 ft., at Thirty-eighth and Thirty-ninth Streets and Thirteenth Avenue, as an extension to its present plant. The company manufactures machinery.

BROOKLYN, N. Y.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a naval hospital at the Brooklyn Navy Yard to the White Fireproofing Construction Company, 286 Fifth Avenue, New York City. The cost is estimated at $1,000,000.

BUFFALO, N. Y.—Plans are under consideration by the International Railway Company for improvements to its system on Broadway.

CAMP UPTON, N. Y.—The War Department has authorized the construction of shops, warehouses, barracks and office buildings for the utilities department at Camp Upton, to cost about $128,650.

CANISTEO, N. Y.—Plans are being considered for the erection of an electric transmission line to Hornell to secure electricity for the town. It is proposed to issue $15,000 in bonds to provide funds.

LONG ISLAND CITY, N. Y.—Plans have been prepared by the United States Gas Defense Company for extensions and improvements to its plant at Second and Jackson Streets.

MARTINSBURG, N. Y.—Application has been made to the Public Service Commission by Hirschey & Lewis for permission to construct an electric plant in Martinsburg and approval of franchise.

NEW YORK, N. Y.—Plans have been filed by the New York, New Haven & Hartford Railroad Company, for an addition, 43 ft. by 200 ft., to its engine house at its East 132d Street shops.

NEW YORK, N. Y.—Plans are being considered by the Air Nitrates Corporation, 360 Madison Avenue, New York City, for the erection of 24 buildings at its different plants, of which 12 will be located at Toledo, Ohio.

PELHAM, N. Y.—Plans are being prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for an addition to the power house at the local naval training station. Charles Ewing, 101 Park Avenue, New York City, is architect.

TROY, N. Y.—Bids will be received by Captain A. Coffey, secretary of the State Board of Armory Commissioners, 158 State Street, Albany, until Oct. 24 for construction, heating, plumbing and drainage and electric work for the State Armory at Troy. Drawings and specifications may be consulted at Bolton Hall, Troy, and at the New York office of the Department of Architecture, Room 1715, Tribune Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

WEST HAVERSTRAW, N. Y.—Bids will be received by George Blagden, president of New York State Hospital for the Care of Crippled and Deformed Children, West Haverstraw, for electric elevator for main hospital building and for heating equipment and also additional equipment for laundry for the New York State Hospital for the Care of Crippled and Deformed Children. Drawings and specifications may be consulted at the above hospital, at the New York office of the Department of Architecture, Room 1715 Tribune Building, New York City, and at the Department of Architecture, Capitol, Albany. Lewis F. Pitcher is state architect.

CAMDEN, N. J.—The New York Shipbuilding Company, Broadway and Fairview Street, Camden, is planning to erect a new plant and angle shop, 200 ft. by 500 ft., to replace the one recently destroyed by fire. The cost is estimated at about $100,000.

GLOUCESTER CITY, N. J.—A new electric power plant is being erected at the Pusey & Jones shipbuilding plant to furnish power heretofore supplied by the Public Service Electric Company. The equipment will include a battery of five boilers with superheaters, fuel economizers, stokers and auxiliary equipment and electric generating machinery. Substations will be installed at the Pennsylvania, New Jersey and Middle yards.

MORGAN, N. J.—The War Department, Washington, D. C., has announced that work of rebuilding the shell-loading plant at Morgan will begin at once. The cost is estimated at $10,000,000.

TRENTON, N. J.—Plans have been prepared by the Trenton & Mercer County Traction Company for the installation of new electric generating equipment in its power plant.

CLIFTON HEIGHTS, PA.—Plans are being prepared for the erection of a new engine plant at the works of the Kent Manufacturing Company. Frank E. Hahn, 1112 Chestnut Street, Philadelphia, is architect.

EASTON, PA.—The Easton Transit Company and the Northampton, Easton & Washington Traction Company of Easton are considering plans for extending their systems to the new naval base at Stewardville and also to build a belt line around the property.

HAZLETON, PA.—Plans, it is reported, are under consideration by the Harwood Electric Company and the Lehigh Navigation Electric Company, at Hazleton and Hauto respectively, for extensive additions to their plants and systems. The companies, it is understood, will extend the transmission lines to supply electricity as far distant as Philadelphia.

NICETOWN, PA.—Bids, it is reported, are being taken by the Midvale Steel & Ordnance Company, Widener Building, Philadelphia, for the construction of a power house, 44 ft. by 46 ft., to be used as a substation at its local gun plant and for alterations in the pattern building.

PHILADELPHIA, PA.—Plans have been filed by the American Insulation Company, Roberts Avenue and Stockley Street, Philadelphia, Pa., for an addition, 25 ft. by 80 ft., to its plant.

PHILADELPHIA, PA.—Ground has been broken for an addition, 28 ft. by 80 ft., one story, to the power plant of the Schwarz Wheel Company at Trenton and Margaret Streets, to cost about $12,000.

PHILADELPHIA, PA.—Plans have been filed and contract awarded by the American Insulation Company for the erection of a new building, 25 ft. by 80 ft., at Roberts Avenue and Stockley Street.

PHILADELPHIA, PA.—Plans are being prepared by the Ordnance Department for the construction of a case shop at the Frankford Arsenal; also for a new experimental shop at the arsenal. Contract has been awarded by the Ordnance Department to W. W. Anstine & Company, 1218 Filbert Street, for the construction of a carpenter shop, 59 ft. by 244 ft., to cost with equipment and machinery about $200,000.

BALTIMORE, MD.—The General Chemical Company, 25 Broad Street, New York, N. Y., is contemplating building a plant, 200 ft. by 600 ft., on Race Street, to cost about $200,000. Westinghouse, Church, Kerr & Company, 37 Wall Street, New York, N. Y., are engineers

CAMP MEIGS, MD.—Contract has been awarded by the War Department, Washington, D. C., to Frank L. Wagner, 1413 H Street N. W., Washington, for the construction of power plant and laundry at Camp Meigs. F. B. Wheaton is advisory architect, and F. M. Gunby advisory engineer, both at Seventh and B Streets, S. W., Washington.

CUMBERLAND, MD.—The Edison Electric Illuminating Company is contemplating extending its electric system through the Ridgedale addition to Cumberland.

FAIRMONT, W. VA.—The War Department, Washington, D. C., has awarded contract to the American Phosphorus Company for the construction of a phosphorus plant at or near Fairmont, to cost about $500,000.

QUANTICO, VA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning to construct a power plant at Quantico, at a cost of about $45,000.

RICHMOND, VA.—Contract has been awarded by the Newport News Shipbuilding & Dry Dock Company (through the United States Shipping Board of the Emergency Fleet Corporation) to John T. Wilson & Company of Richmond for the construction of marine boiler works on the west side of the James River near South Richmond. The cost of the entire plant is estimated at about $2,000,000 and will include a main building, 600 ft. by 160 ft., and smaller structures for power plant, office, storerooms and service buildings.

SEVEN PINES, VA.—The War Department, Washington, D. C., it is reported, has authorized doubling the capacity of the powder-packing plant now under construction at Seven Pines, increasing the cost from $3,000,000 as at first contemplated to from $4,000,000 to $5,000,000. The original plans contemplated 140 units on a site of 1740 acres with facilities to include electric power plant, heating equipment, large warehouses and 40 miles of railway trackage. The plant will be operated by Du Pont de Nemours & Company of Wilmington. The Foundation Company, Woolworth Building, New York, N. Y., has contract for entire construction of plant.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, is planning to erect an additional boiler plant at the Washington Navy Yard, to cost about $150,000.

WASHINGTON, D. C.—The War Department has announced that a T. N. T. plant will be erected immediately at Giant, Cal., on land adjacent to the nitric-acid plant of the Giant Powder Company, to cost about $1,438,999. The plant will be operated by the Giant Powder Company. Two sulphuric-acid plants will also be built in Pennsylvania, one at Emporium and the other at Mount Union, to cost about $3,000,000. The Emporium plant will consist of eight units and will be erected on a site which has been selected on Driftwood Creek, close to the plants of the Aetna Explosives Company and the Emporium Iron Company. If sufficient power cannot be obtained from the plant of the iron company, a 1000-kw. plant will be erected. The cost of this plant is estimated at $2,000,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Various deliveries, Schedule 1993—copper, brass and bronze wire; Schedule 6411½—four motor generators; Schedule 6343½—six circuit breakers. Washington, Schedule 6265½—eight electric floor grinders; Schedule 6272½—radio detectors and renewals; Schedule 6293½—electrically driven machine tools. Brooklyn, Schedule 6327½—500 portable electric drills; Schedule 6345½—copper wire and pipe. Brooklyn and Portsmouth, Schedule 6291½—copper tubing. Portsmouth, Schedule 6298½—electric switches and fittings. Pensacola, Schedule 6303½—telegraph wire; Schedule 6346½—4000 ft. copper wire. Philadelphia, Schedule 6328½—motor-driven emery grinder. South Brooklyn, Schedule 6333½—wire and cable. Boston, Schedule 6348½—twelve split switches. Puget Sound, Schedule 6374½—one panel and switchboard instrument. New London, Schedule 6379½—200 rheostats. Norfolk, Schedule 6380½—one 5-hp. motor. Philadelphia, Norfolk and Puget Sound, Schedule 6410½—Twenty-four motor equipments. New Orleans, Schedule 6412½—four portable ventilators. Applications for proposals should designate the schedule desired by number.

North Central States

SENTER, MICH.—The War Department, Washington, D. C., has authorized the construction of a tetryl plant at Senter, to cost approximately $250,000. Boiler and power houses, packing houses, magazines, tramways, etc., will be built in connection with the proposed plant.

AKRON, OHIO.—The Northern Ohio Traction & Light Company is contemplating the construction of an extension to the factory of the Canton Sheet Steel Company. The latter company, it is understood, has promised the Northern Ohio company a loan of $40,000 to finance the work.

BELLAIRE, OHIO.—The power plant of the Progressive Coal Company of Bellaire was recently destroyed by fire.

CAMBRIDGE, OHIO.—The capital stock of the Cambridge Home Telephone Company has been increased from $100,000 to $175,0000, the proceeds to be used for improvements.

CINCINNATI, OHIO—Contract has been awarded by the Huenfeld Company to the L. Eid Concrete Steel Company of Cincinnati for an addition to its power plant on Spring Grove Avenue.

COLUMBUS, OHIO.—The City Council has approved of an issue of $30,000 in bonds for the completion of extensions to the municipal electric light plant, which include the purchase of additional transformers for commercial service and the completion of the street-lighting plans.

LORAIN, OHIO.—Work has resumed on the construction of the Lorain County Electric Company in Lorain on which operations were suspended last spring. The company has received a loan of $400 000 from the United States government. When completed the plant will have a generating capacity of about 10,000 kw.

NELSONVILLE, OHIO.—The Hocking Creek Traction Company is contemplating an extension of its system from the present terminus to the court house. The cost is estimated at $35,000

HAZARD, KY.—The Hazard Coal Company is planning to rebuild its power plant, which was recently destroyed by fire.

SMITH'S GROVE, KY.—The capital stock of the Smith's Grove Light & Ice Company has been increased from $5,000 to $10,000.

WHITESBURG, KY.—The Elkhorn Jellico Coal Company is reported to be considering the installation of a power plant.

ALTON, ILL.—Contract has been awarded by the War Department, Washington, D. C., to the Wimmer Construction Company of St. Louis, Mo., for additional buildings to be used by the Western Cartridge Company of Alton. The amount of the contract, it is reported, is nearly $2,500 000, and the output of the plant will be doubled. The Bureau of Housing is considering an expenditure of about $2,000,000 for improving the housing conditions for workmen at this plant.

CHICAGO, ILL.—Contract has been awarded by the Crane Company to the Lanquist-Illsley Company, 1100 North Clark Street, for the erection of a one-story nipple shop, 100 ft. by 448 ft., at its Corwith plant, to cost about $225,000.

CHICAGO, ILL.—The Edison Electric Appliance Company has awarded general contract to the W. A. Pillinger Company, 11 South La Salle Street, for the construction of a factory, 100 ft. by 146 ft., one story, at 5660 West Taylor Street, Chicago. The cost is estimated at $40,000.

CHICAGO, ILL.—Bids will be received at the United States Indian Warehouse, 308 South Green Street, Chicago, Ill, until Oct. 17 for furnishing 8100 ft. rubber-covered wire, 3750 ft. rubber-covered wire, 1125 sockets, 86 receptacles, 2729 dry batteries, 7835 ft. flexible lamp cord, etc. Further information may be obtained on application to the above office.

KEWANEE, ILL.—Extensive improvements are under way at the plant of the Consolidated Light & Power Company, involving an expenditure of about $75,000. The work will include the installation of an Ames "Una-flow" engine, to be directly connected to the electric generator, a water softener, a deep well with compressed-air pump, a motor-generator, new regulators on all circuits, etc. H. M. Smith is manager.

ROCK ISLAND, ILL.—The War Department has authorized additions to the Rock Island arsenal, which will consist of an addition of three stories to the warehouse and an addition to the artillery vehicle plant. A large garage for motor trucks will also be erected. The facilities for fire protection will be increased by the installation of turbine pumps and an extensive system of water mains and hydrants. The cost of the proposed work is estimated at $883,500.

ALBERT CITY, IOWA.—The Citizens' Electric Company of Albert City has petitioned the Board of Railroad Commissioners for a franchise to erect and operate an electric transmission line on certain roads and highways in Buena Vista County for the distribution of electricity for lamps and motors.

SHOPTON, IOWA.—The Atchison, Topeka & Santa Fe Railroad Company of Chicago, Ill., is considering the construction of a new electric shop at Shopton, to cost about $75,000. Shopton has not a post office.

JOPLIN, MO.—Arrangements have been completed whereby the Empire District Electric Company will supply electricity to operate the municipal electric system during the period of the war.

KENNETT, MO.—The purchase of an electric light plant is reported to be under consideration by the Gideon-Anderson Lumber Company. O. B. Gwyn is superintendent.

ST. LOUIS, MO.—The Philip Gruner Brothers Lumber Company is planning to equip a new yard and will require an electrically operated derrick, locomotive crane and other machinery.

MITCHELL, S. D.—Bonds to the amount of $175,000 have been voted for improvements to the municipal electric light and waterworks plant. Burns & McDonald, Interstate Building, Kansas City, Mo., are engineers.

LEBO, KAN.—The plant of the Lebo Elevator, Light & Power Company was recently destroyed by fire. Arrangements, it is understood, will be made to erect an electric transmission line from Emporia to furnish electricity in the town.

SCRANTON, KAN.—At an election to be held on Oct. 19 the proposal to issue $12,000 in bonds for the erection of a municipal electric light plant will be submitted to the voters.

Southern States

AUGUSTA, GA.—The War Department is planning to build a double-track street car line through Camp Hancock, 3 miles long. Rolling stock and energy will be supplied by the Augusta-Aiken Railway & Electric Corporation, which will also operate the railway.

PENSACOLA, FLA.—The construction of a new drydock, with shop facilities, and the installation of a motor-driven pumping system to replace the present steam pumping equipment is under consideration by the Bruce Dry Dock Company of Pensacola.

MEMPHIS, TENN.—Bids will be received at the office of the Mississippi River Commission, First and Second Districts, Custom House, Memphis, until Oct. 24 for turbines, pump set, feed-water heater and electric light plant for hydraulic grader No. 1820. Further information may be obtained on application to the above office.

DE QUEEN, ARK.—The Commonwealth Public Service Company of Okmulgee, which recently purchased the local electric light system and ice factory, is contemplating improvements to both plants.

SPARKMAN, ARK.—The local electric light plant recently destroyed by fire, it is understood, will be rebuilt. Edward Sparkman is owner.

SHREVEPORT, LA.—W. K. Henderson, owner of Henderson's Garage, has purchased a building, which, it is understood, will be used for the electrical department of garage. It will be equipped for repairing magnetos, generators and other appliances.

PONCA CITY, OKLA.—Bids will be received at the office of the city clerk, Ponca City, until Oct. 23 for furnishing material and equipment for water and lighting plant, separate bids to be submitted as follows: (1) For furnishing and erecting complete one steam engine directly connected to a 475-kva. generator; (2) one condenser equipment for above unit including spray pond equipment; (3) one 500-hp. heater without metering device; (4) one 500-hp. heater with metering device; (5) for purchasing from the city one 75-kw. and one 100-kw. direct-connected unit now operating in the above plant. Copies of blanks, contract and specifications may be obtained from Burns & McDonnell, engineers, Interstate Building, Kansas City, Mo.

STILLWATER, OKLA.—The contract for electric wiring of the armory-gymnasium building and science building at the Oklahoma Agricultural & Mechanical College has been awarded to the Oklahoma Electric Supply Company of Oklahoma City.

GRANBY, TEX.—The municipal electric light plant, recently destroyed by fire, will be rebuilt. The loss is estimated at about $20,000.

Pacific and Mountain States

COULEE CITY, WASH.—The local electric light plant was entirely destroyed by fire recently.

SEATTLE, WASH.—The War Department has ordered the installation of an additional cable between this city and Port Angeles and the installation of a new cable between Port Angeles and Victoria, B. C., under the Strait of Juan de Fuca. The cost of the work is estimated at about $120,000. The government has also taken over the city dock at Port Angeles for handling the new cable on its arrival from the East.

PORTLAND, ORE.—For the protection of its water rights on Hood River and in preparation for development after the war the Pacific Power & Light Company has purchased a number of power sites between Wynans, about 25 miles south of Hood River, and the mouth of the river. Surveys, it is reported, have been made for a pipe line from a dam site near Wynans to Ruthton. Rights-of-way have also been secured.

PORTLAND, ORE.—The Jaeger-Shroufe Company, electrical contracting engineer, 103 West Park Street, Portland, is reported to have secured the contract for wiring in all the concrete vessels to be built by the Great Northern Concrete Shipbuilding Company at Vancouver, Wash ; also for wiring all the vessels to be outfitted at the plant of the Pacific Iron Works, the twenty vessels built by the Foundation Company, and all the vessels under construction by the Coast Shipbuilding Company and the Supple-Ballin Shipbuilding Company.

SAN FRANCISCO, CAL.—The Board of Supervisors has authorized Mayor James Rolph to enter into an agreement with the United States government accepting the offer of a loan of $450,000 for the construction of a municipal street-car line from Army Street to the Hunter's Point dry dock and repair yards. It is expected to have the entire line in operation within 90 days.

TUOLUMNE, CAL.—The electric generator in the power plant of the West Side Lumber Company was badly damaged recently by fire.

ARCO, IDAHO.—An election will soon be held to vote on the proposal to issue $30,000 in bonds for extensions and improvements to the municipal light and power plant.

Canada

GRANDE PRAIRIE, ALTA.—The by-law authorizing the construction of a municipal electric plant in Grande Prairie has been approved by the rat payers. The cost is estimated at about $40,000.

CHATHAM, ONT.—Extensions are contemplated to the local hydroelectric plant to meet the increasing demands for electrical service. The cost is estimated at $45,000. J. G. Jackson is local manager.

FERGUS, ONT.—The Town Council is contemplating the purchase of a new transformer to replace the one recently destroyed.

OTTAWA, ONT.—A. F. Macallum, commissioner of public works, is considering the purchase of an electric thawing device for the city, to be used for thawing purposes, etc.

SMITH'S FALLS, ONT.—The by-law for the construction of an extension to the hydroelectric system, to cost $11,000, has been passed by the ratepayers.

Record of Electrical Patents

Notes on United States Patents

1,277,384. Series Transformer; Lewis W. Chubb, Edgewood Park, Pa. App. filed April 12, 1915. Core made of alloy which becomes substantially saturated when subjected to low magnetizing forces.

1,277,385. Machine-Switching Telephone-Exchange System; Henry P. Clausen, Mount Vernon, N. Y. App. filed Feb. 5, 1917. Calling party, failing to secure a response, may operate signaling device.

1,277,386. Telephone-Exchange System; Henry P. Clausen, Mount Vernon, N. Y. App. filed Jan. 2, 1918. Means for controlling application of signaling current to line.

1,277,388. Ignition Mechanism; Frank Conrad, Pittsburgh, Pa. App. filed Dec. 29, 1914. Induction coil, interrupter, condenser and distributer in one unit.

1,277,389. Electrical Accumulator; Emile A. Cotte, Paris, France. App. filed Nov. 28, 1917. Closes jar through cover of which electrode stems and tube for escape of gas from cell pass.

1,277,394. Current-Collecting Device; John S. Dean, Wilkinsburg, Pa. App. filed June 4, 1915. Shunt interposed between brush and pressure-exerting means.

1,274,398. Locomotive; George M. Eaton, Pittsburgh, Pa. App. filed Dec. 14, 1916. Jack shaft and side rod connect propelling motors and driving wheels.

1,277,414. System of Distribution and Control; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Jan. 23, 1915. For automatically increasing voltage supplied to each phase of polyphase motor with increase of motor load.

1,277,415. Control System; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Dec. 18, 1914. For automatically varying phase compensation in induction motors with load conditions.

1,277,416. Control System for Single-Phase Motors; Rudolf E. Hellmund. Swissvale, Pa. App. filed May 27, 1916. Motors may be started and accelerated in smooth and gradual manner.

1,277,418. Telephone System; Edward E. Hinrichsen, New York, N. Y. App. filed Sept. 25, 1917. Apparatus for determining idle or busy condition of telephone lines.

1,277,421. Trolley Catcher and Retriever; Walter W. Hunzicker, Mansfield, Ohio. App. filed July 9, 1917. Means for engaging reel to prevent winding up of rope.

1,277,422. Liquid Heater; Manuel S. Iglesias, Vera Cruz, Mexico. App. filed Nov. 27, 1917. Employing heating element without protective covering whereby liquid comes into direct contact with conductor.

1,277,426. Electric Switch; Charles J. Klein, Milwaukee, Wis. App. filed Sept. 11, 1914. Snap-switch mechanism for pull-cord operation.

1,277,440. Telephone-Exchange System; Alben E. Lundell, New York, N. Y. App. filed June 17, 1916. Connection may be established between calling line and called line by automatic selector switches or by manually operated apparatus.

1,277,441. Telephone-Exchange System; Harry W. MacDougall, East Orange, N. J. App. filed Jan. 2, 1918. Employing trunk circuits extending between two central offices.

1,277,453. Electric Iron; Christian Martinsen, Seattle, Wash. App. filed Aug. 30, 1917. Means easily operated by user for controlling circuit of heating element.

1,277,464. Distance Temperature Apparatus; Harry Y. Norwood and Frederick W. Stalkes, Rochester, N. Y. App. filed June 14, 1915. For determining at central station temperatures at plurality of separated and distant points.

1,277,478. Telephone Switch; John N. Reynolds, Greenwich, Conn. App. filed May 20, 1916. To reduce size of cross-bar type structure without change in size or efficiency of operating parts.

1,277,495. Liquid Rheostat; Karl A. Simmon, Ridgewood Park, Pa. App. filed Dec. 10, 1914. To cool entire body of circulating electrolyte by continuously dissipating large amount of heat from relatively small portion of electrolyte.

1,277,497. Brush Holder; Charles W. Starker, Pittsburgh, and Gustav L. S. Kronfeld, Wilkinsburg, Pa. App. filed June 30, 1915. Body portion formed entirely of pressed metal.

1,277,499. Motor Controller; William C. Stevens, Summit, N. J. App. filed Nov. 30, 1914. To compensate automatically for load variations and to limit rate of deceleration to insure gradual slow-down irrespective of load conditions.

1,277,505. Railway and Like Signaling; Reuben W. Tarrant, Clapham, London, England. App. filed April 20, 1916. Rail-circuit system for electric control of railway traffic.

1,277,507. Main-Line Telegraph Repeater; Sylvester Voorhies, Enderlin, N. D. App. filed Jan. 10, 1917. Dispenses entirely with use of local battery.

1,277,520. Control-Switch Mechanism; Richard N. Woodman, Chicago, Ill. App. filed July 15, 1916. For rear signal used on motor cars.

1,277,533. Lamp Lock Socket; Reuben B. Benjamin, Chicago, Ill. App. filed Oct. 7, 1914. For locking lamp in socket against withdrawal.

1,277,534. Gripping Device; Reuben B. Benjamin, Chicago, Ill. App. filed July 26, 1915. Means for holding lamp against accidental loosening due to vibration or like causes.

1,277,540. Fuse Plug; Tonjes A. C. Both and Alexander H. Trumbull, Stratford, Conn. App. filed Jan. 19, 1915. To increase efficiency and safety of fuse plugs having screw-shell body and non-brittle construction.

1,277,549. Electric Lantern; Charles W. Conger, The Dalles, Ore. App. filed Aug. 13, 1917. Rays from lamp will be reflected directly upon ground.

1,277,550. Metallic Conduit for Electrical Conductors; Andrew J. Connell, App. filed June 22, 1916. To inclose completely and keep conductors and conduit body free from dust.

1,277,572. Automatic Telephone Responder; Mary B. Hamacher and Ignatius McCutchan, Windsor, Mo. App. filed Nov. 22, 1916. For answering telephone call so that person calling will hear certain predetermined signals or messages.

1,277,576. Remote-Control Electric Switch; Gerald W. Hart, Hartford, Conn. App. filed July 12, 1916. Has single energizing coil, which successively closes switch, opens switch and provides reciprocating means for automatically interrupting controlling circuits.

1,277,587. Signal Horn; Dwight B. Hill, Bridgeport, Conn. App. filed Dec. 16, 1915. Automobile type in which sound-producing diaphragm is vibrated by electromagnet.

1,277,609. Electric Switch; Channing E. Law and Lorenzo C. Law, Denver, Col. App. filed Aug. 31, 1916. Used with electrically operated signaling devices for automobiles.

1,277,615. Testing Sender; Alben E. Lundell, New York, N. Y., and Herbert G. Eddy, Bayonne, N. J. App. filed Feb. 5, 1917. May readily be associated with apparatus to be tested and provides means whereby progress and success of desired connection may be supervised.

1,277,621. Electric Heating Device; William R. Macklind, Cleveland, Ohio. App. filed Sept. 11, 1915. For heating varnish and air preparatory to applying to article by means of air brush.

1,277,627. Mount for Crystal Detectors; Thomas B. Miller, Seattle, Wash. App. filed Jan. 2, 1917. For use in radio signaling.

1,277,633. Automatic Fire-Alarm Attachment; Morris D. Montecino, Smoke Bend, La. App. filed July 29, 1916. For closing electric circuit after temperature of atmosphere surrounding device has reached a predetermined degree.

1,277,639. Electrode for Arc Soldering; Antoine B. Pescatore, London, England. App. filed June 10, 1918. Has covering of slag-forming material and is used for electric arc soldering or welding of iron or steel.

1,277,643. Signaling System for Single-Track Railroads; Neil D. Preston, Rochester, N. Y. App. filed July 8, 1916. Of absolute permissive block type.

1,277,646. Locatable Socket Cap; Ralph A. Belmont, New York, N. Y. App. filed Oct. 31, 1914. Switch key can be positioned relatively to key aperture in husk as well as to socket-supporting bracket.

1,277,647. Fuse Plug; Ralph A. Belmont, New York, N. Y. App. filed Nov. 3, 1914. Use of insulating material which is non-brittle and not easily breakable.

1,277,657. Electrical Apparatus for Heating Liquids; William H. Smith, Falkirk, England. App. filed Dec. 12, 1916. To avoid tendency for granules to become too tightly packed.

1,278,089. Perforating Device; Charles G. Ashley and Ernest T. Byshe, Toronto, Canada. App. filed Feb. 5, 1916. Used in preparation of transmitting tapes for automatic telegraph systems.

1,278,096. Motor Construction; Joseph Bijur, New York, N. Y. App. filed June 4, 1915. Relates to the construction of electric motors and to motors for use in starting internal-combustion engines.

1,278,110. Fuse; Henry M. Cogan, Brooklyn, N. Y. App. filed April 13, 1917. Refillable fuse for electric circuits of comparatively small current.

1,278,121. Current Transformer; Richard C. Downing and Lloyd C. Nicholson, Buffalo, N. Y. App. filed April 14, 1915. For use on high-tension electric circuits.

1,278,143. System of Control; Arthur J. Hall, Wilkinsburg, Pa. App. filed Jan. 10, 1916. Connects plurality of momentum-driven dynamo-electric machines in proper initial relation to effect return of energy to supply circuit.

1,278,151. Starting Apparatus; Ormond E. Hunt, Detroit, Mich. App. filed March 8, 1915. Relates to the starting of internal-combustion engines by means of dynamo.

1,278,171. Carbon Holder for Arc Lamps; Joseph C. La Chance, Vancouver, B. C., Canada. App. filed July 7, 1916. More rapid means for clamping or releasing carbon, with more effective contact-making hold.

1,278,183. Electrical System for Motor-Driven Vehicles, Motorboats, Etc. App. filed Sept. 9, 1910. To supply energy for engine ignition, for lighting and for other purposes.

1,278,189. Retarded Solenoid; Albert T. Marshall, Hartford, Conn. App. filed March 25, 1916. To provide retarding mechanism which permits gradual acceleration of movement after initial force is applied.

1,278,191. Controlling Apparatus for Motors; Calixa N. Moisan and William A. Smith, Montreal, Quebec, Canada. App. filed Jan. 4, 1917. For stopping motor at end of predetermined number of revolutions.

1,278,192. Method of and Apparatus for Proportioning the Load Between a Plurality of Series Motors; Thomas F. Mullaney and Walter J. Quinn, New York, N. Y. App. filed April 18, 1916. Automatically reduces counter-emf. of motor or motors running at higher speeds than other motors in circuit, while counter-emf. of such other motors is increased.

1,278,193. Process of Electric Welding; Joseph B. Murray, Brooklyn, N. Y. App. filed March 22, 1918. Maintains pressure until after critical temperature of structural change in bodies has been passed.

1,278,201. Commutator; John W. Pearson, Chicago, Ill. App. filed May 26, 1916. Adapted for locking the clamping members rigidly together without danger of expanding bar engaging parts of either of complementary gripping members.

1,278,202. Connector for Electric Circuits; John Pehrsson, Elyria, Ohio. App. filed Feb. 12, 1917. Cannot be shaken loose, because it locks the fastening-means.

1,278,234. Method of Welding Metal Plates and the Like; Frank L. Sessions, Lakewood, Ohio. App. filed March 26, 1917. Thickness of metal is not increased at joint.

1,278,245. Telephone-Exchange System; Arthur B. Sperry, New York, N. Y. App. filed March 30, 1917. Relates to exchanges wherein line finders are apportioned to calling lines by extended starter wire.

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Daylight Saving Throughout the Year

WE NOTE with interest the efforts now being put forth in Congress to continue the daylight-saving program from the last Sunday in October *sine die.* During the summer months there unquestionably has been a certain amount of saving in the use of artificial light by the change of clock time. From now on the aggregate of this small gain will be decreased by the added use of artificial light during the morning hours. If according to program the various industries hold throughout the year to their old accustomed hours, the longer daylight saving is in force the larger will be the morning requirement for light. The result on the load curve of the central station should be rather beneficent. The evening peak, and especially the lap load, will be somewhat decreased, and additional load will be provided just prior to the beginning of the normal day load.

One may safely say that on the whole the daylight saving through the past summer can be regarded as a success, chiefly from advantages altogether collateral to the actual saving in light. Just how it will work out through the winter months remains to be seen. No country has yet tried it, although in an excess of economic fervor some of our British friends have suggested a two-hour difference of clock time instead of that now current. The detailed effect of so great an innovation can only be ascertained by experience, but this much is certain, that if it is thought wise to continue our present program through the winter the central-station industry can have no reasonable objection to make. It will gain a material amount of sales of energy and at a time when the use of such energy will have an effect upon the general load which may be regarded as altogether advantageous.

The enterprise upon which you have embarked is a hazardous and difficult one. This is not a war of words; this is not a scholastic struggle. It is a war of ideals, yet fought with all the devices of science and with the power of machinery.—President Wilson to the Students' Army Training Corps.

War's Influence Upon Radio Communication

IT IS a well-known maxim that war is an art which calls upon all the arts and sciences for its support. Per contra, war stimulates the development of various sciences and arts for its own benefit. Two very marked cases of this kind during the present war are the sciences and arts of aircraft and of radio-communication. It is probable that more progress has been made in these cases during four years of war than could have been expected in twenty ordinary years under peace conditions.

Experts tell us that we shall probably not be able to know much about the technical military history of this great world war until at least twenty years after it is over, while full details, if they are ever obtained for publication, cannot be expected for many years more. The books which have been written about the first Marne battle of 1914 show great divergences and lack of reliable information concerning some of the most prominent events. Yet this battle probably decided the fate of the civilized world. No books have yet appeared upon the almost equally important second Marne battle of 1918.

In a similar way, the actual developments in radio-communication during and due to the war are shrouded in military secrecy It will not be until after the close of the war that we shall have the results available in publications There is this difference, however, between the technical history of the war itself and the technical results produced by the war in engineering, that while the former may not be made generally known in this generation, the latter will speedily become distributed after the conclusion of peace—because the results attained will be fully as useful and necessary in peace as in war.

From a technical point of view, the most salient advance in radio-engineering made since the opening of the world war has been in the construction and use of vacuum tubes. These tubes have been so far improved and so much utilized for many purposes that vacuum-tube engineering seems to offer a promising new branch of electrical engineering, intimately associated with radio-engineering on one side and with electric power and wire communication on other sides. It is clear that the essential theory and the principal working applications of vacuum tubes will have to be learned by most electrical engineering students. The technical colleges and engineering laboratories of the world will have to teach these subjects in the future.

From an operating point of view, a striking feature of radio-engineering in the world at war with Germany is the great number of uses to which radio-communication is being applied. From the transmission of diplomatic notes across oceans to the regulation of troops and guns across short distances and small intervening obstacles, the electric waves are perpetually skimming over the surface of our globe. The number of radio stations is constantly increasing, and yet the power of selective and non-interfering communication is also keeping pace.

Notwithstanding the vast prospective increase in radio-communication all over the world, there is no immediate prospect of a diminishing need for wire communication. No doubt the two systems of wire and wireless transmission will be more and more merged and consolidated, both in theory and practice, each being employed to supplement the other.

For the greatest causes the world has ever known the army you enter to-day is fighting and suffering and sacrificing.—Elihu Root to the Students' Army Training Corps.

Facts About Spot Welding

THE use of spot welding by electricity is rapidly increasing in a wide variety of applications, and the paper by Messrs. G. A. Hughes and R. H. Pool in our columns this week gives welcome data on some details of the process and on the energy required. There are many cases in which spot welding is greatly to be preferred to riveting. It is not by any means wholly a question of relative strength, but rather of strength plus convenience. There are many places in which it is very difficult to do a good job of riveting, or where a flush surface is desired and there is objection to countersinking the rivet head. Just there the spot-welding process often fits in admirably. In particular, thin material inconvenient to rivet can be worked with great facility and a comparatively small expenditure of energy. Heavy welding is merely a matter of power, but there seems to be no difficulty in working half-inch material with welders of very ordinary output. Thus the process is conveniently applicable not only to general sheet-metal working but to structural steel and to certain not inconsiderable features of shipbuilding.

The data secured by the authors were on stock of medium thickness, from $\frac{9}{32}$ in. (7 mm.) down to 18 gage, and the tests were made with a 30-kw. hand-operated machine, controlled by an auto-transformer in the primary of the welding transformer. In general, the spots were from $\frac{5}{16}$ in. to $\frac{7}{16}$ in. (8 mm. to 11 mm.) in diameter in the thicker materials. Roughly, the energy required was 20 kw. or 25 kw. and the time of a weld was from less than half a minute to a scant three-quarters of a minute on the heavier stock. On the thinner sheet stock the energy ran low, something less than 0.02 kw.-hr. per weld, and at a correspondingly increased speed. The power factor of the welder ranged in the various work somewhat on each side of 0.50. As to the strength of the spot welds, it proved to be highly satisfactory. On a series of welds of 14 gage sheet-steel single-lap joint the tensile strength of a pair of $\frac{5}{16}$-in. (8-mm.) spot welds proved to be fully up on the average to that of a pair of $\frac{1}{4}$-in. (6-mm.) rivets in drilled holes.

There seemed to be no room for doubt of regularly obtaining quite adequate strength in any case. As to the convenience of the process, it quite goes without saying that wherever a large amount of work has to be done under fairly uniform conditions the welding process can be made at least semi-automatic and a great saving of time and labor effected. The chief gain is the lessening of the amount of skilled labor required, which in these days is an item of the highest importance. The fact is that electric welding generally is just now coming into its own, and it will be found steadily replacing the old and reliable riveting in an increasing number of instances. Probably the two methods of uniting metals will continue to coexist, as each has a special field of applicability, but we feel very strongly that in fairly standardized work of almost any kind the automatic welding machine will find rapidly increasing use. The energy required is not costly, the process is quick, and the resulting joints are good. We are learning new labor-saving schemes at a magnificent rate under these war conditions, and as labor grows even scarcer one cannot afford to neglect any method that promises relief.

There can be no doubt of the issue. The spirit that is revealed and the manner in which America has responded to the call are indomitable.—President Wilson to the Students' Army Training Corps.

First-Class Wiring for War Plants

THE emergency character of building construction required in many war-industry plants leads one to ask whether temporary wiring may not suffice for such installations in place of the high standards normally enforced in shops and mills. A shortage in larger sizes of iron conduit has been and still is keenly felt. There are so many installations where conduit is vitally necessary, as in marine work, that it is natural to regard the war-industry plant of mushroom growth as a proper field for types of construction which ordinarily would be looked at askance by both the central-station man and the contractor.

No rigid rule can, of course, be laid down and followed regardless of conditions in such plants, and the first essential in every case is that such shops shall begin mass production with the irreducible minimum of delay. To get things moving, the engineer may have to concede, temporarily, now and then wiring arrangements not of the best. But only temporarily. The penalties of poor wiring are their own condemnation, and beyond this the ultimate cost of sub-normal standards in wiring, even of fair quality, may be extremely heavy. In the interests of the lowest possible fire risk, of the maximum degree of personal safety to operatives and other employees, and of continued reliable service, all temporarily below-par wiring should be revamped and put on the plane of first-class practice at the earliest feasible moment. In the barracks of the cantonment abuse of the wiring by inquisitive or careless recruits who hang their wet uniforms upon open runs or attempt experiments for off-duty entertainment is far from an imaginary affair. In the munitions shop the forcing of heavy tools and of raw material through processes at top speed in the interests of production first of all tends to lead to mechanical injuries to wiring unless it is of the best possible type. Hence the field for the use of either rigid or flexible metal conduit is very important, as is the "fool-proofing" of switches, fuse boxes and other necessary impedimenta of the electric art. Despite the scarcity of iron conduit and the difficulties in obtaining deliveries even of orders placed half a year ago, the general use of this material should be insisted upon in all cases where its application means the avoidance of real disaster. It is significant that the United Illuminating Company of Bridgeport, Conn., has this year brought out a set of wiring rules which raise the standard of installations in this important munitions community even above the normal insurance test of excellence, and other central stations and contractors may well make every effort to secure permanent work of the best type regardless of the pressure often brought upon them to sanction for an indefinite period methods of construction which are, to say the least, inherently hazardous.

Good wishes will not buy ammunition, nor will hopes cause Germany to surrender—it takes cash. While there is time invest in Liberty bonds.

Burning Pulverized Coal

FROM time to time we have described various experiments with pulverized coal as a fuel for central stations. Most of these appear to have turned out favorably. But this week we add to the list of experiences that of the Milwaukee Electric Railway & Light Company, which seems to be exceptionally significant from the care with which the experiments were conducted and the exact comparative results obtained. In this case the test was made in practical competition with well-handled mechanical stokers, and there was due allowance for the necessary factors of difference. The fuel used has to be pulverized and dried before it can be properly fed by the air blast. A pulverizer with a capacity of 4 tons per hour was provided and an indirectly fired drier of 15 tons capacity per hour. The fuel was taken directly from one of the ordinary coal bunkers, conveyed mechanically to the drier and thence to the pulverizer supply bin. On its way to the pulverizer a magnetic separator removes any magnetic fragments, and, thus cleared for suitable pulverizing, the fuel is fed through the mill. Thence it is carried by a screw conveyor to the storage bin in the boiler room, whence it is fired by an air blast fed by screw conveyors. Agitator wheels mix it thoroughly with air and the blast carries it into the furnace. This furnace is of the Dutch-oven type with a very liberal combustion chamber, a provision altogether desirable for securing efficient burning of fuel.

After thorough experiments as to capacity with this apparatus, a careful efficiency test was made. The net result of this showed an evaporation of 9.47 lb. of water per pound of coal (9.47 kg. of water per kilogram of coal). Considering the fact that the analysis of the coal showed nearly 14 per cent of ash and 2 per cent sulphur with 12,000 B.t.u. (3024 calories) calorific drive, it is very clear that the evaporative efficiency was exceptionally high.

From a practical standpoint, the ease with which full rating and efficiency are kept up on the boilers, freedom from cleaning the fires, ease of handling heavy overloads and good banking conditions combined to cause a decided advantage for the pulverized-fuel method. The net efficiencies seem so close as to constitute no particular advantage one way or the other so far as this only is concerned. It seems quite probable, however, that a grade of fuel can be burned in the pulverized state which would be likely to show less satisfactory results if fired in the ordinary manner. It is perhaps in this particular that the pulverized-fuel gain can be made to pay the best returns. At all events the data obtained in this Milwaukee test are of a character to make the central-station manager keep an eye out for possible gains along this line. Much will necessarily depend on local conditions, and further experiments should be made, particularly with decidedly inferior grades of fuel, since in the future one will have to deal with these with increasing frequency.

A lasting and worthy peace may be secured only through victory. The only way for most of us to bring this about is to help the government by buying Liberty bonds.

Economical Load of Transformers

IN OPERATING an alternating-current network with high efficiency in view it is obvious that attention must be paid to keeping down the transformer losses and that if the plant be scientifically handled the transformers in service will be regulated in number to suit the conditions. A brief article in our columns sets out the principles which must be followed in adjusting the transformer capacity to the load. The vital point of the matter is that as the load increases on a single transformer a second transformer, if available, should be cut in if by so doing the total losses will be decreased, and so on. The losses being the sum of core and copper losses, the addition of a second identical transformer doubles the total core loss and must therefore reduce the combined copper loss of the pair by an equal amount, which is another way of saying that it pays to add the second unit when the copper loss of the first is double its core loss.

The exact point on the rating of the transformer that is implied by this ratio depends on the particular characteristics of design. Where transformers of different types are used together, the same principles hold, but their application depends on the particular losses involved. The same sort of convenient graphic investigation here shown is useful in arranging an operating schedule for a generating plant, since here again the point of most economical operation is determined by the relation between the constant losses and those dependent upon the load.

The Coming Issues

THE observations which Dr. Charles R. Mann has made in studying how educational methods meet emergency needs will be given in the next issue of the ELECTRICAL WORLD with an outline of a method by which education can be made more effective. Another coming article will describe some features of plant design and apparatus arrangement embodied in the new Hampden steam station of the Turners Falls Power & Electric Company. Numerous itemized costs of construction will be included. Still another article will call attention to the urgent need for power producers as well as power users to improve their power factor if adequate power and maximum use of equipment are to be had. This will be followed by articles discussing details connected with the actual task of improving power factor. War-time lighting economies that have been suggested by the war service committee of the Illuminating Engineering Society will also be the subject of a paper.

Arrangements to Avoid Operating Difficulties—I

Special Attention Has Been Given in the New Dayton Plant to Handling Coal Economically, Obtaining Clean Intake Water, Providing Flexible Piping Layout and Furnishing Adequate Boiler-Room Instruments

GROWTH in load and the increasing difficulty of getting coal and water to its two existing plants in large enough quantities made it necessary for the Dayton (Ohio) Power & Light Company to build a new plant. The two old stations, which were rated at 15,000 kw. and 4300 kw. respectively, are both in the business district of Dayton. The former, which was originally designed for only 4000 kw., has literally outgrown the site. The new station is situated at Miller's Ford, a site which has three advantages: It is below the junction of four streams, where at the period of minimum flow water enough is available for a 100,000-kw. plant; it is on the "Big Four" Railroad, over which coal supplies can be delivered, and it is only 2.5 miles (4 km.) from the load center of the city. The ultimate rating of the new plant is 100,000 kw., but the machines so far installed have a rating of only 25,000 kw. In general the plant design follows what is considered well-established modern practice, but close attention to engineering details in design and construction has produced a plant in which it is believed the ordinary operating difficulties will be reduced to a minimum. Simplicity, ease and convenience of control, as well as economy of first cost and operation, were given careful consideration in all selections of apparatus and layouts. The present building will accommodate about one-half of the ultimate rating of the station. Above it towers the self-supporting steel stack, which is 16 ft. (5 m.) in inside diameter and stands 300 ft. (91 m.) above the boiler-room floor. The superstructure consists mainly of I-beams fastened together with bolts and distance pieces to form girders which are filled with concrete. This class of construction was adopted to save steel. The condenser pit has been made watertight in order to guard against leakage during high-water periods.

For handling coal a steam hoist is used which operates a clamshell bucket discharging its contents into a hopper above the bunkers. From here the coal goes through a motor-driven crusher and is discharged into a cable car where it is weighed before it is distributed along the 975-ton bunkers over the boilers. The cable car is electrically operated and is controlled by a man who sits by the scale. When the coal is delivered it is dumped from the cars, if it is to be used immediately, into a concrete coal pocket which holds about six carloads. If it is to be carried in storage, it is unloaded by a locomotive crane and stored near the power house. The same crane can take coal from storage and dump it into the coal pocket. This general method of handling the coal was chosen because the equipment is economical to operate and maintain and because it was thought best adapted to get coal up to the station under high-water conditions. The system is rated at 90 tons per hour and is large enough to serve half of the ultimate plant.

Ashes go by gravity from the ash hoppers into side-dump cars which are hauled out onto the low ground around the station by a home-made gasoline-engine-driven tractor. For some time to come the company will use the ashes in filling up the 32 acres (13 hectares) of low land which it owns around the plant.

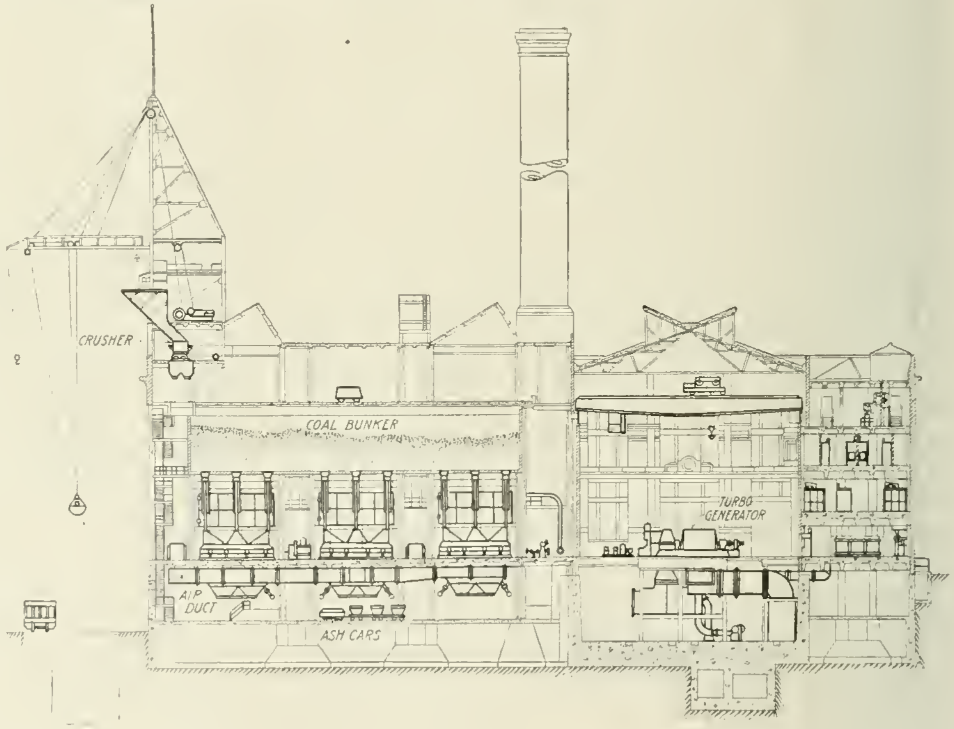
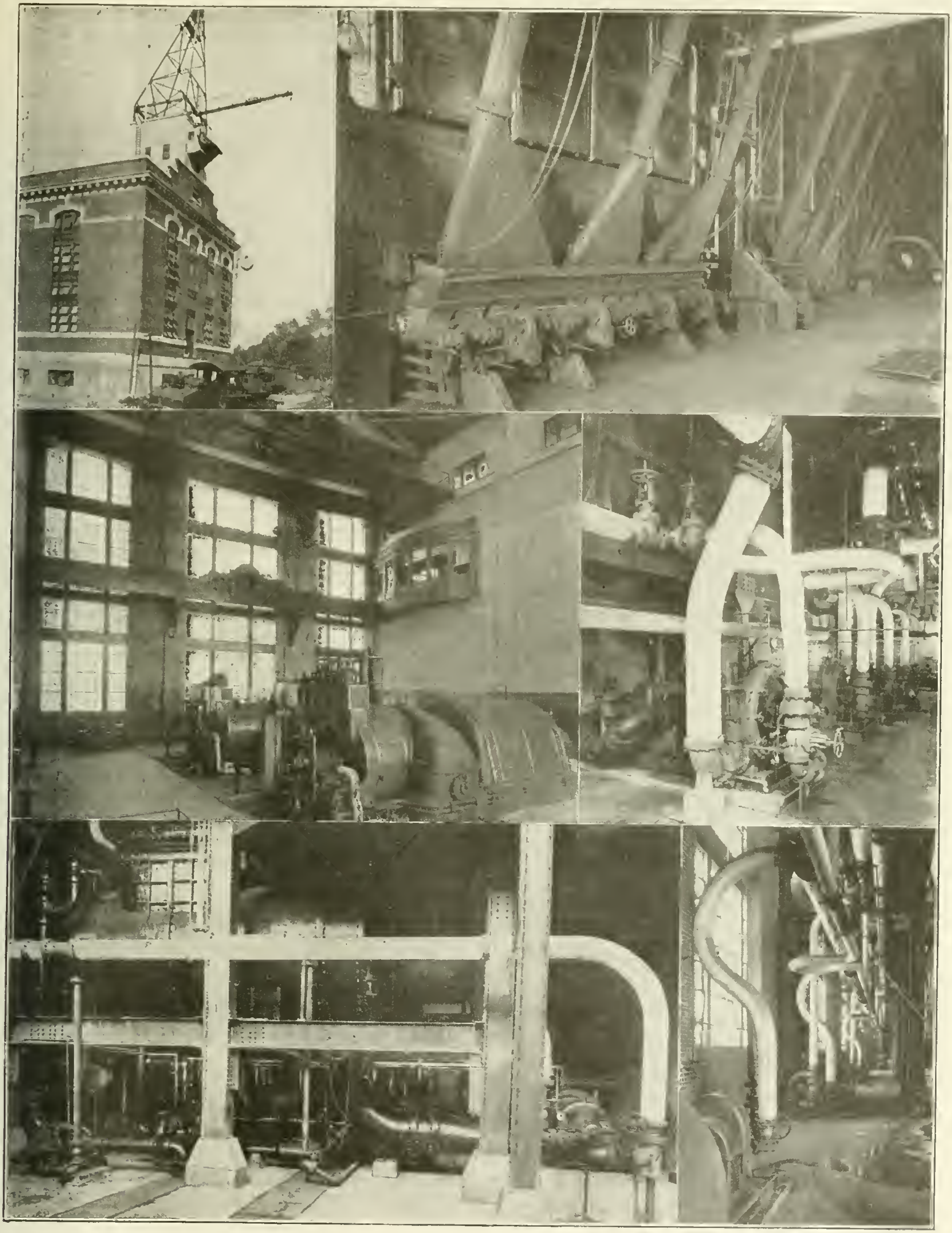


FIG. 1—CROSS-SECTION OF STATION, SHOWING COAL AND ASH HANDLING ARRANGEMENTS

Instead of building the usual long intake extending upstream for circulating water, the Dayton company built an intake basin with the mouth pointing downstream so that the current of the river does not flow into it. By taking water out of the basin, trouble from gravel, driftwood and sewage getting into the circulating system is avoided, since it has an opportunity to settle to some extent. Besides, the intake tunnel is shorter.

The intake and discharge tunnels are side by side underneath the power house, being separated only by a 3-ft. (0.9-m.) wall of concrete. The difference in water temperature in the discharge and intake tunnels amounts to about 14 deg. Fahr. (—10 deg. C.). To take the water from the intake tunnel to the circulating pumps five



FIGS. 2 TO 7—VIEWS OF NEW DAYTON PLANT, SHOWING PORTIONS OF BOILER AND GENERATOR ROOMS, SOME AUXILIARIES AND CURVED PIPING USED TO ALLOW FOR EXPANSION AND CONTRACTION

large cast-iron intake tubes have been installed in the water-tight condenser pit. Those which are not already in use are covered with cast-iron covers which are bolted in place.

Owing to the fact that the water supply available is unfit for boiler use without treatment, a hot-process water softener is used to take care of the make-up, which was estimated to amount to 2 per cent of the total water evaporated. In order to keep down the size of water-softening equipment and at the same time take care of fluctuations in the demand for make-up and not operate the softener above rating, the following arrangement is used: A 10,000-gal. (38,000-l.) tank is installed on the roof and supplied with condensate from a concrete tank in the basement by means of two pumps operating at the rate of 100 gal. (380 l.) per minute, one motor-driven and one turbine-driven, their operation being controlled by a float valve in the roof tank. The water from the softener, which is heated to 200 deg. Fahr. (93 deg. C.) goes direct to the heater whenever the water level in the concrete overflow tank is lowered. This is accomplished by means of a Kitts water-supply regulator valve installed in the line from the softener to the heater and actuated by the level in the concrete tank. This valve will remain open until it has filled the roof tank and the concrete tank about one-half full by raising the level in the heater. It operates the float-controlled valve in the line from the condensate pumps to the heater, causing the condensate to overflow into the concrete tanks. The overflow tank also prevents the loss of hot water overflowing from the heater. The water supply from the roof tank to the heater is controlled by two float-controlled valves set at different levels. The condensate is used for gland sealing and wherever the well water would be troublesome. This well water contains about twenty-six grains of hardness originally, and when treated it contains about one grain of hardness.

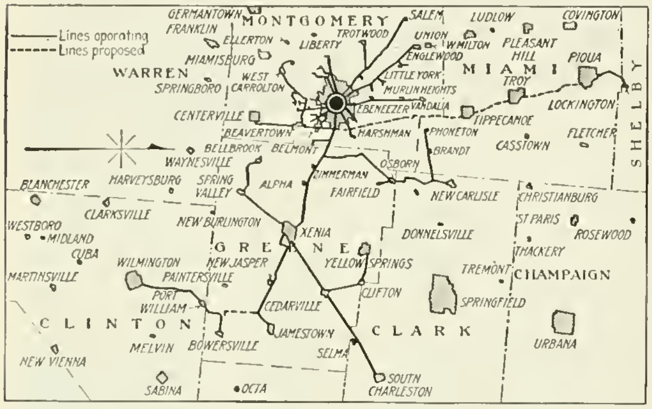


FIG. 8—TERRITORY SERVED BY DAYTON COMPANY

The general water supply for the station is obtained from driven wells and is pumped to a roof tank similar to the one just mentioned by two pumps operated at the rate of 300 gal. (1140 l.) per minute, one motor-driven and the other turbine-driven. The water softener obtains its supply from this tank. In an emergency well water can be used directly for make-up. The fire pumps and general service pumps have two sources of supply—wells or river water from the discharge tunnel.

The boiler-feed pumps are directly connected to turbines. One pump is rated at 1000 gal. per minute and is driven by a 2400-r.p.m. E-5 type turbine, while two pumps are rated at 500 gal. per minute and are driven by a 2800-r.p.m. type D-5 turbine. To facilitate testing on water rates, the piping and valves are so arranged that the condensate can be sent to permanently set weighing tanks, from which it is taken to the heaters.

All blow-down from the boilers goes to a blow-down tank, from which it passes through a Lea V-notch weir for measurement.

The Boilers and Their Auxiliaries

The boiler room is laid out so that the three boilers which serve the two turbines are all in one aisle. This aisle runs parallel to the turbine room instead of at right angles to it. This general layout was selected to give a symmetrical design. The three boilers at present installed are rated at 1373 hp. and are of the cross-drum type. Vulcan soot blowers are installed on each boiler.

The furnaces are equipped with underfeed stokers having steam-operated dumps. The stokers may be driven either by an engine or an induction motor through a No. 6½ class E Reeves variable-speed transmisison. The introduction of this device was necessary since there is no source of direct current in the plant and variable speed with alternating-current motor drive was desirable. Under ordinary operating conditions the stokers are driven by the motor and the engine is held in reserve. The drive shaft is installed under the boiler-room floor in front of the stokers, where it is out of the way, but the engine and the motor are both on the boiler-room floor, where they will receive close attention.

The forced draft required by the stokers is supplied by three Sturtevant multivane blowers driven at 750 r.p.m. through gears with a ratio of 5.88 by a Sturtevant turbine. These fans will deliver 80,000 cu.ft. (2240 cu.m.) of air per minute against 7 in. of pressure (49 kg. per sq.cm.) at maximum rating. Control of the air delivered to the boilers is effected through sensitive air-pressure regulators.

In the uptake, gases go through a Murray cinder catcher between the boiler and the breeching. All of these passages are designed so that the velocities of gases will not be excessive at 300 per cent rating.

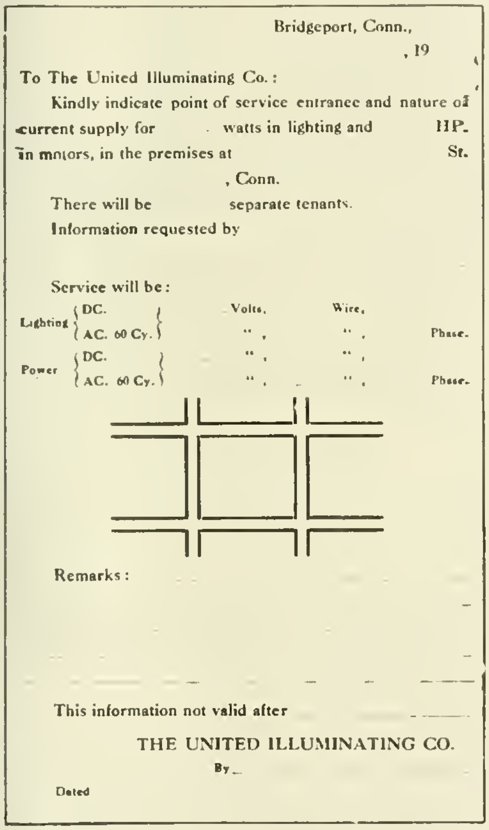
The steam piping is arranged on a ring system in which the largest size pipe used is 15 in. (38 cm.) outside diameter. Two steam outlets leave each boiler, a Bailey boiler meter being connected in each. While this practice of having two boiler meters per boiler may at first seem extravagant, it has already been proved in pratice that it is desirable to have such a check on the work the boilers are doing. On the ring header four motor-operated valves have been installed for sectionalizing. Each of these can be operated from the turbine room or from a point close to the valve. To make the piping accessible it is above the floor, except where it was necessary to run it under the floor to serve the turbine.

There is an auxiliary steam header in the boiler room and another in the basement of the turbine room for auxiliaries. All drips are taken to a common point, where the water is picked up by a Davidson horizontal automatic feed pump and delivered back to the boiler.

Insuring Against Disagreements Over Wiring

Bridgeport (Conn.) Utility Has Established Service Code Which Has Been Carefully Worked Out from an Engineering as Well as a Commercial Standpoint and Is Giving General Satisfaction

IN MANY central-station systems the regulations with regard to service wiring and transformer installations are loosely drawn and leave so much to implication that misunderstandings may arise between the customer and the company, with resulting friction and dissatisfaction. To insure first-class standard work with no opportunity for subsequent disagreements, the United Illuminating Company of Bridgeport, Conn., has recently established a service code which goes into particulars not provided in the National Electrical Code, supplementing the latter and not intentionally in conflict with it in any respect. Some of the points covered in these rules are given below. The code has been carefully worked out from the engineering as well as from the commercial standpoint.


Bridgeport, Conn.,
, 19

To The United Illuminating Co.:
Kindly indicate point of service entrance and nature of current supply for watts in lighting and HP. in motors, in the premises at St.
, Conn.
There will be separate tenants.
Information requested by

Service will be:
Lighting { DC. / AC. 60 Cy. } Volts, Wire, / " , " , Phase.
Power { DC. / AC. 60 Cy. } " , " , / " , " , Phase.

Remarks:

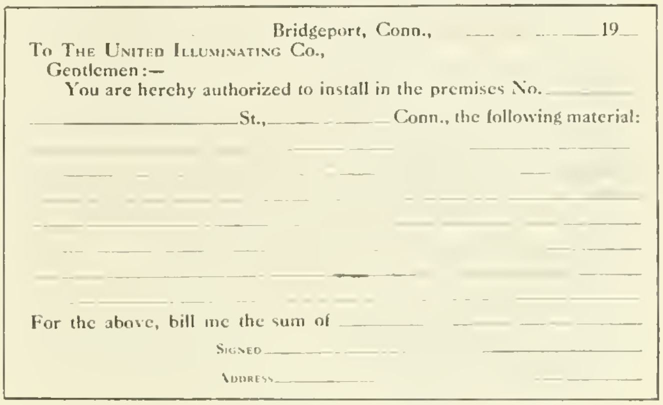
This information not valid after
THE UNITED ILLUMINATING CO.
By
Dated

FIG. 1—BLANK SERVICE CHARACTERISTICS FORM

Diagram map of service entrance location insures accuracy in planning of exact kind of service wanted and available. Issued in duplicate, one copy going to electrical wiring contractor and one to the United Illuminating Company's file.

In accordance with the general practice, the company provides at its own expense overhead low-tension service wires from existing overhead lines to the nearest outer wall of the customer's building, provided that the distance from the curb to the point of service connection does not exceed a stated amount—in this case 50 ft. (15 m.). Other less common provisos, however, are that no obstruction shall prevent the service wires from extending directly, in the clear, from pole to building, and also that no property not owned or controlled by the consumer is interposed between the pole and the point of service connection. When the distance exceeds 50 ft. the added expense due to the excess distance is charged to the consumer. The consumer or his representative is expected to apply for the location of the service attachment at the office of the company. In order that no question may arise concerning the location or nature of energy supply or needless expense be incurred, the location of the service attachment must be secured from the company on a blank provided for the purpose before appliances are purchased or the wiring installation begun.

The company requires that service pipes, which should be included in wiring contracts, of approved rigid iron conduit at least ¾ in. (19 mm.) inside diameter, be run outside of and securely fastened to the building walls, extending from the point of service attachment designated by the company to the point where it enters the basement, and continuously to the main service switch. If the main service switch, in order to avoid coal bins or toilets or to be placed in a public space, must be installed in the rear of the building, the service pipe may be run down outside the wall so as to enter the basement wall near the required location of the service switch. The service pipe must run to height sufficient for the company's service wires to clear the roadway not less than 18 ft. (5.5 m.). At the outer end the service pipe must terminate in an approved weather cap and at the inner end in an approved salable service box if the meters are remote from the entrance. If the meters are at the same location with the main service switch, the company has a standard protective box which is used. Effective and permanent grounding of the service pipe is insisted upon, and single-conductor, rubber-covered wire, approved by the company for the voltage supplied, and in no case less than No. 12 B. & S. gage, is specified to be used in the service pipes, extending at least 2 ft. (60 cm.) beyond the outer end of the pipe, with all wires plainly marked.


Bridgeport, Conn., ______ 19__
To The United Illuminating Co.,
Gentlemen:—
You are hereby authorized to install in the premises No. ______
______ St., ______ Conn., the following material:

For the above, bill me the sum of ______
Signed ______
Address ______

FIG. 2—INSTALLATION AUTHORIZATION CARD ORDER

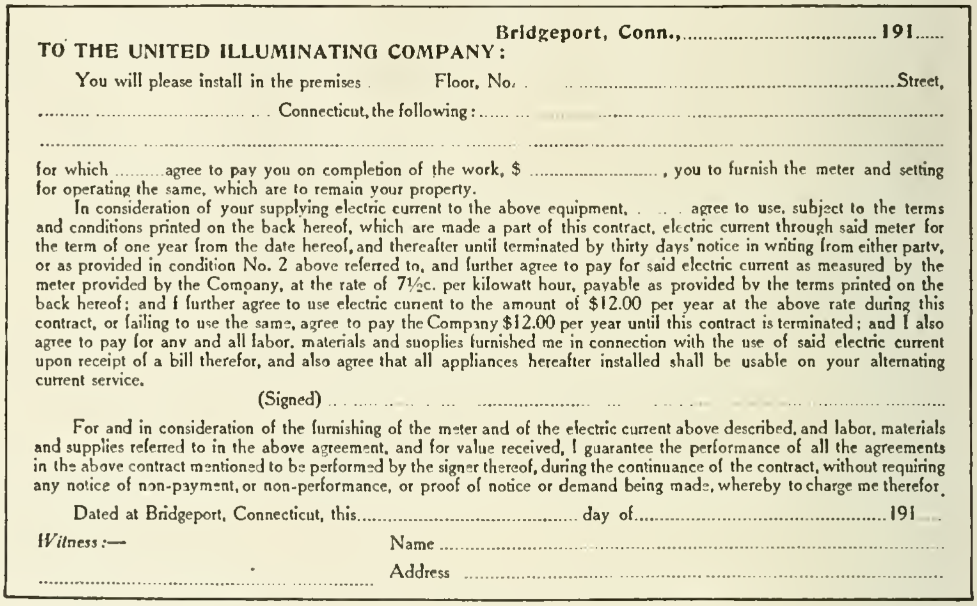
On this consumer agrees to pay cost of all labor and material from curb to consumer's premises, including main service switch and fuses.

When the consumer requests or conditions require underground service from overhead mains, the customer is required to bear all expense for labor and material from the mains to his premises. Under no circumstances is any contractor allowed to attach wires to the company's overhead lines. Lead-sheathed cable is required for underground entrances, and the insulation requirements of the company are as follows:

INSULATION OF SERVICE CABLES

Volts Between Wires	Size of Wire	Insulation Thickness in 1-64 In.	Lead Sheath Thickness in 1-64 In.	
			1 Wire	2 or 3 Wire
Below 600	No. 8—No. 2 B.&S.	4	6	6
Below 600	No. 1—No. 0000	6	6	6
Below 600	225,000 circ. mil. to 2,000,000 circ. mil.	8	6	7
Below 2500	All sizes	12 (30% Para)		7
2500 to 6800	All sizes	16 (30% Para)		7
Below 2500	All sizes	12 (var. cambric)		7
2500 to 6800	All sizes	16 (var. cambric)		7

The United company specifies further that with underground service entrances the cables must be placed in galvanized-iron conduit not less than 1½ in. (38 mm.) in inside diameter; all 90-deg. bends are to be not less than 18-in. (45.7-cm.) radius, and the conduit is run at least 3 ft. (91.4 cm.) below the ground surface. From a point 8 ft. (2.4 m.) above the sidewalk the company requires that the pipe be inclosed in fiber conduit extending to the chafe bushing or pothead on top of the pipe. The sections of fiber conduit are required to be connected together with standard screw couplings and clamped to the pole at least every 5 ft. (1.5 m.), and with screws not smaller than 2 in. (5 cm.). One clamp is fastened to the pole directly under the lower end of the fiber conduit to prevent its slipping down on the pipe.



Bridgeport, Conn., ... 191......

TO THE UNITED ILLUMINATING COMPANY:

You will please install in the premises .... Floor, No. .... Street,

.... Connecticut, the following: ....

....

for which ....agree to pay you on completion of the work, $ ...., you to furnish the meter and setting for operating the same, which are to remain your property.

In consideration of your supplying electric current to the above equipment, ... agree to use, subject to the terms and conditions printed on the back hereof, which are made a part of this contract, electric current through said meter for the term of one year from the date hereof, and thereafter until terminated by thirty days' notice in writing from either party, or as provided in condition No. 2 above referred to, and further agree to pay for said electric current as measured by the meter provided by the Company, at the rate of 7½c. per kilowatt hour, payable as provided by the terms printed on the back hereof; and I further agree to use electric current to the amount of $12.00 per year at the above rate during this contract, or failing to use the same, agree to pay the Company $12.00 per year until this contract is terminated; and I also agree to pay for any and all labor, materials and supplies furnished me in connection with the use of said electric current upon receipt of a bill therefor, and also agree that all appliances hereafter installed shall be usable on your alternating current service.

(Signed) ....

For and in consideration of the furnishing of the meter and of the electric current above described, and labor, materials and supplies referred to in the above agreement, and for value received, I guarantee the performance of all the agreements in the above contract mentioned to be performed by the signer thereof, during the continuance of the contract, without requiring any notice of non-payment, or non-performance, or proof of notice or demand being made, whereby to charge me therefor.

Dated at Bridgeport, Connecticut, this.................................... day of.................................... 191......

Witness:— Name ....

.... Address ....

FIG. 3—LIGHTING CONTRACT CARD FORM WITH PAYMENT GUARANTEE (GENERAL TERMS AND CONDITIONS ON REVERSE SIDE)

For low-tension service wires the pipe top is protected by a terminal box furnished by the company and charged to the consumer. For 600 volts and higher service the pipe ends at the pole and building are threaded, and the cable is protected by a suitable pothead approved and installed by the company at the expense of the consumer. No wire less than No. 8 B. & S. gage is permitted in such service pipes, and the maximum drop allowed between the overhead street mains and the main service switch in the basement is 1 per cent. Where a new service tap is required from underground street mains of the company, the company installs the tap after receiving a written order from the consumer that the latter will pay the cost of all labor and material from the curb to his premises, including main service switch and fuses. In case the service to be connected is less than 1 kw. the customer is now required to pay the entire cost of the service extension.

When several stores or apartments are grouped in one block, the load may be too great to permit the transformers to be placed on poles, as may factory loads also. In such cases, at the discretion of the proper company official, the consumer is required to furnish the platform or vault at his own expense. In general, the limit in size for transformers to be placed on a pole is two 10-kva. units or their equivalent. The wiring of transformer vaults is installed only by the company and at the consumer's expense. When transformers are installed in an interior vault, this must be placed against the street wall, and besides being in accordance with the National Electrical Code, the following points are insisted upon by the company:

Floor dimensions and head room depend upon the size of the load and are specified by an official of the company upon request. A suitable, approved padlocked fire door is required to be not less than 48 in. (124.4 cm.) in width of clear opening and of a height depending on the size of the transformer. Wider door openings are of course required in large factory vaults. The central-station representative determines the location of the door, and a sill 4 in. (10.16 cm.) high is required at the doorway of the vault as a protection against oil and water. Another requirement is a passageway allowing transformers to be installed without cutting away building walls. When possible, an outside entrance through the sidewalk is provided. In these vaults the company permits no combustible material, water, gas, sewer or other pipes. Ventilation is enforced by means of an air inlet placed not more than 1 ft. (30.4 cm.) above the floor line and an outlet at the ceiling line. In case of vaults inside buildings both inlet and outlet are piped to the outer air. The required area of ventilating ducts is not less than 36 sq.in. (232 sq.cm.) per 100 kva. of transformer capacity or fraction thereof. Protection of the openings from rain or snow and foreign materials is another stipulation, and the lower edge of the ventilating inlet is set at least 4 in. (10.16 cm.) above the floor line. All such vaults are provided with drainage connections, and the wiring, which is installed only by the company and at the consumer's expense, includes underground cable and all transformer wiring. The consumer arranges to have his wiring contractor bring the mains to the vault, with ground connections when necessary, the mains being long enough to connect to the secondary bus. Meters and secondary overload protective devices are not permitted in the vault, but are preferably placed just outside the vault walls and in an accessible public space.

All lighting installations of more than 660 watts are wired for three-wire connections, and the company requires that an installation containing fewer than twenty sockets must be balanced within one socket; between twenty and fifty sockets the balancing must be within 10 per cent, and with more than fifty sockets balancing is required within 5 per cent. Show windows are balanced against one another unless a single show window contains more than three sockets, in which case it is balanced within itself. Chandeliers containing more than twelve sockets are required to be balanced within themselves. In combined single-phase installations of light and power, all power of ¼ hp. (186.5 watts) or more is specified to be 220 volts, and balancing is required as outlined above under sockets. Each floor is required to be balanced within itself, and where there are two or more suites of rooms on one floor each suite is required to be balanced within itself. In every case of addition to an old installation the company requires the same attention to balancing as on a new job.

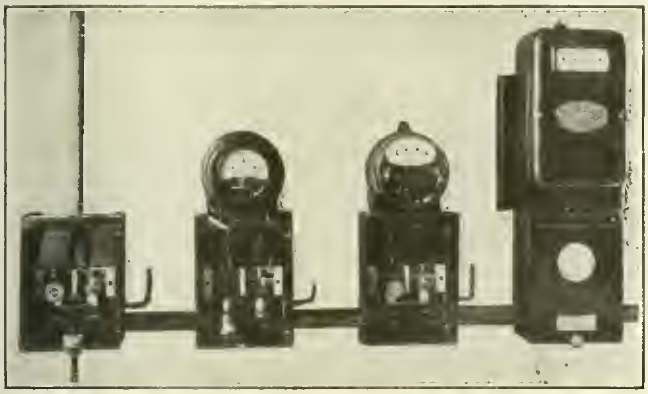


FIG. 4—PROTECTED SERVICE AND METER BOXES USED BY BRIDGEPORT COMPANY

Boxes manufactured by Metropolitan Engineering Company, Brooklyn, N. Y. By running a solid neutral, the same box adapted can be used for both two-wire and three-wire meter service. By cutting away top of box, as suggested by United Illuminating Company, and as shown above, meter does not have to be made an integral part of box structure, saving metal and increasing compactness of layout. Meter is recessed into space in upper part of box as shown, and is rendered tamper-proof by close-fitting box cover.

My advice to the young man taking the electrical or mechanical course would be to supplement his regular work with as much hydraulic engineering work as possible, for the indications are that when the industries of the world are once more operating on a peace basis unusual activity will be concentrated in water-power developments all over the country.—*S. A. Redding, General Superintendent Clerical Department, Georgia Railway & Power Company.*

THE ECONOMICAL LOADING OF TRANSFORMER BANKS

Curves Which Make It Possible to Keep the Most Economical Number of Transformers in Service—Units of Uniform Size

WHERE several transformer banks of similar characteristics are available to carry a variable load it is of interest to determine the economical point for switching an additional unit into service. Ordinarily this is done when the load has reached the capacity of the working units, but this may not always be the most economical practice. Obviously, switching in an idle unit will increase the total core losses which are constant for each unit, but the corresponding decrease in the variable or copper losses may more than counterbalance this increase. As the ratio between these losses differs widely in different classes of transformers, it is necessary to investigate each case individually.

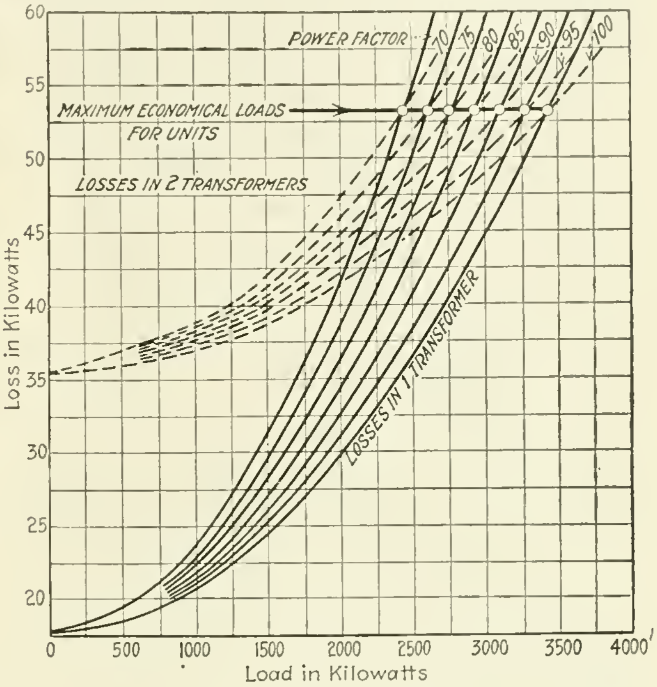


FIG. 1—LOSSES IN THREE-PHASE, 3000-KVA. TRANSFORMERS UNDER VARIABLE LOADS

Gives comparison between losses in one unit carrying total load and two units each carrying one-half of total.

Fig. 1 is a sample set of curves indicating the losses in a 3000-kva. three-phase transformer for varying loads and power factors. From this the loss in kilowatts may be read directly for any load at any power factor. The curves are plotted in kilowatt load rather than kilovolt-amperes, as the load may be read directly in kilowatts on the station meters and will thus permit the operator to pick the economical switching point more readily than if expressed in kilovolt-amperes. The curves are based on test results or data furnished by the transformer manufacturer. On the same sheet is plotted a second set of curves showing the total losses in two transformers, each carrying half the load. These curves may be readily calculated from the first set.

For instance, at unity power factor and 1500-kw. load, the loss in one transformer is seen to be 24.5 kw.

Therefore, for a total load of 3000 kw., if two transformers are used the total loss will be 49 kw., which gives one point on the unity power-factor curve of the second set. Each loss curve for two units intersects the corresponding loss curve of one unit, beyond which point of intersection it will be more economical to operate two units than one. It will be noted that in the particular example given the economical point on the unity power-factor curve is at 3430 kw. (or kva.), or slightly more than full load. On the 70 per cent curve the intersection is at 2440 kw., or 3486 kva. Thus it will be seen that the economical point of change is at a practically constant kva. load regardless of power factor. It will also be noted that the economical switching point is at a constant value of loss regardless of power factor, and that this point is that at which the total loss in one transformer is three times the core loss in one transformer. This may be readily proved for identical transformers as follows:

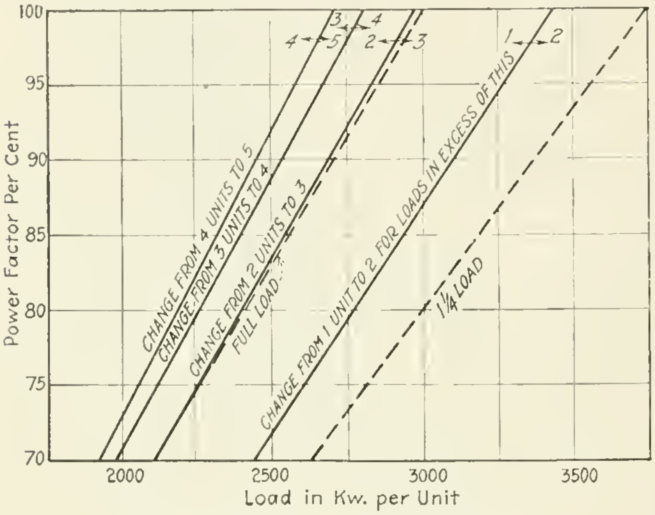


FIG. 2—ECONOMICAL SWITCHING LOADS

Thus if the load reaches 3000 kw. at 87 per cent power factor, it becomes economical to switch in a second transformer.

Let W = total transformer loss,
W_c = core loss of one transformer,
W_{c_1} = copper loss of the single transformer,
W_{c_2} = copper loss of one transformer of the bank of two,
I = equivalent load current,
R = equivalent transformer resistance.

Then for one transformer:

$$W = W_c + W_{c_1} = W_c + I^2R,$$

and for two transformers:

$$W = 2W_c + 2W_{c_2} = 2W_c + 2(I/2)^2R.$$

Equating for condition of economical switching point,

$$2W_c + 2(I/2)^2R = W_c + I^2R,$$

$$W_c = I^2R/2 = W_{c_1}/2;$$

or, the economical point is that at which the core loss in the single transformer equals one-half the copper loss in that transformer, or one-third the total loss.

Similarly, with the two units in service it will be most economical to switch in a third when the core loss per transformer equals one-sixth the total copper losses or when the core loss in one of the pair equals two-thirds the copper loss in one of the pair. For $W = 2W_c + 2W_{c_2} = 2W_c + 2(I/2)^2R = 2W_c + I^2R/2)$ and $W = 3W_c + 3W_{c_3} = 3W_c + 3(I/3)^2R = 3W_c + (I^2R/3)$. Equating,

$$2W_c(I^2R/2) = 3W_c + (I^2R/3),$$

$$W_c = I^2R/6 = 2W_{c_2}/3;$$

or, in a general way, when n units are running switch to $n + 1$ units, when the losses per transformer are $W_c = nW_{c_n}/(n + 1)$.

These results are plotted in Fig. 2 for a number of combinations. Knowing the load per unit, the operator can tell at once when it will be economical to switch a unit on or off. If the load is known in kva., the division points on the unity power-factor line should be used.

While the above equation holds true only for groups of identical transformers or other apparatus having losses partly constant and partly varying with the square of the load, the graphical investigation may be suitably modified to apply to generators, dissimilar transformers or other apparatus.

Belgium Shall Be Free—Buy Bonds

CONSIDERATIONS NECESSARY IN CHOOSING CONDENSERS

With High Efficiency a National Necessity, It Is Important to Choose Condensers of Correct Type and Design for Each Plant

IN THESE days when fuel is scarce and high in price too much stress cannot be laid upon the best possible economy in power-plant operation. Careful operation will be of no avail, however, if the condensing equipment is not chosen to the best advantage. This subject was discussed at the recent annual convention of the Association of Iron and Steel Electrical Engineers by D. D. Pendleton of the Wheeler Condenser Company, in a paper entitled "Condensers and Condenser Engineering Practice."

The paper by Mr. Pendleton included a comprehensive discussion of the three principal types of condensers, namely, surface condensers, low-level jet and barometric condensers. Vital points in the selection and operation of these condensers were brought out. The author warned against the practice of making condenser requirements so high that the cost is not justified by the increased economy effected. This places a hardship upon the purchaser.

While the efficiency of a condenser may be expressed in one figure, namely, the terminal difference between the temperature of the steam or vacuum and the temperature of the water leaving the condenser, account must also be taken of the vacuum maintained and the power required by auxiliaries for any condenser system. The vacuum practical to maintain also depends upon the type of prime mover. A reciprocating condensing steam engine is seldom proportioned for more than 26 in. to 27 in. (660 mm. to 690 mm.), whereas a properly designed steam turbine should be so designed as to utilize properly the highest theoretical vacuum obtainable.

TYPES OF CONDENSERS

The barometric condenser lends itself most admirably to the use of very bad, dirty or acid water. Care must be taken, however, to see that the tail pipe of the condenser is positively large enough to carry off all water and débris by gravity without clogging. In the opinion of the author, this type is the most "foolproof" of all condensers. Where the exhaust piping is under, say, 4 ft. to 5 ft. (1.2 m. to 1.5 m.) in diameter an installation can be made well within practical possibilities for high duty up to slightly more than 28.5 in. (720 mm.) vacuum. Air leaks and other difficulties occur with exhaust piping that measures above 5 ft. (1.5 m.) in diameter.

Considering the low-type jet condenser, it has the same advantages and disadvantages as the barometric, but care should be given to the design of the discharge or tail pump, so that it will at all times keep the outgoing water ahead of the incoming water. Single jet condensers of 10,000 kw., or approximately 140,000 lb. (63,000 kg.), of steam per hour seem to be the practical limit in size.

Dirty or acid water becomes a very serious matter in the case of the surface condenser. There is no limit to the size of these condensers. They are now made in sizes from 50 sq.ft. (5 sq.m.) of surface up to 75,000 sq.ft. (7000 sq.m.) commercially, the latter size being capable under proper rating and design of condensing 600,000 lb. (270,000 kg.) of steam per hour. Another advantage of the surface condenser lies in the fact that it is generally considered to entrain only one-half as much air as either the barometric or jet condenser types. Regarding the water velocities of surface condensers, 15 ft. (1.5 m.) per second seems to be the average. All talk of 8 ft. to 10 ft. (2.4 m. to 3 m.) per second seems to be absurd in view of the fact that excessive power is required for such velocities. The greatest care should be exercised in keeping the tubes of surface condensers clean. A number of very ingenious methods have been devised for doing this cleaning. High velocities help, but the excess power required materially overbalances the cost incurred with mechanical cleaning.

Although the condenser surface required for any generating unit cannot be properly expressed in terms of square feet per kilowatt, still the author pointed out that in a number of typical cases this value ranges from 1.14 sq.ft. to 1.66 sq.ft. per kilowatt. Data taken from a number of recent installations show the steam condensation per square foot per hour to be 5.4 lb. to 8.5 lb. (2.4 kg. to 3.7 kg.) where the vacuum is about 28 in. (710 mm.) and the temperature of the incoming circulating water about 75 deg. Fahr. (24 deg. C.)

AUXILIARY PUMPS

Roughly, 90 per cent of the steam heat delivered to auxiliaries will be returned as heat to the feed water, provided that there is enough water at a suitable temperature to absorb this heat. At light load there is considerable danger of showing an excess of exhaust steam, which has led to the development of combined auxiliary drive, using turbines and motors. The use of economizers in connection with boilers emphasizes the desirability of avoiding an excessive amount of exhaust steam from auxiliaries. In some cases an excess amount of exhaust steam may be reclaimed by delivering it to an intermediate stage of the turbine; in fact, this has sometimes been proved very feasible and practicable as well as economical.

The writer suggests that the reciprocating rotative crank-end flywheel dry-vacuum pump, when used in connection with a proper condensate pump, is really the most efficient in point of power consumption, where space is available. It is practicable, say, up to 250,000 lb. (113,000 kg.) of steam per hour at a 28-in. (710-mm.) vacuum, but for jet or barometric work at the same vacuum about one-half that amount of steam can be handled. The hydraulic or turbo-air pumps are very generally used, and, although large consumers of power, they are very well adapted to all types of work where economy of space, convenience of arrangement, layout, etc., make them more practicable than other types. The steam jet is rapidly coming to the front and in some ways is proving more desirable than any other type. In specifying an air pump careful consideration should be given to the requirements under winter conditions with cold water. Regarding circulating-water pumps for condensing purposes, there is little call for any type except the centrifugal pump.

AUXILIARY POWER REQUIRED

A comparison of different types of condensers with regard to the amount of auxiliary power required is given in the following table:

	Surface, Kw.	Jet, Kw.	Barometric, Kw.
Water supply and tail pump	152	467	352
Condensate pump	34	...	...
Rotative dry-vacuum pump	86	114	114
Turbo-air pump	197	256	256
Steam-jet	215	250	250

From this table it may be seen that the total power required to drive auxiliaries for the three types of machines for a 10,000-kw. turbine varies from 2.7 per cent to 4 per cent with the surface, 5.8 per cent to 7.2 per cent with the jet, and 4.7 per cent to 6 per cent with the barometric.

We Want No Bernstorffs—Buy Bonds

Books Received

WIRELESS TELEGRAPHY AND TELEPHONY. By W. H. Eccles. London: Benn Brothers, Ltd. 514 pages, 434 illustrations.

AIRPLANE CHARACTERISTICS. By Frederick Bedell. Ithaca, N. Y.: Taylor and Company. 123 pages, illustrated. Price, $1.60 net.

ENGINEERING OF POWER PLANTS. By Robert H. Fernald and George A. Orrok. New York: McGraw-Hill Book Company, Inc. 586 pages, 300 illustrations.

HANDBOOK OF MECHANICAL AND ELECTRICAL COST DATA. By H. P. Gillette and R. T. Dana. New York: McGraw-Hill Book Company, Inc. 1740 pages, illustrated. Price, $6.

A CALENDAR OF LEADING EXPERIMENTS. By William Franklin and Barry MacNutt. South Bethlehem, Pa.: Franklin, MacNutt & Charles. 205 pages, 107 illustrations. Price, $2.50.

COURS DE PHYSIQUE GENERALE. By H. Ollivier. Vol. III. Mouvements Vibratoires; Acoustique; Optique Physique; Ondes Electromagnétiques; Electro-optique; Effets Optiques du Mouvement. 632 pages, 378 illustrations. Paris: Librairie Scientifique A. Hermann et Fils. Price, 30 francs.

Checking Stored-Coal Temperatures Electrically

Effective Method of Detecting Incipient Fires in Piles of Stored Coal by Means of Electrical Thermometer—Coal Must Be Stored and Conserved from Unnecessary Waste

BY THOMAS W. POPPE

IT IS absolutely necessary at this time for the central stations to store coal. In the first place, the economical operation of the railroads requires it, and, again, such procedure is necessary in anticipation of serious delays in coal delivery during the winter period. The experience of the writer, who was charged with the responsibility of storing 10,000 tons of bituminous coal and protecting this coal against fire, may be of value to other central-station engineers.

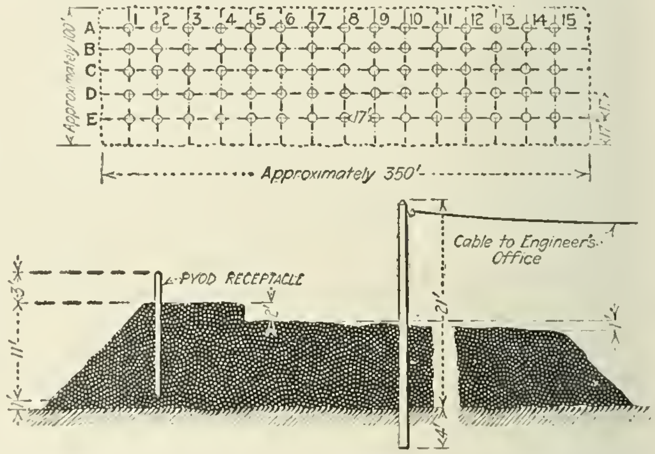
The greatest danger connected with storing coal is in the slow combustion which takes place and is not detected until the odor of sulphuric fumes becomes noticeable. When this action commences the coal should be redistributed so that the pressure existing on the heating layer is removed. In some cases the entire coal pile would have to be turned over, since the greatest pressure is on the bottom, thus requiring quick action and the expenditure of a large sum of money. Any scheme whereby an increase of temperature in the coal pile can be detected or by which it can be retarded or prevented will therefore be a saving. To accomplish the first objective where the writer is engaged an electrical thermometer system was installed with the temperature-indicating instrument or pyrometer in the engineer's office. Switches were so arranged that the temperature of predetermined locations in the coal pile could be obtained almost instantly. The second objective was obtained by reducing the pressure on the heated layer, removing all the coal at that particular point if necessary. A temperature of 250 deg. Fahr. (120 deg. C.) was assumed to be the safe internal temperature; if the pyrometer showed a close approach to this figure, the coal at this point was immediately removed to the point nearest the place of consumption. This involved little additional expense in operating costs, as the coal would eventually find its way there anyway. This is not true of the "turn-the-coal-over" method, especially if the storage place is limited.

To keep within the safe temperature limits, the coal, as consumed, was removed from the top in 2-ft. (60-cm.) layers with a gradual slope toward the point of consumption. The removal of the two feet of coal reduced the lowest layer from the pressure of the removed weight, and the gradual slope made the work of the men with loaded wheelbarrows less than if a perfect level was retained. One advantage of the removal of the top layer was that additional shipments received could be methodically added and the good and poor qualities automatically mixed, maintaining a fair average.

Ten thousand tons of coal piled 12 ft. (3.5 m.) high meant that a ground area of 33,350 sq.ft. (31,000 sq.m.) would be required, assuming a value of 50 lb. per cubic foot (800 kg. per cu.m.). A trackage of 400 ft. (120 m.) permitted the unloading of coal on a plot 350 ft. by 100 ft. (100 m. by 30 m.).

For satisfactory detection of heat changes in the coal to be stored on this plot it was decided to place pyod receptacles spaced as shown in the illustration. The receptacles were constructed of 1-in. (2.5-cm.) wrought-iron pipe welded to a point at the end which entered the coal pile. The exposed end was fitted with a self-closing cap to prevent the entrance of any substance which might interfere with the ready insertion of the pyods. Fifteen pyods were purchased. These were portable. The wiring to the engineer's office, however, was of a permanent nature from a central location on the coal pile. From this point lines radiated to the portable pyods.

The pyod receptacles were numbered 1 to 15 on each row, which had a distinguishing letter as shown in the accompanying illustration. The switches in the engineer's office were numbered and lettered in a manner to correspond with the pyod receptacles. This plan permitted an attendant to place the pyods in the desired receptacles and the engineer to observe and record in the station log, in numerical order, the temperature readings of the coal at the different points. After placing the last of the pyods in row A, the attendant immediately commenced transferring them to row B in numerical sequence. The time elapsing between the insertion of the first and the fifteenth pyod was considered sufficient for the pyod to adjust itself to the various temperatures encountered inasmuch as the temperature to be measured already existed in the pockets formed by the pyod receptacles. Thus an unbroken operation can be carried out in the shortest possible period of time. After the temperature existing in the last pyod receptacle was read all the pyods were transferred to centrally located receptacles, as it was assumed that this would be in the vicinity of the greatest possible heat generation, inasmuch as they are the furthest removed from the cooling effect of the air.



PLAN SHOWING SPACING OF PYOD RECEPTACLES—ABOVE. SECTIONAL ELEVATION OF COAL PILE WITH TEMPERATURE MEASUREMENT APPARATUS IN PLACE.

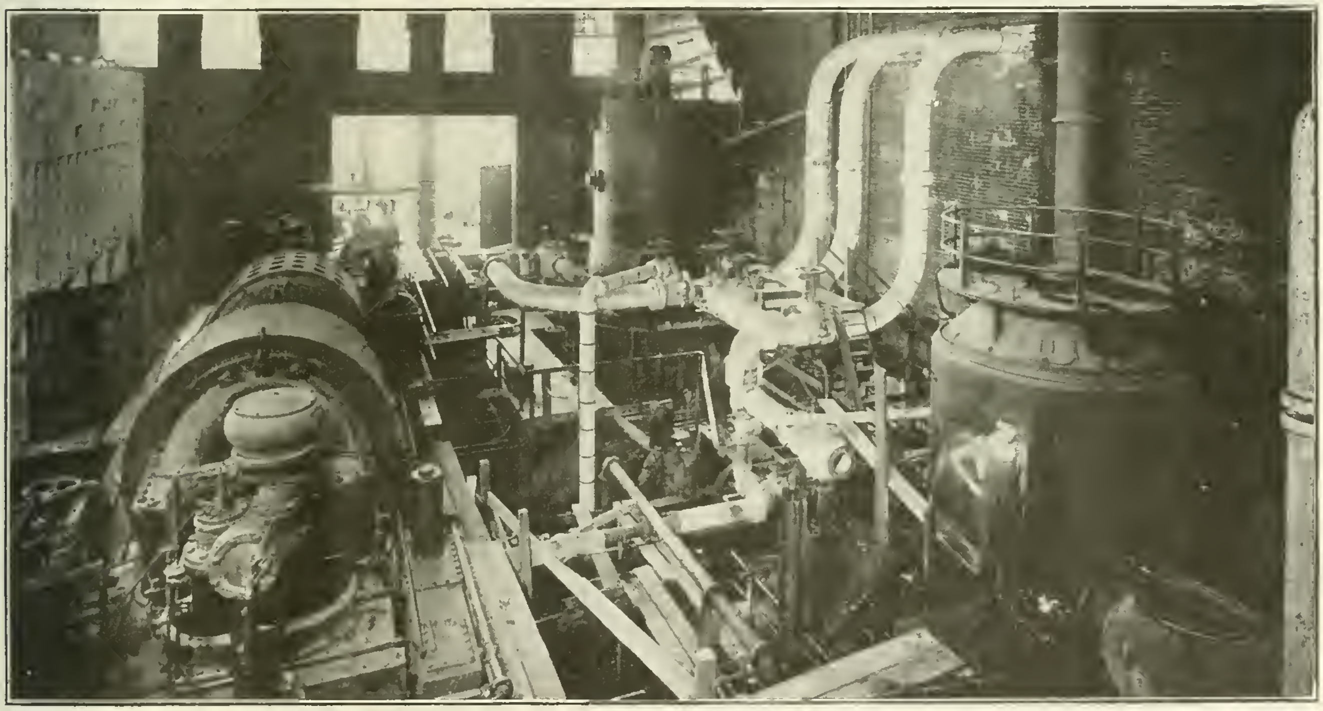
If desired, a recording pyrometer can be installed in conjunction with the indicating instrument.

Kansas City Plans for Reducing Power Shortage

Additional Equipment Costing $1,250,000 Installed to Render Temporary Service Until New Plant Can Be Put in Operation—Company Succeeds in Getting Turbines in Cleveland and Boston—A Total of 15,000 Kw. Is Added to Rating of Station

BY MUCH hard work Kansas City, Mo., will have available 15,000 kw. more power in the winter of 1918-19 than in the winter of 1917-18. Last year the peak load on the power house of the railway company, which supplied energy for light and power as well as transportation, was 52,000 kw. The demand for energy was so great, however, that as much as 17,000 kw. of load actually on the lines had to be dropped on some days solely because there was not power enough to supply all users. So it appears that while the company has made an extraordinary effort to install equipment to take care of this added business, it may be necessary at times again to effect an agreement with power users to stay off the company's lines during the peak-load period.

The changes and additions made to the company's plants in order to have available more energy for customers until the company's new 50,000-kw. plant is placed in service are the more interesting because they represent an expenditure of $1,250,000 laid out purely in the interest of providing temporary service to customers. When the power shortage came the Kansas City Light & Power Company had, in addition to the energy which it was purchasing from the railway company, a station at Central Avenue and Water Street and one at Baltimore Avenue and Thirteenth Street. The equipment in the Central Avenue station consisted of two 1500-kw. engines driving 25-cycle generators. The building in which this equipment was installed was fortunately not all occupied by machinery. It was also fortunate that the company had under contract four 550-hp. and four 750-hp. Stirling boilers. As a part of the emergency work a new boiler house was built adjacent to this central Avenue station and arrangements were made to set additional generating equipment in the existing engine room. From the Boston Edison company the Kansas City company then purchased one 3500-kw. General Electric Company 25-cycle turbine. Another second-hand vertical turbine, rated at 9000 kw., 60 cycles, was procured in Cleveland. In addition the company was able to obtain delivery on one 1500-kw. low-pressure Westinghouse horizontal 60-cycle turbine with auxiliaries. Thus even in the stringent market generating machinery was purchased and shipped to Kansas City.



NEW CONSTRUCTION UNDERTAKEN TO REDUCE POWER SHORTAGE

Central Avenue station of the Kansas City Light & Power Company, showing in the foreground a 1300-kw. low-pressure turbine. Alongside of this unit and to the right is a 3500-kw. vertical turbine, and at the rear stands a 9000-kw. turbine. In close proximity to the 1500-kw. low-pressure unit is a section of bus structure, and to the left of it is a section of vertical bus structure which takes care of all of the new installations.

Then the real rush and scramble began, for it was necessary to install all of this equipment in the existing station while it was in operation. Moreover, while it was probable that the installation would not be in service more than perhaps three years, the equipment had to be installed as well as if it were being placed for operation over a period of twenty years. This meant that new water intakes and discharges, new screens and wells, new coal-handling equipment, feeders and switchboards all had to be added to the plant.

At the same time one 2000-kw. Allis-Chalmers turbine, one 250-kw. direct-current engine unit and two 1500-kw.

General Electric turbines in the Baltimore Avenue station had to receive a thorough overhauling to be sure that they would stand up under the strain of the coming winter peak. With this work accomplished the management of the company is of the belief that it will have enough additional equipment to carry 15,000 kw. more load than the company could take care of last winter.

A study of the economics of installation of temporary equipment may be interesting because both the new and the second-hand equipment were bought in a market where demand exceeded the supply by an unprecedented figure. Moreover, some of the generating equipment bought will probably be of little service after it has served its temporary usefulness in Kansas City, because it is now somewhat obsolete. However, the boilers will no doubt be found useful in other locations after the Central Avenue plant has been abandoned in favor of the company's new station on the Missouri River. Hence, while the generators will have to pay for themselves in the period during which Central Avenue station is operated, the investment in the boilers can be spread over a longer period. How long this period of operation will be is as yet a matter of conjecture, but it is thought that it will not be long, as the schedule calls for the starting of the company's first 25,000-kw. units in its new station in the spring of 1919.

Disarm the Lawless Hun—Buy Bonds

MAN POWER SAVED BY REMOTE CONTROL OF SUBSTATIONS

Saving in Expense of Attendance Soon Pays for Increased Cost—No More Trouble than When Operators Are Present

W. T. Snyder, electrical engineer for the National Tube Company, McKeesport, Pa., pointed to a year of successful operation of a remote-controlled substation, at the annual convention of the Association of Iron and Steel Electrical Engineers, in a paper entitled "Remote-Controlled Substations."

Mr. Snyder made the statement that push-button control of oil switches and motor-operated rheostats permit the generating plant attendant to control the motor-generator sets in the substation which is locked up and unattended except for the daily inspection. Ammeters and voltmeters at the generating plant give the operator there all the information necessary for starting and loading the substation. The writer states that the remote-control feature added about 10 per cent to the cost of the substation. This increase in fixed charges should be readily wiped out by saving in operating expense, in addition to conserving labor for other purposes. A great saving in copper was effected in the direct-current system by locating the substation near the load center.

The paper was discussed by C. S. Lanckton, H. C. Crank, D. M. Petty and C. A. Menk. In reply to questions, Mr. Snyder said that the substation had been in operation for about a year and that no changes had resulted excepting that solenoids had been replaced by motors for rheostat control. He preferred the remote-control scheme to a full automatic substation and said that two more motors are to be installed soon.

PRACTICAL DATA UPON ELECTRIC SPOT WELDING

Power Consumption, Strength of Welds and Speed with Which Welds Can Be Made Determined for Various Kinds of Plates

BY G. A. HUGHES AND R. H. POOL
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Youngstown, Ohio

TO DECIDE whether it is better to rivet or to spot-weld an article one must take into consideration the use of the article and must not base his decision on the cost of obtaining a desired strength. In light work spot welding can successfully replace riveting in 90 per cent of the cases. There are numerous conditions where it is impossible to use rivets because the stock will not permit the punching of the hole or because the rivet head is objectionable. Special spot-welding machines can be made to take care of the difficult shapes and thus reduce the cost of an article in the saving of the rivets and dies, maintenance of dies and labor in laying out and punching the stock.

TABLE I—DATA OBTAINED USING THREE 3/16-IN. PLATES

Volts	Amp.	Kw.	P.F.	Size of Spot, In.	Condition of Materials	Tap of Auto-Transformer	Time in Seconds
232	186	17.6	0.41	7/16	Free from rust	5	44
232	176	18.4	0 45	7/16	Free from rust	5	42
232	180	18 1	0.43	7/16	Free from rust	5	44
230	256	25.6	0 43	7/16	Free from rust	7	30
230	248	24.0	0.42	7/16	Free from rust	7	31

TABLE II—DATA OBTAINED USING TWO 9/32-IN. PLATES

Volts	Amp.	Kw.	P. F.	Time in Seconds	Tap of Auto-Transformer	Condition of Material
218	208	26.4	0.57	24	7	Scale and rust were present
218	224	26.0	0.53	22	7	
218	224	26.4	0.53	24	7	
218	228	26.8	0.54	22	7	
218	216	26.0	0.55	22	7	
218	224	26.4	0.54	26	7	
218	220	25.5	0.53	25	7	
218	224	28.0	0.57	22	7	

TABLE III—DATA WITH DIFFERENT MATERIAL

Volts	Amp.	Kw.	P. F.	Material Used	Time, Seconds	Tap of Auto-Transformer	Size of Spot, In.
220	244	24	0.54	Two 3/16-in. mild-steel plates.	15	7	⅜
220	260	20	0.35	Two 3/16-in. Vasco non-shrinkable steel plates..........	20	7	⅜

TABLE IV—COMPARISON* OF SPOT-WELDED AND RIVETED JOINTS

Test No.	Size of Spot, In.	Condition of Sheets, and Contacts	Maximum Load, Lb.	Nature of Failure	Number of Spots
1	5/16	Free from scale. Contacts good	4,460	Welds pulled out	1
2	5/16	Free from scale. Contacts good	7,250	Welds pulled out	2
3	5/16	Free from scale. Contacts good	10,920	Welds pulled out	3
4	5/16	Scale on sheets. Contacts poor	4,400	Welds sheared	2
5	5/16	Rust and scale. Contacts good	8,100	Welds sheared	3
6	Two-¼-in. rivets, holes drilled and rivets inserted with care		4,700	Rivets sheared	..
7	Two-¼-in. rivets, holes drilled and rivets inserted with care		5,200	Rivets sheared	

* All tests were on No. 14 gage sheets, steel 3 in. wide, single lap-joint, single-shear.

An ideal condition for spot welding is where a smooth surface is desired and the material does not permit the countersinking of the rivet heads. But spot welding is not confined to the sheet-metal industry alone. Structural steel can be successfully welded. In fact, it is being used in shipbuilding to advantage. The question that arises is, "What is the greatest thickness of material that can be successfully welded?" The thickness of material will depend entirely upon its size and shape, together with the rating of the welding machine. The writer has seen two pieces of ½-in. (1.27-cm.) material—a total thickness of 1 in. (2.54 cm.)—welded on a 30-kw. machine.

TABLE V—TENSION TESTS ON SPOT-WELDED JOINTS

Test No.	1	2	3	4	5	6	7	8
Maximum load, lb	3,700	3,740	6,470	6,195	4,980	4,980	7,830	7,790
Nature of failure	Weld pulled out	Weld pulled out	Weld pulled out	Weld pulled out	Weld pulled out	Weld pulled out	Plate failed	Plate failed
Number of spots	1	1	1	1	2	2	2	2
Kind of joint	Lap Single shear	Lap Single shear	Butt Double shear	Butt Double shear	Lap Single shear	Lap Single shear	Butt Double shear	Butt Double shear

Material tested—No. 16 gage sheets, 3 in. wide; welds ¾ in. spots.

The data are intended to give an idea of (1) power consumption, (2) strength of the weld, and (3) speed at which welds can be made All the tests on which the data are based were made on 30-kw., 220-volt, 60-cycle hand-operated machines made by the Federal Welding & Machine Company of Warren, Ohio. Fig. 1 shows its standard 449-B machine, and Fig. 2 its special heavy-duty machine. The machines were in service for two hours before the tests were made. This was to allow for the heating of the machines. Each machine had an auto-transformer in the primary circuit of the welding transformer to control the welding current. Taps were provided on the auto-transformer to adjust the primary voltage in eight steps from 65 per cent to full-line voltage.

In making the test recorded in Table I three plates of soft steel $\frac{3}{16}$ in. (4.8 mm.) thick were used, making a total thickness of $\frac{9}{16}$ in. (13.2 mm.). The first three welds were made with the auto-transformer on tap 5. The time of welding varied from forty-two to forty-four seconds and the power demanded from 17 kw. to 18.4 kw. The fourth and fifth welds were made with the auto-transformer on tap 7. The time of welding was thirty to thirty-one seconds and the power demanded 24 kw. to 25.6 kw. All of the welds were satisfactory.

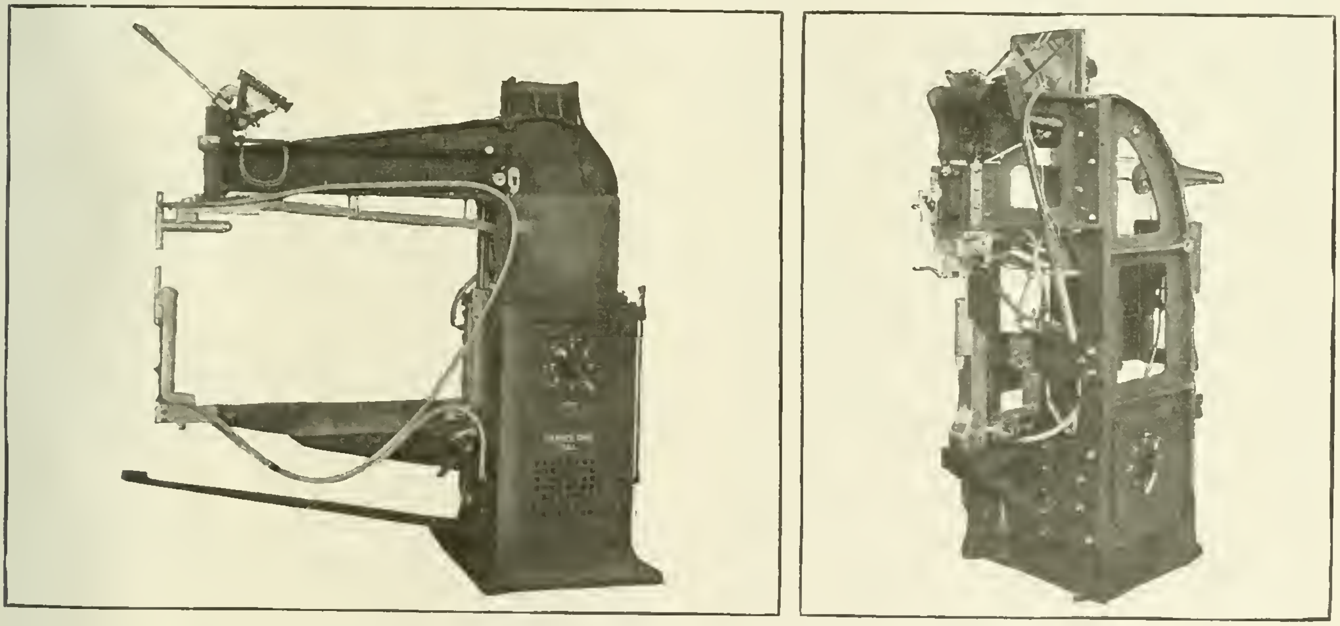


FIG 1 AND 2—STANDARD AND HEAVY-DUTY SPOT-WELDING MACHINES

(Note the power factor.) An attempt was made to weld on tap 8, but this was unsuccessful as the material next to the copper contacts would become hotter than the center plate and would be forced out from under the contacts and thus burn the material at point of weld.

An attempt was made to determine the proper pressure for the contacts while welding, since the presence of the scale and rust caused considerable arcing and burning of the material under the contacts, forcing the molten metal out and thus leaving a bad weld, although it would have the appearance of a perfect one. Upon cutting into the weld, however, it would have the appearance of a honeycomb. To avoid this trouble it was decided first to burn the rust and scale off. This was accomplished by forcing the welding contacts firmly on the material and then turning the power on the welder for a moment. This method removed the scale and assured a good contact between the welding points and the material. Then the power was turned on and the material brought up to a welding heat without arcing. This saved the cleaning of the stock and added about 50 per cent to the life of the welding points.

To determine the kilowatt-hours consumed in a day's run an integrating watt-hour meter was installed. Some conclusions made from these readings are given:

1480 welds of two pieces No. 18 gage sheet steel.
1050 welds of four pieces No. 16 gage and one piece $\frac{3}{16}$-in. plate.
2530 welds total in ten hours. Energy consumed, 42 kw-hr.

680 welds of two pieces No. 18 gage sheet steel.
1350 welds of four pieces No. 16 gage and one piece $\frac{3}{16}$-in. plate.
545 welds of one piece of No. 18 gage and one piece of ¼-in. mild steel.
2575 welds total in ten hours Energy consumed, 35 kw.-hr.

In making the tests indicated by Table III it was impossible to obtain two results alike owing to the different chemical analyses of the steel.

The number of welds made in a ten-hour period was not large owing to the nature of the material, it requiring three men to handle the work and one man to operate the machine. The result of tension tests on spot welding are given in Tables IV and V. Table IV compares the use of ¼-in. rivets and spot welding.

Experience with Pulverized Coal

Comparison with Stoker Firing—Uniform Performance and Efficiency Possible—Can Utilize Low-Grade Fuels Economically—How Difficulties Were Overcome in the Plant of a Milwaukee Utility Company

IN AN effort to determine the advisability of utilizing pulverized fuel in its plants, the Milwaukee Electric Railway & Light Company early in 1918 decided upon a trial installation at the Oneida Street station. The necessary equipment for preparing and feeding the coal was installed and the boiler was placed in service during the early part of May. From that time until early in August, when the installation was finally proved successful, changes were made to eliminate undesirable conditions encountered during preliminary operation.

Drying and Pulverizing Equipment

The drying and pulverizing equipment, installed in a room near the plant coal bunkers, consists of one 15-ton-per-hour indirect-fired dryer and one 4-ton-per-hour pulverizer. From one of the coal bunkers the fuel as delivered to the plant is carried to the dryer supply bin by means of a screw conveyor and bucket elevator. From this supply bin the coal is drawn into the drying cylinder by means of another screw. It is carried through the dryer by means of gravity and discharged into an elevator which carries the dried fuel to the pulverizer supply bin. In the dryer the moisture is reduced from 11 per cent to 1 per cent at the rate of about 10 tons per hour.

In passing to the pulverizer supply bin the coal is run over a magnetic separator pulley which removes such iron and steel as has been carried that far. From the bin last mentioned the fuel is fed to the pulverizer through a small screw conveyor on top of the mill. Being driven from the mill shaft by means of a small belt, this screw can be varied in speed through a cone pulley arrangement to allow for the kind of material being powdered.

After passing through the pulverizer the fuel is carried by means of a screw conveyor to the pulverized-fuel storage bin in front of the boiler. All drives on the conveying and pulverizing equipment are so arranged that only such machinery as is in use will be operating.

The equipment for firing the fuel into the furnace consists of a blower and two screws driven by variable-speed motors. The screws, at the base of the powdered coal bin, carry the coal at a uniform rate to the feeder pipes, where it is thoroughly mixed with air by means of agitator wheels attached to the end of the screw shafts. From the paddlewheel the fuel is carried into the furnace by the air blast supplied from the blower. The furnace is of the Dutch-oven type so as to insure the proper flame travel, thus preventing destruction to the brickwork.

When the boiler was first put into operation a number of undesirable conditions resulted. An insufficient air supply caused high furnace temperatures. These temperatures caused fusion of the ash particles and a consequent accumulation of slag between the tubes, on the furnace walls and in the ash pit. The removal of the molten slag presented a rather difficult proposition. It was also found that the combustion chamber was of insufficient size. High gas velocities resulting from insufficient air tended toward destruction of the refractory surfaces of the furnace.

A new furnace was therefore designed. The combustion chamber was enlarged, and a regulated air supply was provided for by means of a number of auxiliary air openings equipped with dampers. The accumulation of slag in the pit was prevented by raising the point of admission of the fuel into the furnace. As a result the flame path was raised above the base of the pit; hence particles of ash dropping from the flame are not fused. The ash can therefore be drawn from the pit in the form of a powder and small slugs of slag. Analysis has shown that the ash contains practically no carbon.

Having established satisfactory furnace operating conditions, a series of efficiency and capacity tests were conducted to prove contract guarantees. The brickwork was then given a thorough trial by carrying the boiler at a continuous rating of 180 per cent over a period of several days. A final efficiency test, the results of which are published herewith, followed.

The boiler is an Edge Moor three-pass water-tube boiler, equipped with a superheater and vertical baffles. The coal feeders and burners are of the "Lopulco" type, manufactured by the Locomotive Pulverized Fuel Company of New York.

Because of the nature of the equipment the coal could not be weighed on the firing floor. To arrive at exact coal figures, it was necessary to run all drying and pulverizing equipment free of coal. The fuel in the pulverized storage bin was run to as low a level as possible and a measurement taken to determine the cubical contents of the powdered coal on hand at the start. Coal for the test run was then weighed into the system at the moist coal bunker. At the close of the run the starting conditions so far as was possible were again established. The samples for analysis, upon which the test results are based, were taken at the moist coal bunker as the coal was weighed in. Moisture samples were also taken at the pulverizer feeder and the burners. All analyses were made at the laboratories of the Milwaukee company.

The feed water used during the test was weighed on the standard tank scales of 2000 lb. (907 kg.) capacity each. All feed-pump gland leakage was accounted for in the way usually adopted on standard boiler tests.

All temperatures and pressures were taken with instruments which previous to the test had been checked against standard instruments. The blow-off piping on the boiler was disconnected so as to insure against any possible loss of water. Flues were blown five times during the twenty-four hours.

Flue gas analyses were determined by means of an Orsat apparatus.

Throughout the test very uniform conditions were maintained. The speed of coal feeders and the drafts carried were held constant. The feed-pump speed had to vary somewhat from time to time. The variation in the rate of evaporation was, however, due to slight changes in the quality of coal during the test run.

PULVERIZED COAL VERSUS MECHANICAL STOKERS

1. Under this heading fuel-preparation costs will be considered first. In the case of powdered coal this information can be classed under three general divisions:

(a) The cost of crushing the coal. This expense is the same for both types of equipment.

(b) The cost of drying and pulverizing the coal. Although no cost records are available at present, it is estimated that 32 cents per ton will cover this preparation cost in a 200-ton-per-twenty-four-hour plant using bituminous coal containing about 12 per cent moisture.

(c) The maintenance cost of the drying and pulverizing plant. This unit has not been determined from actual experience; however, it is estimated that 3 cents per ton will cover the maintenance. In stoker practice the maintenance cost per ton of fuel fired is close to 5 cents.

Summarizing the above facts, it is evident that, with fuel at $5 per ton, the gross efficiency shown by the pulverized-fuel boilers will have to exceed that shown by the mechanical-stoker-fired boilers by 6 per cent in order to offset coal preparation costs. A 6 per cent deduction from a gross efficiency of 85 per cent gives a net efficiency of 79 per cent for the powdered coal burner. In stoker practice the maximum attainable gross efficiency at any of the Milwaukee electric plants has been 80.54 per cent. Deducting 2.5 per cent for auxiliary uses, the resulting net efficiency is 78 per cent, which is lower by 1.1 per cent than the figure obtained in pulverized-fuel practice.

Other advantages resulting from the use of pulverized fuel are summarized herewith:

2. Continuous boiler operation at a uniform rating as well as a constant efficiency is made possible. At no time is there a loss in capacity due to the clinkering of coal on the grates or the cleaning of fires.

3. Heavy overloads can be taken on or dropped off in a very brief time through adjustment of the coal feeders and the furnace drafts.

4. From 97 to 98 per cent of the combustible in the coal is utilized, regardless of the quality of the fuel.

5. The ash-handling costs are reduced to a minimum owing to the reduced volume.

6. The banking conditions when operating with pulverized fuel are somewhat different from those obtained in stoker practice. By stopping the fuel supply and closing up all dampers and auxiliary air inlets a boiler can be held up to pressure for about ten hours. The furnace brickwork, having been heated to incandescence during operation, gives off radiant heat which is absorbed by the boiler rather than sent out through the stack.

The ease of controlling the fuel, feed and drafts, the ability to take on heavy overloads in a brief time, the thorough combustion of the coal and the uniform high efficiency obtainable under normal operation make pulverized coal a most satisfactory form of fuel for central-station uses.

The full story of maintenance expense is only partly known to us as yet. Indications are that no unusual difficulties will be met. The cost of fuel preparation and labor for operating a boiler room fully equipped with pulverized-coal-burning boilers will be a question for the engineer to decide for himself according to his particular conditions. Properly installed with respect to capacity of storage, size of dryer and pulverizers, and on a sufficient number of boilers properly and fully to employ the minimum number of men, the pulverized-fuel installation will most undoubtedly be more advantageous.

LOG OF OFFICIAL TEST AT ONEIDA STREET STATION

Heating surface, sq.ft	4,685
Temperature of feed water (deg. Fahr.), average	157.2
Temperature of steam (deg. Fahr.), average	448.7
Temperature of flue gases (deg. Fahr.), average	495.3
Average boiler pressure	167.0
Fuel (100 per cent bituminous coal) fired per hour, lb	1990.6
Water apparently evaporated per hour lb.	16,392.0
Water apparently evaporated per lb. of coal, lb.	8.23
Factor of evaporation	1.1502
Water evaporated from and at 212 deg. Fahr., per lb. of coal, lb	9.47
CO_2, per cent average	13.85
O, per cent average	4.38
CO	None
Fuel Analyses:	Average, Per Cent
Moisture	10.49
Volatile	35.96
Fixed carbon	49.53
Ash	13.93
Sulphur	2.04
B.t.u., as received	10,779
B.t.u., dry	12,045
Accumulation of slag on tubes	None
Condition of smoke	Light
Heat effect on brick	None
Backlash of flame in burner	None
Lb. steam per hour	16,390.3
Lb. steam per hour from and at 212 deg. Fahr.	18,842.6
Per cent of rating	116.7
Boiler efficiency	85.22
(Flues blown five times during test.)	
Fuel Preparation Deductions:	
Coal used in dryer, lb	1,140
Kilowatt-hour motor operation (449.3), coal equivalent at 3 lb. per kw.-hr	1,348
Total deduction, lb	2,488
Resulting net efficiency (per cent)	81
No deduction made for stand-by losses in dryer.	

The chief items that must be borne in mind by engineers are the ease with which a high efficiency is obtained and the constant nature of that efficiency as compared with the absence of these advantages in a stoker-fired boiler, unless very closely supervised. There is no doubt that with a well-equipped plant burning pulverized fuel having all the necessary recording and indicating instruments to guide the operators in maintaining the proper conditions, a lower cost of generating steam will be possible than has heretofore been the case with any other style of equipment.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

FLASHLAMP SUITABLE FOR USE AS TESTING DEVICE

Can Be Used with Good Results to Trace Circuits, to Test Continuity of Fuses and for Other Similar Purposes

BY T. H. REARDON

Flashlamps, which are usually carried by electrical inspectors, can be utilized to test fuses and trace circuits when other means are not available. For such use it is easiest to employ a flashlamp the battery of which is accessible from the end opposite the lens. The cap on this end should be removed so that one end of the fuse to be tested can be pressed against the bottom of the battery. If connecting the other ends of the fuse and the metal ring on the flashlamp case with the handles of pliers lights the lamp, the fuse is perfect. Plug and cartridge fuses can be tested in the same way.

Coils of wire, etc., not having too high resistance, can also be tested for continuity, and circuits can be traced by using the flashlamp battery as the source of energy and the lamp as the signal.

Stop Boche Brutality—Buy Bonds

ISOLATING HIGH-TENSION CABLES IN SUBSTATIONS

Leads Brought to Apparatus in a Cored Wall—Switches Placed in Compartments and Separated by Firebrick or Sandstone Slabs

In order entirely to isolate failures in high-tension cables, a central-station company in the Middle West is building all of its substations with a standard cored wall with winged compartments. This method of building the cored wall with ducts in the brick involves skill and entails labor upon the bricklayer, but the company believes that it is justified because it absolutely prevents a failure in one line from spreading to the next. All of the switching apparatus and meter transformers are installed in this double-winged wall. The wings are 3 ft. (1.22 m.) deep, their width depending upon the size and type of the apparatus. The brick separations are one brick wide, whereas the smaller divisions are made by inserting, as needed, sandstone barriers 1½ in. (3.8 cm.) thick. In one main compartment are the three lines of a three-phase circuit, these being completely isolated by a 1½-in. (3.8-cm.) sandstone slab. Each compartment is inclosed by means of an asbestos board door hung from the top of the compartment. This is done so that in case of accident the gases will escape and the force of the explosion spend itself without endangering the remainder of the structure. The entire structure is arranged on two or three floors with the transformers, oil switches, disconnecting switches and instrument transformers installed in the most convenient manner.

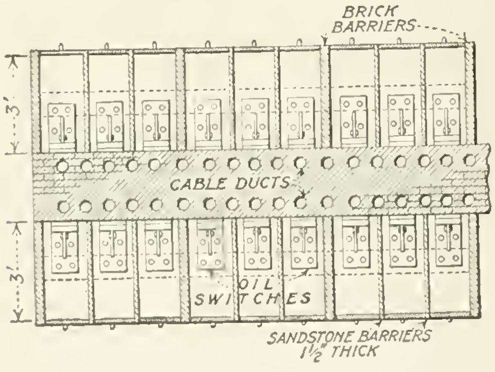


FIG. 1—MINOR BARRIERS ARE SANDSTONE AND HINGED DOORS OF ASBESTOS BOARD

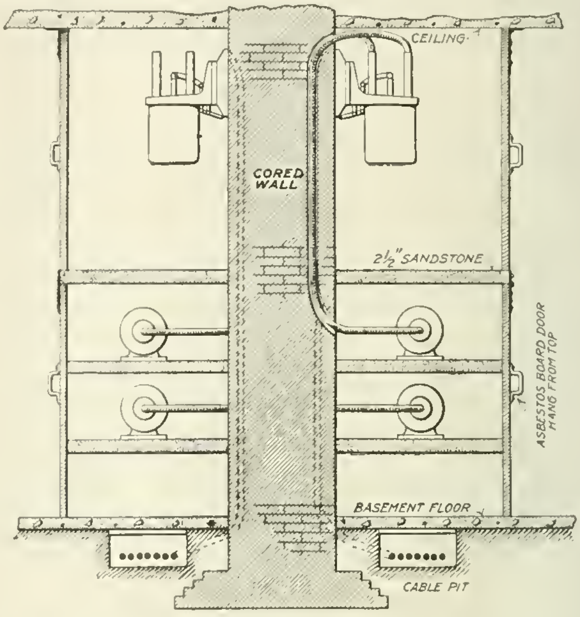


FIG. 2—PLAN SHOWING MAIN WALLS AND WINGS OF BRICK—CABLES ARE WELL ISOLATED

Remember Brest-Litovsk—Buy Bonds

A PLACE FOR GAS ENGINES IN ELECTRICAL SYSTEMS

Additional Power at Small Expense by Driving Existing Motor-Generators and Synchronous Condensers by Internal-Combustion Engines

In many electric service systems there are frequency changers or synchronous condensers at various points that might be utilized to help carry increased loads without much additional investment, says Henry M. Trench, a construction engineer. Since these units are usually situated at the tie-in points between systems or at centers of distribution, the conditions are almost ideal for their operation as generators. To permit this little additional equipment is needed besides some internal-combustion engines (gas or oil, depending on which is more convenient to use) to drive the units.

Where such machines are installed a clutch or other mechanical connection may be inserted between them and the internal-combustion engine so that they may be engaged or disengaged as conditions require. With this arrangement the units may be used for their original purpose or as generators whenever desired. The engine attached to a motor-generator should be rated at the combined capacities of the motor and generator so that both may be driven as generators. Starting of such reserve plants could be made automatic if desired, since power would always be available to start the outfits from the generator end.

Free the German Slaves—Buy Bonds

ACTUAL CONSTRUCTION COST OF INDUSTRIAL SUBSTATION

Data Refer to a Semi-Outdoor Installation Rated at 600 Kva.—Energy Is Received at 22,000 Volts and Delivered at 2300 Volts

The following data cover the actual cost of construction of a 600-kva. industrial substation of the semi-outdoor type on the line of the Eastern Massachusetts Electric Company, interconnecting the properties of C. H. Tenney & Company in the Boston-Salem district. The substation is served by a three-phase line which is dead-ended on strain insulators bolted to wooden poles tied together by angle-iron and channel-iron braces. Taps from the incoming leads are run to air-brake switches, choke coils and fuses, from which connections are made to a transformer bank housed in a structure at one side and containing low-tension switching and metering equipment. The incoming line is operated at 22,000 volts, and energy is delivered to the customer at 2300 volts. The lightning arresters are of the outdoor type.

COST OF SEMI-OUTDOOR SUBSTATION

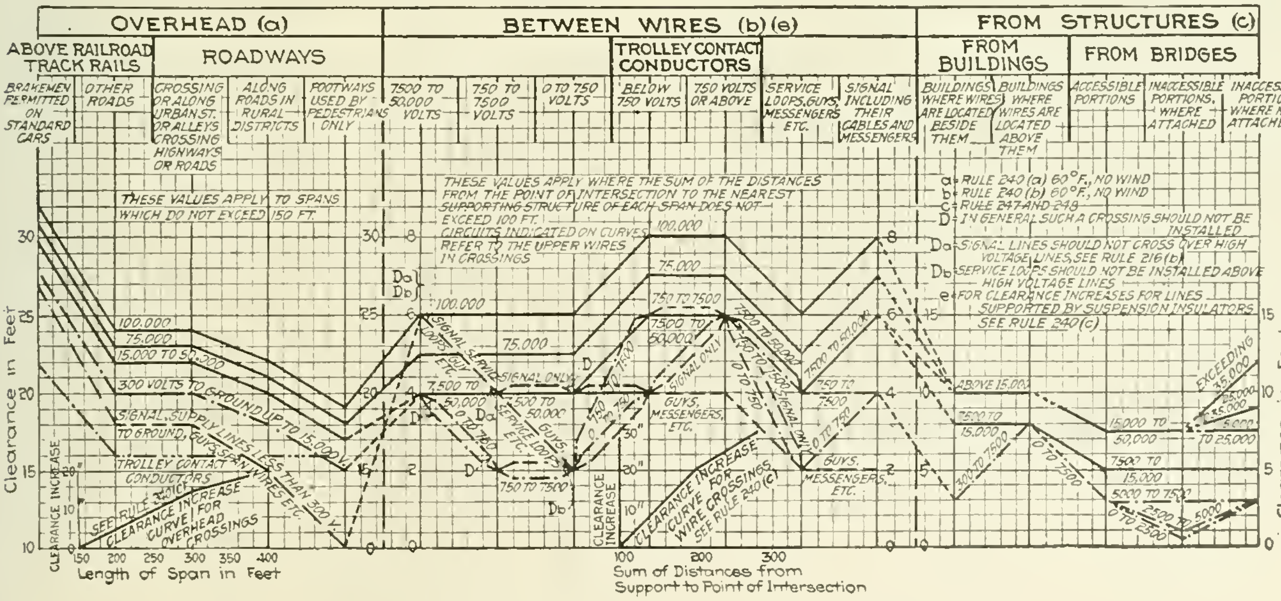
Structures and foundations, including engineering services, $59.72		$533.88
Transformers:		
Three 200-kva., 22,000 2300-volt transformers, oil-cooled, outdoor type	$1,675.16	
Freight on above	82.43	
620 gal. H. F. oil	132.00	
Engineering expenses	390.70	
Miscellaneous items	269.62	
		3,549.91
High-tension arresters, switches, etc.:		
One 22,000-volt, 300-amp. vertical air-break disconnecting switch	$121.00	
One 10-ft. outdoor switch stick	8.62	
One 22,000-volt liquid electrode lightning arrester, three-phase service	413.50	
Three 200-amp., 22,000-volt choke coils and three 25-amp., 22,000-volt fuses	105.30	
Three 25-amp., 22,000-volt fuse holders	51.00	
Porcelain insulators, suspension eyes, hooks, pins, bushings, etc.	90.63	
Freight and expressage	48.70	
Miscellaneous	111.57	
Engineering services	139.34	
		1,152.66
Miscellaneous materials		106.12
Low-tension control:		
One slate panel, 38 in. by 24 in. by 2 in., complete with 300-amp., 2500-volt trip oil switch, polyphase watt-hour meter, two current transformers and two potential regulators	$310.00	
Floor flanges, U-bolt fittings, clamp crosses, terminal lugs, connectors, etc.	45.46	
Miscellaneous supplies, etc.	98.62	
Engineering service	59.72	
		513.80
Labor and installation:		
Labor and expenses associated, including engineering service, $159.24		1,395.88
Total		$7,252.25
Cost per kva.		$12.09

End German Cruelty—Buy Bonds

CHART WHICH GIVES WIRE CLEARANCES NECESSARY

Affords Ready Means for Ascertaining Clearances Needed Between Wires Over Crossings and from Adjacent Structures

Information regarding the wire clearances necessary over any highway, from wires operating at different voltages and from adjacent structures, can be readily obtained from the accompanying chart. This refers to minimum clearances required and is indicative of material which will be included in the supplement to the National Electrical Safety Code, now being revised.



MINIMUM CLEARANCE REQUIRED UNDER DIFFERENT CONDITIONS

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

UTILITY'S SAFETY WORK OF LARGE PUBLIC GOOD

Lives of Non-Employees Are Saved as the Result of the Commonwealth Edison Company's Training in Resuscitation

For more than five years the safety organization of the Commonwealth Edison Company has labored effectively to prevent accidents to persons and property. It has not only been succeesful in this work so far as the company itself is concerned but the training received by employees has in several instances been the means of saving the lives of persons not connected with the company. This is especially true of the employees of the street department of the company, whose work takes them out on the street. However, every employee whose duties require him to work on or near "live" wires is instructed weekly in the Schaefer method of resuscitation and is examined periodically for proof of his fitness.

Not long ago the Edison men showed what they could do in a drowning accident. A ten-year-old girl fell into Lake Michigan not far from where a force of linemen connected with the southern district of the street department of the company happened to be working. Without hesitation one of the men leaped into the water, reappearing a moment later with the apparently lifeless body of the child. The little girl was quickly brought to the shore, and the foreman of the men immediately applied the prone method of resuscitation. In a few minutes there were signs of life. By evening it was reported from the hospital where the child was later taken that she had fully recovered.

In more than one instance Edison employees have made convincing demonstrations of the value of their first-aid knowledge in the case of persons overcome by gas. In one case seven of the men of the northern district of the street department were instrumental in saving the lives of two employees of the People's Gas Light & Coke Company of Chicago, the latter having been overcome by gas while working in a manhole. The Edison linemen were working near by when they received word that two men were lying unconscious in a manhole. They quickly raised the victims to the surface of the street and put in practice at once the Schaefer method of artificial respiration. After about thirty minutes of this work two doctors arrived on the scene, and there was a discussion whether the men should be removed to a hospital or the artificial respiration should be continued. In accordance with the rules of the company, the foreman insisted that his men be allowed to continue with their methods, and this course was followed. After about an hour's work the persevering rescuers were rewarded, the patients giving unmistakable signs of life. The sufferers from the accident, after thus being started on the road to recovery, were removed to a hospital.

Thus the teachings of the safety organization of the company have saved the lives of outsiders, while they have also reduced the number of accidents in the Commonwealth organization to a very marked degree. The safety work is carried on through various committees, the most important being a central committee on safety, coöperating with the bureau of safety, which does safety work over a wide geographical area. The administrative work of the safety movement is carried out under the direction of an inspector of safety and fire prevention.

The Commonwealth Edison Company is one of the holders of the gold medal awarded by the American Museum of Safety to American employers conspicuous in the successful execution of methods and plans for the safety of employees.

Freedom Shall Live—Buy Bonds

EMPLOYMENT OF WOMEN IN STOCK-ROOM POSITIONS

Details of Uniform So Designed that the Woman Worker Will Look as Inconspicuous as Possible

In a paper read at the recent convention of the New England Section of the National Electric Light Association, W. F. Stevens, head of the supply department of the Edison Electric Illuminating Company of Boston, described the use of women in the company stock room. Beginning eighteen months ago, when men left for war service or higher wages, their places were filled largely with boys, men about fifty years of age and women. It was found that the boys as a rule were dissatisfied with the wages, while the older men could not readily meet the physical requirements besides being slow in learning. Women at first were unsatisfactory through their finding it difficult to adapt themselves to the conditions of work in the department, but gradually this disadvantage was overcome and some changes in methods were made which facilitated their new duties. It was not difficult to replace men with women in purely clerical positions, but in stock-room work it was not easy to find women who had sufficient physical strength, education and mentality or desire to learn the work.

Experience showed the necessity of adapting the conditions of work to the women. The company finds that young women with good training naturally prefer stenographic or clerical work, but as the war progresses, more and more of this class offer to take up physical work. This is the class of women the company is trying especially to interest. The working conditions that will meet this class will also attract another class of women, those between the ages of twenty-two and thirty with only a grammar-school education who have been obliged to work for years at some physical task.

Adjusting the Women to the Work

While the work has to be adjusted to the women's physical strength the women have to be adjusted to the work to a greater degree by teaching them the details of the business, avoidance of accidents, and the proper treatment of the men with whom they work and come in contact. Mr. Stevens pointed out that in England and elsewhere various costumes have been adopted for women engaged in industrial work which approach in utility and appearance the overalls and jumpers of the men. These costumes generally in his judgment are ones which the more intelligent class of women would not care to wear, and those sold in the stores at present are in most cases not made of material suitable in color and quality or else are cut in an exaggerated way. Very often they combine all these defects, together with scarcity of sizes and continuous changing of styles. Then, in the case of women working with men, climbing over ladders, walking over piles of stock, leaning over and working on material on the floor, it is desirable to have the costumes made in such a way that the women look as inconspicuous as possible, and the costume which has been worked out has been developed around this essential requirement. The following description gives some of the details and the reasons for them:

Blouse and Bloomers.—In order to reduce the cost it has been necessary to eliminate all unnecessary buttons and details, and the middy blouse meets all these requirements best. The sleeve is made full with a button at the wrist so that in the summer it can be rolled up to the elbow and in the winter buttoned down. The blouse is made so that it can be worn over a sweater in the winter when stock rooms are drafty. This arrangement is superior to the common one of having the blouse fit tightly around the waist, which would require a sweater to be worn outside with the likelihood of its being readily soiled or injured, and in other ways detract from the idea of uniformity.

In reaching for material above the head, pushing trucks about and lifting boxes it is desirable to have the waist as free as possible, and for this reason the bloomers have been arranged to be supported from the shoulders by suspenders. To allow the garment to be removed readily a backward fold is made over each hip, held by a button supplied by the makers and attached by the wearer to fit. The bloomers are made very full with a band around the top and are drawn in at the bottom by another band and buckle midway between the ankle and the calf of the leg.

The cloth has been chosen for wearing qualities and color so as not to show dirt readily and to be durable and fast. It is dark-blue drilling, and is shrunk before being cut.

The suit is made to measure by one of the department stores and delivered in twenty-four hours. Six costumes have been made on these lines, varying slightly in detail, and all have proved entirely satisfactory to the women.

Shoes, Cap, Stockings, Insignia, Etc.—There is some difficulty in finding suitable shoes for women at this time, and most of those in stock are either of bad shape or else are not rugged enough for stock-room requirements. There are two types which have been on the market for some time neither of which is wholly satisfactory—the "Prescription" shoe, sold at $6.50, and the "Nurse's Panacea" shoe, at $3.50. The former is a high-grade orthopedic shoe, but fails in that it is not rugged enough, and the latter, while easy on the feet, is not very strong and soon loses its shape. After talking with the company doctor on the matter the official who drew up the recommendation became convinced that the proper line of procedure is to find some type of orthopedic shoe at about the price of the "Prescription" shoe.

The cap is similar to that worn by nurses except that it has been reduced to the lowest terms and costs practically nothing. The cap is required because of the dust and also in order to prevent the hair getting in a disordered condition.

Stockings should be black and should be strong.

One of the standard costumes sold in the stores which since has gone temporarily out of stock had on the sleeve the letters "N. S. S. A.," or "National Service Suit of America." This caused considerable interest, and one woman who did not have the letters on her sleeve worked them on with a needle. This brought to mind the possible advantage of having on the left sleeve some insignia which would appeal very much as do the naval insignia on the sleeves of the sailors. As the work has resulted from conditions due to the war it seemed well to carry out this idea by placing the words "War Supply Service" on the sleeves.

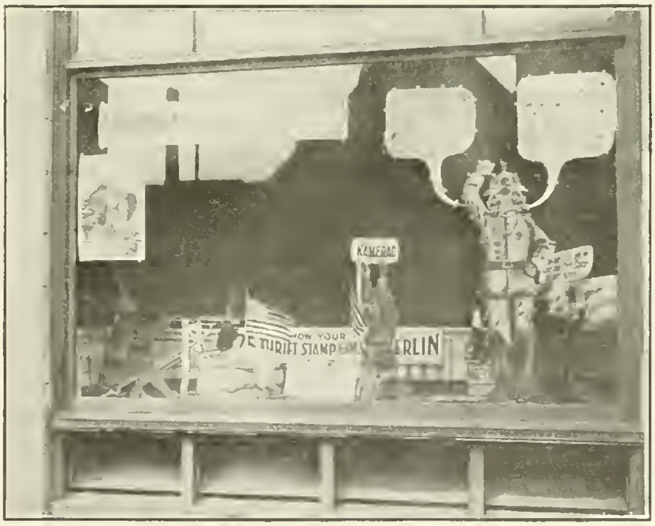
The company expects to raise the standard of the class of women who are going into the work materially and already finds an increasing number of promising applicants. While it does not care to say much about the future after the men return from the war, the work of the women is being watched with much interest to see if the rearrangement of the stock-room work will not disclose the fact that quite a large proportion of it is well within the ability of women.

Big Bond Totals Cheer the Boys

THRIFT STAMPS FEATURED BY HARTFORD COMPANY

A Window Display Made by Connecticut Central Station in the Interest of War Funds Wins Approbation of Patriotic Community

The Hartford (Conn.) Electric Light Company recently "ran" a window display on behalf of thrift-stamp purchases which attracted widespread attention. Among the numerous "war windows" of this company, this made one of the biggest hits of the year and evoked many expressions of approval from patriotic citizens anxious to see the government's war chest kept full.



STRAFING THE KAISER IN A NEW ENGLAND CENTRAL-STATION SHOW WINDOW

The World Power Is Liberty's

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Lamps and Lighting

Automobile Headlamps and Glare-Reducing Devices.—L. C. PORTER.—In spite of all the study that has been given to the subject of automobile headlighting and the legislation that has been enacted to eliminate glaring lights from highways, there has not yet been developed a thoroughly satisfactory device or method to overcome this troublesome feature. However, much can be done to mitigate the evil through proper adjustment of lamps and the correct use of diffusing devices.—*General Electric Review*, September, 1918.

Generation, Transmission and Distribution

Hydroelectric Developments in Tasmania.—RICHARD H. MOORHEAD.—The hydroelectric system developed at the outlet of Tasmania's inland sea, situated 80 miles from the city of Hobart, is described. The energy is used principally in the supply of Hobart and for electrochemical and metallurgical industries, especially the production of electrolytic zinc and calcium carbide.—*Journal of Electricity*, Sept. 1, 1918.

Standard Outdoor Substation.—J. T. BRONSON.—The development of satisfactory switching and transformer equipment for outdoor installation along high-tension transmission lines has been a big factor in extending the service of electric power companies. Through the use of this apparatus the need of special buildings for shelter has been dispensed with, and service can be furnished at a profit in many cases where previously the interest on the investment for buildings, equipment, etc., and the cost of attendance would have shown a loss. In this article are outlined the requirements of outdoor switching apparatus and the types and equipment of outdoor substations. Curves are given to show the comparative cost per kilovolt-ampere of outdoor substations of various size.—*General Electric Review*, September, 1918.

Influence of Poor Power Factor Upon Output.—A. LÉAUTÉ.—By an unfortunate coincidence, at the moment when the war necessitated the maximum production of electrical energy in France, there was an unforeseen falling off in power factor which caused a marked diminution of output. This has led to many studies of the problem, some of which have been already noticed in the Digest. The one now referred to has for its object not to recount the well-known causes of the phenomenon but to analyze the resulting conditions. The author endeavors to determine with exactitude the law according to which the power transmitted by the feeders and the power produced by the alternators both decrease under out-of-phase conditions. He arrives at formulas which express in a striking manner the loss of power that is so caused and which, he contends, deserve the attention of the public authorities with a view to the rectification of prevailing conditions.—*Revue Générale de l'Electricité*, Aug. 10, 1918.

Methods for More Efficiently Utilizing Our Fuel Resources, XXI.—MARIUS R. CAMPBELL.—A map showing and classifying the coal fields of the United States and a diagram giving the chemical composition and calorific values of different grades of coal form part of this article. A table showing the original and present quantity of coal in the United States, the production of the mines in 1913 and 1914 and the total production from the beginning of coal mining to the present time is given. The estimated production of coal in the United States to the year 2055 is interesting.—*General Electric Review*, September, 1918.

Improving Engine Economy, II.—M. A. SALLER.—A discussion of the possible increase of efficiency and capacity of engines by giving proper attention to the steam supply.—*Power Plant Engineering*, Sept. 1, 1918.

Traction

The Swiss Electric Railways.—A. GIVELET.—In a comprehensive review of the mountain railways of Switzerland, in which comparisons of cost per ton-kilometer are made between electric and steam lines operated in three ways—by adhesion simply, as rack roads and by a combination of both systems—the author concludes that the advantage of electrical operation increases with every increase of grade. For instance, it has been shown that with a grade of 7 per cent and a speed of 18 km. an hour 160 hp. will operate an electric train carrying eighty passengers as compared with 213 hp. with steam traction. Moreover, with electricity, grades as steep as 10 per cent can be negotiated without the necessity of installing a rack road. To the well-known advantages of electric operation the author adds two which, he says, have not been sufficiently insisted on—the avoidance of hauling trains of coal for the engines, which has proved a hindrance to traffic, especially on single-track roads, and the possibility of operating electrically snow plows at night, thereby doing away with the heavy expense to which steam lines are put in removing snow.—*Revue Générale de l'Electricité*, Aug. 24, 1918.

Installations, Systems and Appliances

High-Speed Circuit Breakers for Chicago, Milwaukee & St. Paul Electrification.—C. H. HILL.—Each of the fourteen substations in the 440-mile electric zone of the Chicago, Milwaukee & St. Paul Railway is now equipped with a high-speed circuit breaker, some of which have been in operation for over a year. This protective device is connected into the negative return circuit between the ground and the negative bus, and it is in parallel with a limiting resistance which becomes effective immediately the breaker opens. The article describes the details of construction of this unusual equipment, to which brief reference was made in the July issue.—*General Electric Review*, September, 1918.

Electric Winding Engines and Mine Hoists.—H. H. Broughton.—In this article the mechanics of the winder are considered. Simple expressions are given which lead to the evaluation of the cardinal points of the torque diagram of a balanced cylindrical-drum winder. Finally the derivation of the diagram by a step-by-step method is explained.—London *Electrician*, Aug. 16, 1918.

Electrically Driven Printing Presses.—In this article particulars regarding a series of electric motors installed for driving printing presses at the works of Morrison & Gibbs, Edinburgh, Scotland, are set forth. Starting and control devices are discussed. These starters are called "inching" starters because the motors may be "inched" forward as much as the work in hand may require by the method of alternately closing and opening the motor circuit in quick succession so that the motor armature is permitted to revolve only a short distance at a time and is not allowed to accelerate to its normal speed. It is worthy of note that prior to the installation of the electric equipment the works were driven by a modern and efficient steam-engine plant which was in excellent running order. The firm, however, was persuaded that the conversion to electric driving was absolutely necessary if it was to keep its large printing business abreast of the times. It therefore scrapped the engine plant though the boilers are still retained for heating purposes.—London *Engineer*, Aug. 16, 1918.

Induction Motor Troubles, II.—Gordon Fox.—Consideration is given in this article to the troubles occurring within induction motors. These are classified and discussed under two heads, mechanical and electrical.—*Power*, Sept. 10, 1918.

Mining Electrical Engineering.—C. Jones.—A continuation of this paper, presented before the South Wales Institute of Engineers, discussing the necessity of installing reactance on systems in order to limit the mechanical stress imposed on circuits by current flowing through a fault between phases This is best secured by inserting the reactance at a point where all such fault currents must pass, such as at the generator terminals.—London *Electrical Review*, Aug. 16, 1918.

Bibliography of Electric Welding.—William F. Jacob.—Reference is made to some 250 articles on the subject of electric welding.—*General Electric Review*, September, 1918.

Electrophysics and Magnetism

Capacity-Potential Curves of an Induction Coil.—E. Taylor Jones.—An expression is given for the maximum secondary potential of an induction coil calculated on the theory that two oscillations are set up in each circuit at break. The relation between the primary capacity and the secondary potential and that between the maximum efficiency of conversion and the coupling are shown by means of calculated and experimental curves. The present results are compared with those found in previous experiments on the relation between capacity and spark length. The uses of capacity-potential curves in the determination of the constants of induction coils are discussed, and examples are given of the calculation of optimum capacities. A repetition of Rayleigh's rifle-bullet experiment is described, the result further confirming the present theory.—London *Electrician*, Aug. 30, 1918.

Some Properties of Metals Under the Influence of Alpha Rays.—A. G. McGougan.—The delta-ray current from a metal under bombardment by alpha-rays in high vacuum is reduced by scraping the surface of the metal with a steel scraper while the vacuum is maintained. The reduction effected in these experiments varied from 6 per cent for platinum to 37 per cent for lead, but it is not permanent. These experiments indicate that the delta-ray effect is due to a gas film on the surface. The reduction of delta-ray activity by heating and by continued low pressure shows that the surface film under these circumstances loses gas molecules to its surroundings which are not replaced from the residual gas.—*Physical Review*, August, 1918.

Specific Inductive Capacity of Metals.—Fernando Sanford.—In a table given in this article it is seen that the metals take their places in the contact or frictional series with dielectric substances just as the latter do with each other. The natural inference is that the places are determined by the dielectric constants of the substances. If this is true, the specific inductive capacities of metals are of the same order of magnitude as are those of non-metallic substances, and the more electro-positive a metal is in the contact series, the higher is its specific inductive capacity.—*Physical Review*, August, 1918.

Electrochemistry and Batteries

Discharge Characteristics of a Certain Make of Dry Cell.—C. A. Gillingham.—A careful study of the discharge characteristics of a 6-cm. by 15-cm. dry cell made by a well-known firm. The tests were made by discharging to give end-point voltages, (1) through constant resistances, (2) at constant current through varying resistances, (3) through "mazda" lamps. In each case the cells were discharged either continuously, or half, quarter, an eighth, etc., of the time. The results are given and discussed in extenso.—*Paper presented at convention American Electrochemical Society*, Sept. 30, 1918.

Nitrogen Fixation Furnace.—E. Kilburn Scott.—The various types of electric arc furnaces for fixing nitrogen are first reviewed and compared. The Kilburn-Scott three-phase furnace is then described in detail (comparing it with other furnaces), taking up such points as the balance of the current phases, starting the furnace, size of furnace, radiation and cooling-water losses, electrodes, stabilizing the arc, power factor, reactance, air supply, air compressor, preheated air, effect of increasing oxygen in the gas, effect of increasing pressure, absorption of the products, cooling the gases, raising steam in boilers, and theory of the reaction and its reversibility.—*Paper presented at convention American Electrochemical Society*, Sept. 30, 1918.

Units, Measurements and Instruments

Current Transformer Ratio and Phase Error by Test Ring Method.—H. S. Baker.—This method of testing may be indicated briefly as follows: A special current transformer or test ring is connected with its primary and secondary of the current transformer under test The number of turns in the secondary coil of the special current transformer is varied until the primary and secondary ampere turns of the special current transformer or test ring are equal to each other and show a balance. Then the ratio of turns in the special current transformer is the current ratio of the transformer under test. Of course, the primary and secondary ampere turns can never actually balance, because they are not exactly in step or opposition, but a point can be found where the vector difference between them is at right angles to one of them, and this point is taken as the balance point. This actual minimum value of vector difference gives a measure of the phase difference between primary and reversed secondary amperes. —*Proceedings A. I. E. E.*, September, 1918.

Miscellaneous

Effect Upon Fuel Economy of Different Arrangements of Baffles.—Lieut. William G. Eager.—Different arrangements of baffles for the most economical production of steam from coal are discussed, together with tests made at the combination ice and electric plant of the Valdosta (Ga.) Lighting Company. The principles considered in the investigation, arrangement of baffles, discussion of results, conclusions as to completeness of tests and recommendations as to further research are given. There are few improvements that can be made at comparatively small expense which offer such encouraging possibilities of improvement in economy as the proper arrangement of baffles.—*Journal A. S. M. E.*, September, 1918.

Education and Training of Engineering Apprentices. —P. H. S. Kempton.—In this article of the series the author describes work being done in Germany for the training of engineering apprentices and points out that ten years ago there were in Germany 10,000 well-educated men over eighteen studying engineering, compared with only 900 in Great Britain. In Germany continuation schools, compulsory for workmen and apprentices under eighteen, are in use throughout the country. Larger firms maintain their own schools. Here a part of each day is given up to the instruction of the apprentices, though some night schools and early morning hours are made use of. No cultural work is attempted in this connection. The writer recommends for consideration in England that education of apprentices should proceed side by side with their trade training and during work hours. This educational training should not be entirely vocational, but general culture, citizenship and physical training should find a place in the curriculum. A periodic sifting process is necessary in order to render the training most efficient and economical. Specialized training and adequate prospects must be offered to prospective teachers in such schools.—London *Electrical Review*, Aug. 9, 1918.

Electrically Welded Ships.—This deals with the welding of a ship 125 ft. between perpendiculars and 16 ft. beam, with a displacement of 275 tons. The hull was rectangular in section amidships, with only the bilge plates curved. It was made of seventy-one transverse frames and contained three bulkheads, those fitted fore and aft being watertight and the one amidships non-watertight. The shell plating was $\frac{1}{4}$ in. and $\frac{5}{16}$ in. (6.3 mm. and 7.8 mm.). All joints were lapped in the manner described. Some interesting details are provided of the comparative cost of the electric-welded and riveted barge.—London *Electrician*, Aug. 9, 1918.

Electric Arc Welding.—A. M. Candy.—The exacting demands of the present world war have given a tremendous impetus to the application of electric-arc welding methods for making rapid repairs to a great variety of machinery and apparatus required in the successful conduct of the conflict. The British Admiralty has adopted the process extensively for ship construction, including minor structural parts and calking of seams, and for partially eliminating riveted construction. At present the United States Shipping Board has an active welding committee working upon the application of electric welding with a view to ultimately producing merchant ships which will be largely built by welding instead of the present riveted construction. Probably the chief reasons for the apparent apathy of the general industrial world toward arc welding are the haphazard methods employed, using any kind of electrical equipment, any kind of wire for electrode material and any kind of laborer or general handy man as a welder. This situation is being gradually improved, as indicated by a number of articles appearing recently in the technical press, which emphasize the proper methods for the execution of satisfactory welds, general methods of supervising and inspecting welding work, and the selection of proper electrical equipment.—*Proceedings A. I. E. E.*, September, 1918.

Value of Peat Fuel for the Generation of Steam.—An abstract from a report made by John Blizard to the Canadian Department of Mines (*Bulletin No. 17*, Dominion Government Printing Bureau of Ottawa) is presented. After an introduction on the general uses of peat, methods of conducting tests are given in full.—London *Engineer*, Aug. 9, 1918.

New Type of Reinforced-Concrete Poles.—A new type of pole for power transmission lines has recently been developed and tested by a firm in Geneva, Switzerland. The poles are built up of hollow blocks which are light enough to be easily transported. After being placed one on top of the other, reinforcing rods are placed inside, after which cement is poured in, making the whole one solid structure. Experiments were made with two types of pole. Poles for telegraph lines were approximately 20 ft. (6 m.) high, extending 5 ft. (1.5 m.) underground. Dimensions were 10 in. by 10 in. (25 cm. by 25 cm.) at the base, while the top half measured 8 in by 8 in. (20 cm. by 20 cm.). The blocks are reinforced with 4½-in. (11-cm.) round rods, placed 1¾ in. (44 mm.) from the outside. These rods are not provided with barbs. Rupture resulted after a load of 233 lb (106 kg.) was applied for ten minutes. The deviation at 18 ft. 9 in. (570 cm.) was 5¾ in. (15 cm.). Microscopic cracks appeared after thirty minutes with a load of 121 lb. (55 kg.) (deviation 3 in. = 8 cm.). The large poles measuring 28 in. by 32 in. (70 cm. by 80 cm.) at the base were made up of four columns 11 in. by 12 in. (28 cm. by 30 cm.). The outside dimensions at 15 ft. 6 in. (475 cm.) were 22 in. by 26¾ in. (56 cm. by 68 cm.), and the columns 9½ in. by 9½ in. (24 cm. by 24 cm.) The first microscopic cracks appeared when a load of 335 lb. (152 kg.) was applied vertically and 353 lb. (160 kg.) horizontally. Measurements of the deviation with this load were no longer exact as the foundation supporting the poles started to give. The tests proved that the poles so constructed could withstand a load reaching from 200 per cent to 300 per cent of the normal. They seem as strong as if made out of one solid piece of concrete, the joints between the blocks having no influence whatever on the resistance of the poles.—*Schweizerische Bauzeitung.*

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Coöperative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

Research in Progress or Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Technical Theory and Practice" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

FUSE CUT-OUTS, REACTIVE LINK.

In connection with the development of a heavy-service oil-immersed cut-out, we have designed a new form of fusible element to be used where the conditions are exceptionally severe, and more particularly with voltages above 2500. In this "reactive link" the main fusible strip is shunted by means of two inductively wound, inclosed helixes of high resistance, and the final rupture of the circuit occurs within these inclosures. When the main link melts only a small, quickly suppressed arc results, because the current is shunted through the inclosed helixes. This current is quickly reduced owing to the rapid increase in resistance before the melting point is reached. The coils of the secondary link are surrounded by porous material thoroughly saturated with oil, and this structure causes the final interruption of the current to take place simultaneously at a number of points within the inclosures. In this way very quiet operation is secured under the most severe conditions and the period of arcing as well as its intensity is materially reduced. Oscillograph records under the same short-circuit conditions show that with a plain link the arc continued for 0.155 second, while with an inductive shunt its duration has been reduced to 0.017 second.—*L. W. Downes, Providence, R. I.*

LIGHTNING ARRESTER, ELECTROTHERMAL.

The item referring to the electrothermal lightning arrester on page 1280 of the ELECTRICAL WORLD for June 15 is not quite correct. The discharge does not force the water, which acts as an electrolyte, through the needle valve, but forces it out of the electrolytic chamber, through a pipe at the bottom, into a reservoir at a somewhat higher level. This breaks the contact between the electrodes and leaves the electrolytic chamber filled with hot air and steam. The needle valve, which gives an outlet at the top of the electrolytic chamber, relieves the pressure by permitting both hot air and steam to escape slowly. This permits the electrolyte to return from the reservoir to the electrolytic chamber and re-establishes the contact so that the lightning arrester is again ready to operate.—*H. M. St. John, Research Engineer, Commonwealth Edison Company.*

RECTIFIER FOR HIGH VOLTAGES.

High-tension rectification by means of two electrodes of different materials placed in an atmosphere of carbon dioxide and sulphur dioxide is a promising field for research. In the writer's experiments on the reduction of high-tension alternating currents, gas under pressure was sent through one of the electrodes, striking the face of the second electrode. Hydrogen, sulphur dioxide, carbon dioxide, air and ammonia gas were used at different pressures, and a marked degree of rectification was found to take place at a certain critical pressure. Some of these gases gave better results than the others. Carbon and a pool of mercury as electrodes show fine tendencies for rectification, especially when ammonia gas is used. The writer has used these high-tension rectified currents in charging electrostatic condensers for generating high-frequency currents for radio-telegraphy and radio-telephony.—*Samuel D. Cohen, Brooklyn, N. Y.*

Apparatus Available

TORONTO (CANADA) LABORATORY OF HYDROELECTRIC POWER COMMISSION OF ONTARIO.

(1) 300,000-volt, 60-cycle, 300-kva. transformer; (2) 75,000-volt, 25-cycle, 50-kva. transformer; (3) 33,000-volt, 25-cycle, 1-kva. transformer; (4) three-element oscillograph, with photographic equipment; knockdown table and packing cases to facilitate shipping and setting up in the field; (5) 3-in. (7.6-cm.), 6-in. (15.2-cm.) and 10-in. (25.4-cm.) sphere-gap voltmeters; (6) oscillation transformer; (7) 1-kva. motor-generator set to supply constant alternating-current voltage for meter calibration (it consists of a direct-current motor and an alternator; the set is operated from a battery); (8) 10-ft. (3-m.) photometer, distribution photometer, 10-in. (25.4-cm.) integrating sphere, 84-in. (2.1-m.) integrating sphere, lift racks for multiple and series lamps; (9) approximately 20,000 sq.ft. (1858 sq.m.) of floor space will be shortly available for laboratory purposes.—*W. P. Dobson.*

Suggestions for Research

CABLES, AERIAL, FOR POWER TRANSMISSION.

Aerial cables have been used in special cases in several installations throughout the country for pressures as high as 26,000 volts where open-wire construction was undesirable and the cost of underground construction prohibitive. Experiments and data are desired on the current-carrying capacity of such cables, the effect of direct sunlight and of the color of paint upon the temperature rise, the relative merits of rubber, varnished-cambric and paper insulation, difficulties in joints due to different expansion of the messenger cable, etc.

CABLES, DIELECTRIC LOSSES IN.

The matter of dielectric loss in cables should receive most careful attention, both from cable manufacturers and users. Manufacturers must not be hampered by impracticable and lightly considered specifications. On the other hand, conservatism of manufacturers must not block the road to progress, and as soon as the laws governing dielectric loss can be determined and a practical method of measuring these losses developed the most efficient cable will be called for and must be produced.—*A. I. E. E. Committee on Transmission and Distribution.*

HUNTING OF SYNCHRONOUS MACHINES.

Develop a simple instrument which will accurately determine the amplitude, frequency and form of hunting. Then (a) find if amplitude and frequency are related in any way, (b) make an accurate determination between these factors and the field current. Is the form of surging always a sine wave? If a frequency meter were available which would read to one one-hundredth of a cycle per second, the problem would be made easier.—*R. Brown, Cornell University, Ithaca, N. Y.*

INSULATORS.

Continuation of the investigation of the insulator problem. While at present porcelain seems to be the most available material, yet it is not beyond possibility that some other material such as fused quartz (Mr. Peaslee's work) or even glass may be used.—*A. I. E. E. Committee on Transmission and Distribution.*

MAGNETS, PERMANENT, STANDARD TEST.

The committee on magnetic properties of the American Society for Testing Materials in its 1918 annual report recommends certain definitions of normal residual induction and of normal coercive force, and also proposes a standard magnetic test for material intended for permanent magnets. Those interested should perform these tests and investigate their accuracy, universal applicability and desirability for practical purposes. This should be done before the society adopts these tests as standard.—*Editorial Suggestion.*

NITROGEN FIXATION.

The most interesting electrochemical development of the year is the construction of the cyanamide nitrogen-fixation plant at Muscle Shoals, Ala. Two unique features in this plant are the use of steam for the generation of the electric energy and the use of 60-cycle current for the calcium-carbide furnaces. These features will give interesting subjects for study —on the one hand the energy item in the cost of making ammonium nitrate by the cyanamide process and on the other the power factor of carbide furnaces with high-frequency current.—*A. I. E. E. Committee on Transmission and Distribution.*

POLYPHASE SYSTEMS, UNBALANCED.

In a paper by C. L. Fortescue (A. I. E. E. *Proceedings*, 1918, p. 629), a general method is given for resolving an unsymmetrical and unbalanced systems of polyphase currents, voltages or impedances into a number of symmetrical components. A number of practical problems are solved in the paper, but much remains to be done in order to simplify the formulas and the notation used for unbalanced three-phase circuits.

PROTECTIVE DEVICES.

In view of the proposed interconnection of transmission and distribution systems throughout the country, as a measure of economy and fuel saving, it is recommended that this subject be investigated thoroughly, particularly to determine what protective features are necessary in tie lines for the purpose of insuring continuity of service and stability of operation. Among other subjects which might be investigated are the following: (1) Relays on generators, transformers, synchronous converters, etc. (2) Lightning arresters for transmission lines. (3) Preparation of definite recommendations regarding the standardization of relay nomenclature and rating of circuit breakers. (4) Detrimental effect of power reactors.—*A. I. E. E. Protective Devices Committee.*

SYNCHRONOUS MACHINES, ARMATURE REACTANCE AND REACTION.

In view of the great and constantly growing importance of the subject and of the large amount of literature with contradictory assertions and methods, it is highly desirable for a theoretical expert to go over the whole problem, analyzing critically the various fundamental assumptions made and checking the results against a large number of accurate tests on machines with widely different constants. As a result of such a critical investigation, certain facts should be established beyond any contest or doubt, others to be valid within certain limits, and still others to be rather indefinite and in need of empirical coefficients or further tests. This is a big problem and could be profitably undertaken only if the principal manufacturing companies promised to furnish test data and agreed to perform special tests prescribed by the expert in charge of the work.—*Editorial Suggestion.*

X-RAYS, SINGLE-IMPULSE EXPOSURES.

In some cases of medical examinations, especially with children and restless patients, it is highly desirable to have an instantaneous exposure of the photographic plate, which means a single electrical impulse of sufficient suddenness and intensity. Some work has been done in this direction, but much remains to be done to increase the intensity, so as to keep the X-ray tube further from the patient. A single-impulse generator has been previously developed for testing dielectrics at transient voltages, and a similar idea may be applicable in this case. In view of the importance of roentgenography in military medicine this problem deserves most serious attention. [See a paper by Dr. R. Knox, presented at the April, 1918, meeting of the Institution of Electrical Engineers (British).]—*Editorial Suggestion.*

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

DAYLIGHT-SAVING MEASURE ENCOUNTERS OPPOSITION

Bill Which Has Passed the Senate Awaits Action by House of Representatives, Where Fight Is Anticipated

Senator Calder's daylight-saving bill, which seeks to make the present scheme of daylight saving applicable throughout the year and which was unanimously passed by the United States Senate last week, is still awaiting action in the House of Representatives.

Considerable opposition to the measure has been aroused throughout the country particularly by the original proponents of the daylight-saving measure. It has been pointed out that none of the European countries where the daylight-saving scheme has been in force for some years has ever extended it beyond the summer period, so that if for no other reason than uniformity the United States should not depart from the original daylight-saving measure.

The Attorney General of the State of New York opposes the bill for the reason that it will seriously interfere with the opening and closing of polls on election day, that it would lead to litigation concerning expiring insurance policies and that the New York State law provides for daylight saving up to the last Sunday in October. Inasmuch as this law cannot be remedied until the New York State Legislature meets again in January, a change by the United States government will create a conflict between legal New York State and federal time.

Another objection has been raised by Dr. Abram Jacobi, the eminent physician, who gives warning that in winter to get everybody out of bed before daylight or soon afterward would have a deleterious effect on public health.

Lend to Me, Please—Uncle Sam

ADDITIONAL ENDOWMENT FOR ENGINEERING RESEARCH

Ambrose Swasey Adds Another Hundred Thousand in Appreciation of the War Service Engineering Science Has Rendered

At a joint meeting of the trustees of the United Engineering Society with the Engineering Foundation Board in New York on Oct. 7 announcement was made that Ambrose Swasey of Cleveland, Ohio, had given the Engineering Foundation an additional $100,000 for endowment of engineering research.

Mr. Swasey, who is a past-president of the American Society of Mechanical Engineers, is well known as a designer and builder of large telescopes and other optical instruments and fine machine tools. In 1915 he gave $200,000 for engineering research, so that the total endowment is now $300,000. Mr. Swasey's original gift made possible the establishment of the Engineering Foundation by the United Engineering Society, representing the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. His gifts have been inspired by his conviction as to the necessity for research in engineering science not only in connection with the war but for keeping the United States in the forefront of nations in industrial development. This latest gift is an expression of Mr. Swasey's appreciation of the war service which the United Engineering Society and the Engineering Foundation have rendered to the country.

Let Your Children Have Peace

INSTRUMENT FOR TESTING ELECTRIC WELDS NEEDED

Fleet Corporation Finds Lack of Means for Determining Value of Electrically Welded Joint Inimical to Shipbuilding Success

There is a great and urgent need for a simple workaday instrument or means for properly determining the relative strength or value of an electrically welded joint, according to J. G. Dudley, who is a member of the electric welding committee of the Emergency Fleet Corporation and of its research sub-committee, which is now affiliated with the National Research Council. He says:

"To those who have gone deeply enough into the question of electric welding such a testing machine would not seem to be vitally necessary, but in the shipbuilding industry all work of any sort must be so done as to pass the approval of the so-called classification societies. Chief among these is the British Lloyds, whose ultra-conservatism is blocking somewhat a wider use of electric welding. The principal reason probably is that its inspectors, in widely separated localities, naturally cannot be all-around technicians, and, lacking some simple means of satisfying themselves that an electrical weld is strong, they take the stand that it is wrong and disapprove it or condemn it. Some of the most eminent specialists and the best laboratories in the country have been attacking this problem for many months, but they have not yet solved it."

It is suggested that those who have ideas on the subject communicate directly with Mr. Dudley, in care of Chester Shipbuilding Company, Finance Building, Philadelphia, Pa.

STEEL OUTLOOK BRIGHTER BUT IS NOT REASSURING

Survey Just Completed by the War Industries Board Shows Present Steel Production Far Behind Actual War Demands

Some improvement in the steel situation was shown by a survey just completed for Steel Administrator Replogle of the War Industries Board, but officials in Washington stated on Wednesday that production is still far behind war demands and the outlook for supplies for non-war industries for the remainder of the war is not bright.

Pig iron is now being produced in the United States at the rate of more than 42,000,000 tons a year and steel plates at the rate of nearly 6,000,000 tons, both records in the industry. The plate production is more than 40,000 tons a week greater than ever before.

Production of all steel is running at the rate of only approximately 33,000,000 tons a year, however, and the demands of the government and the Allies are at the rate of about 50,000,000 tons.

A vast amount of steel is required in the manufacture of electrical apparatus and supplies, in electric transmission towers and in the fabrication of central-station structures, substations and steam and coal-handling equipment.

Beat the Germans Back—Buy Bonds

FURTHER CURTAILMENT IN ELECTRIC HEATING APPLIANCES

War Industries Board Restricts Output for Next Six Months to 50 per Cent of Six Months' Production During 1917

The Priorities Division of the War Industries Board in carrying out the plan of the board to conserve material, labor, fuel, transportation and capital in general industry for the purpose of supplying the supreme war demands announced Oct. 10 additional curtailments in electric heating appliances, including electric stoves and ranges. Effective Oct. 1 and for six months thereafter, the output of these devices has been curtailed 50 per cent of the six months' production during 1917.

Buy Bonds—It's War Service Work

APPEAL FOR TELEGRAPHERS FOR SERVICE IN FRANCE

Bonus Workers Needed by the Signal Corps—Physical Standard Will Be Lowered for Men with Technical Qualifications

The Signal Corps announced on Wednesday of this week that it needs 750 bonus telegraphers for service in France. Men skilled in telegraphy between the ages of eighteen and fifty-five inclusive should apply at once for details to the chief signal officer of the army at Washington. One hundred and fifty qualified men are to be sent abroad immediately and the rest will go overseas at the rate of about eighty a month.

The men who enter the service will be kept in training camps for instruction only long enough to receive the necessary clothing and equipment. The Signal Corps states specifically that the physical standard will be lowered in cases of men having the necessary technical qualifications, so that practically any one who is physically able to do his work will be accepted.

If You Like Liberty, Lend for It

GATHERING OF ELECTRICAL MEN IN LOS ANGELES, CAL.

Second "Get-Together" Dinner of California Electrical Co-operative Campaign Draws an Attendance of More than Four Hundred

Under the auspices of the California electrical coöperative campaign, the second "get-together" dinner for 1918 was held in Los Angeles on Oct. 4. More than 400 members of the electrical fraternity in southern California were present, a feature of the gathering being the presence of over fifty women all actively engaged in some branch of the industry. R. H. Ballard, vice-president of the Southern California Edison Company, was toastmaster, and the speakers and subjects were as follows: "Solving New Problems," L. H. Newbert, chairman advisory committee; "War-Time Finances," A. N. Kemp, comptroller Southern California Edison Company; "What to Do," A. E. Wishon, general manager San Joaquin Light & Power Corporation; "War and Women," Miss Gertrude Tucker, Edison company, Los Angeles; "Priorities," D. E. Harris, Pacific States Electric Company; "Let There Be Light," Col. H. D. Loveland, member Railroad Commission, State of California; "More Synergism," R. M. Alvord, General Electric Company; "Mars and the Electric Shop," M. L. Scobey, San Francisco; "To-day's Opportunities," G. E. Arbogast, president California Electrical Contractors and Dealers' Association; "Help Wanted," S. M. Kennedy, secretary and general agent Southern California Edison Company.

The meeting was also addressed by Major Wishard, a prominent "four-minute man," and A. H. Halloran, secretary of the Pacific Coast Section, N. E. L. A., told of the advantages of membership in the National Electric Light Association and what is being done for members.

The keynote of the meeting was the practical discussion of "questions of the hour," in which all were keenly interested. Experienced speakers told dealers and contractors how they could continue to operate profitably, even in war times, by readjusting their businesses so that they could take advantage of changing conditions. Central-station men explained some of the limitations under which they now are operating and demonstrated that the power companies are doing their share in assisting war industries and that they could do more if more capital were made available to develop further their hydroelectric properties. The subject of priority rules laid down by the War Industries Board was carefully gone into, and explanation was given as to the classes of goods affected and the reasons therefor. Dealers were much interested in the information given about the new orders concerning the future manufacture of carbon and metallized-filament lamps and the probable change of attitude on the part of local central stations regarding free lamp renewals.

During the evening opportunities were not overlooked by the speakers to stimulate interest in the fourth Liberty loan, and it was evident that all present had already made liberal purchases and some were going back for more. Patriotic music and songs were part of the program from start to finish, and the evening was conspicuous for the enthusiasm of the gathering and the snappy manner in which the up-to-date subjects were handled. The dinner throughout emphasized the general belief that the California electrical coöperative campaign is an undoubted success and that the manner in which the work is being handled by the advisory committee and the field men has the approval of those interested in the electrical industry throughout the state.

Drive the Bayonet Home—Buy Bonds

WAR UTILITY PROBLEMS DISCUSSED IN KANSAS

Increasing Operating Expenses, Higher Rates, Lightless Nights, Public Education and New Business Are Topics of Interest

The conduct of utility business under war conditions was the topic of a one-day informal discussion by thirty delegates to the annual convention of the Kansas Public Service Association at Hutchinson, Kan., Oct. 4. The date of the meeting had been changed from Oct. 16, 17 and 18 to Oct. 4 because of the demands which government activities are making of central-station men. At the meeting it was decided to go even further in this time conservation program by discontinuing regular meetings of the association throughout the coming year. No definite plans were made, therefore, for the coming year's convention, and no outline for association work was laid down. The representatives expressed themselves as feeling rather that all should hold themeslves in readiness to heed a call at any time the officers of the association believed national or state-wide good could be done by holding a meeting.

Since the association will remain in this semi-dormant state, it was thought best to continue the present officers in power indefinitely as they have a grasp of the situation which will enable them to deal promptly with any emergency. It was the expressed understanding, however, that as soon as the war is over the association will again become active in the matter of regular meetings.

The program included provisions for discussions of fuel costs, other operating expenses, lightless night requirements, rates and temporary increases, education of the public and new business. There was also considerable discussion on classification of accounts following a report presented by a committee of the Kansas Public Utility Commission on this subject. Classification is patterned after the National Electric Light Association's classification. It is expected that the classification will be submitted to the Kansas Public Utility Commission not later than Nov. 1. When it is approved it will be available for all properties of any size in Kansas and will enable them to keep their accounts so that they can make tax reports and furnish information to the government and state authorities easily at any time.

Considerable stress was laid on the importance of the National Electric Light Association's accounting course of instruction, and a committee was appointed to solicit National Electric Light Association members among the smaller companies and urge upon them that they take advantage of this accounting course. The point was brought out at the meeting that on Oct. 1 one of the utility's commissioners said that it was the opinion of the commission that utilities in general should be permitted to increase their rates, but the commission was not inclined to disturb the present rate structures, preferring to add as a war measure certain percentages of increase to the present rates and planning to discontinue these increases six months after peace is declared. It seems that a large number of Kansas utilities will ask for increases on this basis.

On fuel costs it was the consensus of opinion that energy production costs in Kansas are from 48 per cent to 61 per cent higher than in pre-war days. Taxes have increased an average of 30 per cent, wages an average of 60 per cent. There was considerable discussion as to the effects of government employment agents taking labor necessary to operation of utilities. A committee was appointed to investigate this and see if utilities are being fairly treated in the matter considering that they are classed as essential.

The discussion of appliance sales indicated that every company to date has sold more appliances than before the war. It was the opinion that this condition is caused by the unusual prosperity in Kansas and by the facts that there is an increasing shortage of gas and that coal is costing very much more. It was also pointed out that probably a great many people who previously had insufficient income to enable them to purchase electric appliances are now well able to afford them.

In the discussion of lightless nights the delegates agreed that the amount of fuel saved by this order amounts to about one-tenth of 1 per cent of the fuel burned to make electricity. It was also brought out that in nearly all cases the rebate made to municipalities for lightless night outages should be and is made on the basis of the cost of fuel saved. This plan is in effect among the properties of the Kansas Gas & Electric Company.

L. O. Ripley, vice-president of the Kansas Gas & Electric Company, gave a very interesting talk on the subject of public policy. He stated that at this time there is an unusual opportunity to educate the public by presenting locally the conditions under which each utility operates. He said this is the time to combat socialistic tendencies by bulletins, talks and advertisements on the history of the company's growth and on operating subjects presented from the layman's point of view.

There was some disappointment among the delegates over the fact that the state fuel administrator and the engineer for the oil division of the Fuel Administration for the mid-continent field had been called to Washington and were therefore unable to attend the convention.

The officers who will continue in power for the ensuing year are: President, J. D. Nicholson, Newton, Kan.; secretary-treasurer, W. W. Austin, Cottonwood Falls; executive committee, A. M. Patten of Topeka, L. O. Ripley of Wichita, C. L. Brown of Abilene, H. W. Magruder of Liberal, L. S. Small of Concordia, and Walter S. Grundy of Hutchinson.

JOBBERS' AND POWER CLUB MEETINGS ARE POSTPONED

Prevalence of the Epidemic of Influenza Throughout the Country Has Led Ohio Medical Authorities to Issue Edict Against Conventions

The war service convention of the Electrical Supply Jobbers' Association, which was scheduled to be held at the Hotel Statler, Cleveland, Oct. 21, 22 and 23; the fall meeting of the Electric Power Club, which was to be held in the same city at the same hotel on Oct. 17, and the war service convention of the manufacturers of electrical apparatus, including members of the Electric Power Club and all other electrical apparatus manufacturers, have been indefinitely postponed. Owing to the epidemic of influenza the medical authorities of the State of Ohio have ordered postponement of conventions for three weeks, and in view of the edict of the health authorities and of the inability of the various associations to make other arrangements indefinite postponement was decided on.

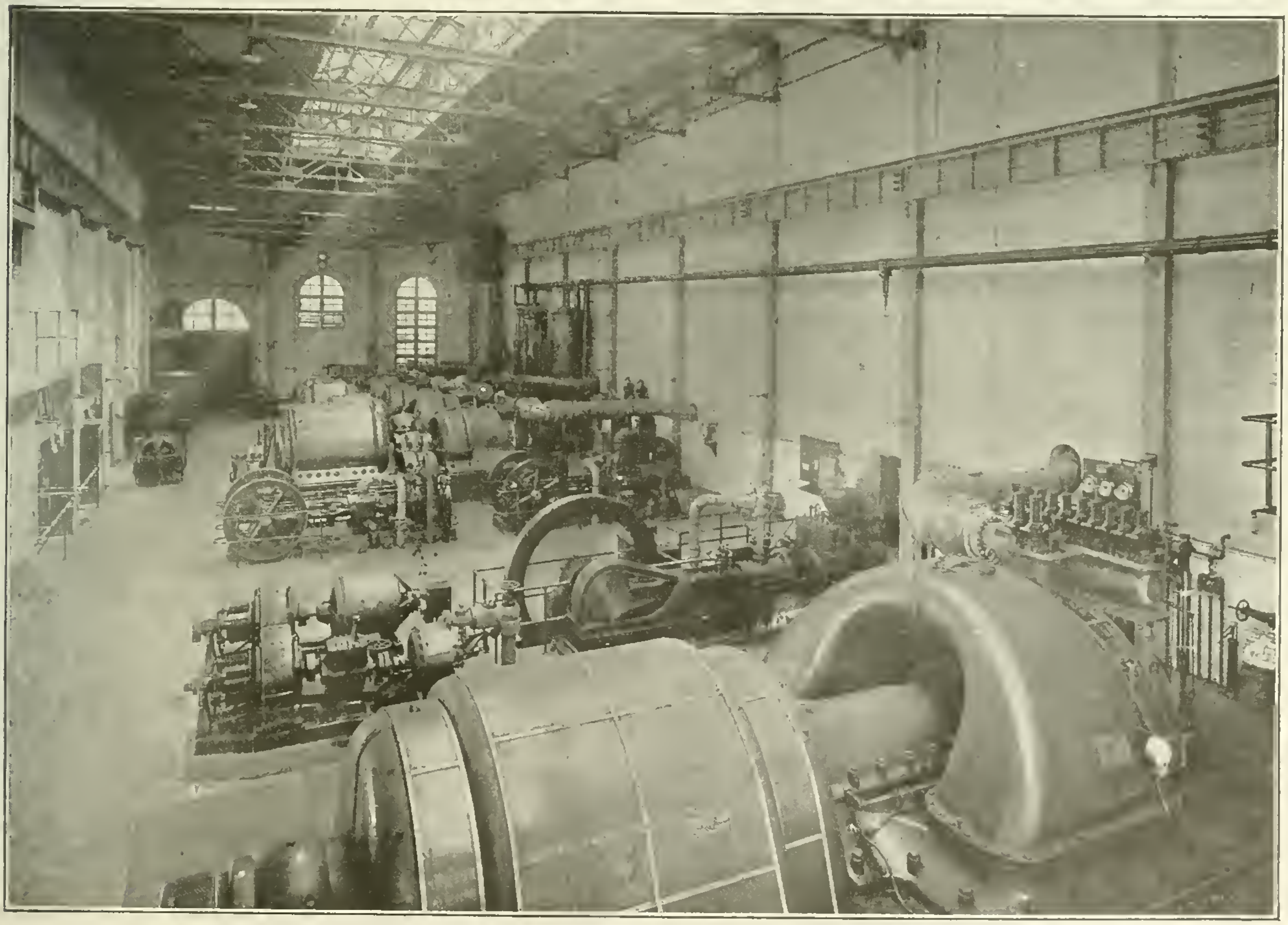
The meetings of the jobbers and the manufacturers were to be among the most important held by those organizations, the subjects to be taken up for consideration being restricted entirely to war service. It was the intention of the Power Club, for instance, to take up such subjects as priorities in obtaining materials for direct and indirect government orders, procedure necessary to obtain materials for making up stock, rulings as to what classes of business and orders may be called essential and how classified, explanation of the reports that must be made to the War Industries Board, conservation of materials used in electrical apparatus, conservation of capital, conservation of labor, etc.

The Electrical Supply Jobbers' Association had purposely moved its meeting forward for the purpose of discussing as quickly as possible government regulations of the supply industry.

Confederate Gunboat Comes to Light in Louisville Plant Construction

Intake-tunnel and condenser-well construction were interesting and difficult engineering features of the recent additions to the generating station of the Louisville (Ky.) Gas & Electric Company. In sinking these water passages to a depth of 40 ft. below the Ohio River bed the caisson method was employed. The heavy caissons cut through the hull of an old Confederate gunboat sunk during the Civil War. Some of the wood brought up by divers was in such good condition that the engineers had it turned into "policemen's clubs" to preserve as souvenirs.

Work is completed on the one 15,000-kw. turbine unit which was being added to bring the station rating up to 47,500 kw. Another 15,000-kw. unit is on order for this plant and will be installed, it is expected, early in 1919. It is from this plant that the Louisville company supplies the large government camps and many war industries.



NEW STATION OF THE LOUISVILLE GAS & ELECTRIC COMPANY, ADDITIONS TO WHICH ARE BEING MADE

RELATION OF WATER-POWER CONSERVATION TO FUEL SAVING

The Economies of Stored Water Power and the Possibilities of Saving Through Redevelopment of Existing Water Powers

Before the Special Commission on Water Resources created by the Massachusetts Legislature to investigate conservation and development of water power, Charles T. Main, consulting engineer, Boston, recently presented an outline of the principal economic factors bearing upon storage. A résumé of Mr. Main's remarks is given below.

The principal items bearing upon the development of storage reservoirs are: (1) The cost of development, including land damage, physical structures, legal, engineering and incidental expense; (2) the amount of water that can be stored and used, taking into account evaporation, distance from reservoir to point of utilization, size of millponds, number of hours in the day when used, and head under which the water is or can be used. The benefit effected by stored water in producing power is principally in the saving of fuel which would otherwise be required to produce the same amount of power in an auxiliary plant. One million cubic feet of stored water, if all were used under 1-ft. head, would produce about 18 kw. on the power-plant switchboard.

The amount of coal required to produce a kilowatt-hour in the average industrial power plant of about 1000 kw. rating is about 2.5 lb. (1 kg.). The cost of this amount of fuel ranges from 0.375 cent with coal at $3 per short ton to $1.25 with coal at $10. This is on the assumption that no use can be made of low-pressure steam available from the steam-power production which the stored water displaces. If low-pressure steam can be used, the amount of coal per kilowatt-hour chargeable to pcwer is somewhat less. A fair average for the cost of coal is about $0.0075 per kilowatt-hour. The saving on account of fuel due to 18 kw.-hr., or 1,000,000 cu.ft. of storage water per foot of head, assuming complete utilization, is 13.5 cents. Control and maintenance of reservoirs would probably average 1.5 cents per 1,000,000 cu.ft. (28,000 cu.m.) of head, leaving a net saving of about 12 cents per 1,000,000 cu.ft. of head. Capitalized at 10 per cent, this would warrant an expenditure of about $1.20 per 1,000,000 cu.ft. of stored water per foot of head, with complete utilization. This 10 per cent would cover interest, depreciation, taxes and extraordinary repairs.

Stored-Water Possibilities

On a river where there are a number of powers, each with a considerable head and a pond of good size, all owned by the same interests, it is possible to use stored water almost completely in some years. In other years it may be difficult to make use of much storage, either because of an exceptionally wet year or because the reservoir did not fill in the spring. If the storage reservoir is comparatively large, there is sometimes a possibility of reducing the size of the auxiliary steam plant or other sources of supplementary power if the reservoir is so controlled that it will increase the minimum flow.

On rivers where there is a diversity of interests, some running twenty-four hours a day and others for shorter periods, or where the heads are low or the ponds small, or any combination of these conditions, it is always impossible to make full use of the stored water. One of the chief difficulties is to let the water out of the reservoirs in such a way that it will arrive at each plant at a usable time. In most cases of this kind probably not more than 50 per cent of the storage would be used. The investment warranted in such a case would then be not over about $0.60 per 1,000,000 cu.ft. per foot of head, or $60 for each 100 ft. of head. The auxiliary plant should never be smaller on account of storage in cases of this kind. On small rivers the water power is apt to be an auxiliary to a steam plant, and the storage is then strictly a fuel-saving affair. This is also true where the power other than that obtained from water power is purchased and where the power bill is somewhat reduced owing to storage.

Storage Reservoirs in New England

The two principal storage reservoirs built in New England in the last few years are the Aziscohos, on the Magalloway River in Maine, and the Somerset, in Vermont. The former has a capacity of 8,000,000,000 cu.ft. (224,000,000 cu.m.) at a cost of $125 per 1,000,000 cu.ft., and the latter, owned by the New England Power Company, has a capacity of 2,675,000,000 cu.ft. at a cost of $299 per 1,000,000 cu.ft. On the Millers River preliminary investigation of the prospective development of storage for use at Turners Falls and Holyoke, Mass., by existing hydroelectric and mill power organizations shows that about 12,500,000 kw.-hr. a year could be realized in addition to existing power, assuming only 20 per cent wastage. The saving is estimated at $110,000 yearly. The estimated cost of the proposed reservoirs is over $2,276,000, and it appears that the state or private owners would have to carry an annual burden of at least $120,000 for the privilege of saving about 14,000 tons of coal yearly in this proposition. If the owners of the water powers benefited by these storage reservoirs (on the Millers River) are to pay the total cost, Mr. Main pointed out, they will be at a disadvantage from a competitive standpoint with the water-power owners on other rivers of the state. As all the developed falls on the Millers River are comparatively low, about 13 ft. average, their first cost must be comparatively high already, and any additional expense as contributions to storage reservoirs would increase them still more.

Redevelopment of Existing Water Powers

The total rated wheel capacity on the Millers River is about 7450 hp. under a total fall of 318 ft. (97 m.). Of this, 4526 hp. is used for twenty-four-hour power and 2924 hp. for ten-hour power. The average efficiency of the wheels, most of which were installed some time ago, is probably about 65 per cent, with a maximum of 75 per cent. The actual output of these wheels is probably not over 6500 hp. The advance in the art of hydraulic turbine design and installation in the past decade has been very marked, and efficiencies of 85 to 90 per cent are now attainable. This increase of 20 per cent in power can be obtained with no more water through the more efficient use of the head formerly employed. Some of the present developments would justify larger installations. Through redevelopment of the present water powers on the Millers River about 21,500,000 kw.-hr. additional power could be obtained at an approximate estimated cost of $1,742,000. At 0.75 cent per kilowatt-hour this would represent a return on the investment of 9 per cent. In case only the more advantageous powers were redeveloped, the additional amount of power would amount to 18,588,860 kw.-hr., and the estimated cost would be $1,132,000, which, at 0.75 cent per kilowatt-hour, represents about 12 per cent on the investment. In any case the wheel installations will have to be redeveloped sooner or later, even if the reservoirs are built, and the fixed charges will not represent additional yearly cost as in the case of the reservoirs.

Storage possibilities on the Westfield River are less promising than on the Millers River because of the greater cost due to the topography of the river valley and the inability to use the stored water on the Connecticut River.

Storage on the large rivers which pass through Massachusetts and are interstate streams holds out a much better promise for a reasonable return on the investment than do intrastate Massachusetts rivers. On the Connecticut River from Windsor Locks north there are nine principal points of utilization with an aggregate head of 289 ft. (88 m.). All of these powers have ponds of considerable area, most of them with comparatively high heads so that the ponds may be drawn down several feet. As the distance between them is considerable, it is possible that stored water on the Connecticut River would be used with not more than 25 per cent waste. On this basis for the use of stored water and its value as before, an investment of 90 cents per 1,000,000 cu.ft. per foot of fall would be warranted, or about $260 per 1,000,000 cu.ft. of storage. On the Merrimac River probably 250 ft. (76 m.) of fall would benefit by storage on the headwaters, and not over 35 per cent of wastage should be necessary, thus warranting an expenditure of about 80 cents per 1,000,000 cu.ft. per foot of fall, or about $200 per 1,000,000 cu.ft. storage.

Nearly all the fall of the Deerfield River, both developed and undeveloped, is controlled by the New England Power Company, which has already developed some storage. The developed fall amounts to about 500 ft. (150 m.) with approximately the same amount of undeveloped fall. In this case practically no wastage would be necessary and an expenditure of about $1,200 per 1,000,000 cu.ft. would eventually be warranted for storage on this river.

Storage reservoirs are of the least value on relatively small rivers having low falls, small millponds and a diversity of ownership. They are of greater value on the large rivers which use the water under comparatively high heads, with large millponds capable of controlling the daily fluctuation in the use of water. They are of maximum value on rivers using the water under higher heads than usual, where the millponds are large enough to regulate the daily use of water and where the interests are all under one control. From a conservation standpoint, storage developments might be warranted where they would not be justified for power alone, in which case a part of the expense should be borne by the state or federal government and not all put upon the power owners. Many existing water-power plants could be redeveloped along modern lines at reasonable cost for increased efficiency. An additional opportunity for conservation exists through interconnection of power systems so that the wastage of ten-hour power may be used in twenty-four-hour plants. In many plants considerable expenditure would be required to electrify the existing mechanical equipment.

End the German Evil—Buy Bonds

CALIFORNIA COMPANY IS TO USE NATURAL GAS FOR FUEL

San Joaquin Light & Power Corporation Builds 26-Mile Line to Supply Bakersfield Steam Plant Which Has Used Fuel Oil

During the latter part of August, 1918, the San Joaquin Light & Power Corporation, Fresno, Cal., completed a 26-mile (42-km.) natural-gas line to supply fuel to its Bakersfield steam plant. The completion of this line inaugurates a very practical war saving measure in that natural gas will be used under the boilers of the steam plant instead of fuel oil as in the past.

The natural gas is purchased from the Midway Gas Company and comes from the Midway (Cal.) oil fields. The gas company was organized in the beginning to supply natural gas to the city of Los Angeles and operates a 12-in. (30-cm.) pipe line from the Midway field to Los Angeles for that purpose. Natural gas is collected from the wells in the Midway field and compressed in a compressor plant up to a pressure of from 250 lb. to 300 lb. per square inch (17.5 kg. to 21 kg. per sq.cm.) at which it enters the pipe line for Los Angeles.

The San Joaquin pipe line consists of pipe 6 in. (15.2 cm.) in diameter, the joints of which are butt-welded by the oxyacetylene process. No flanges or screw joints are used on the entire line. The connection to the Midway Gas Company's 12-in. line is made at a point 26 miles from Bakersfield, and the 6-in. main is carried from that point to the steam plant.

It is expected that approximately 6,800,000 cu.ft. (190,500 cu.m.) of gas per twenty-four hours can be delivered at the 250 lb. to 300 lb, pressure through the 6-in. main to Bakersfield. Using an equivalent figure of 6000 cu.ft. (208 cu.m.) of gas to one barrel of fuel oil, this shows a saving of over 1100 barrels of oil per twenty-four hours when the pipe line is working at its full capacity.

The battery of boilers at the Bakersfield plant consists of four 325-b.-hp. and eight 603-b.-hp. units. The four smaller ones were originally provided with gas burners, but the eight larger units so far have been equipped only for the burning of fuel oil. Gas for burning under the four gas-fired boilers was purchased from the Valley Gas Company, which supplies natural gas from the Midway field for use in the city of Bakersfield. The quantity available for these boilers, however, has been a very variable quantity in the past, and the company decided to install a line of its own in order to make the fuel supply more dependable and also to extend gas firing to all boilers at the plant.

A pressure governor at the plant steps down the pressure from the pipe line to about 50 lb. to the square inch (3.5 kg. per sq.cm.), but this pressure is again reduced at the burners to from 0.75 lb. to 2 lb. (0.05 kg.

to 0.14 kg.) to the square inch. The oil burners have been removed, but no change in the furnace is required for burning gas, so it is always possible to change back to oil firing in case of failure of the gas supply. This change can be made on one-half hour's notice.

The entire pipe line was laid in approximately seventy days. Welding was begun by experienced welders, but before the job was finished the work was being done by Mexican day laborers. No serious trouble was encountered, except that a piece of defective pipe blew up when tested out with full pipe-line pressure, but this was not due to any fault of the welding.

Not only does the burning of gas at this plant furnish a good war saving measure, in that it allows a considerable quantity of oil to be used for war purposes, etc., but it also shows a substantial financial saving to the company. Two years ago fuel oil was purchased for use at the Bakersfield steam plant at 50 cents per barrel. The price now has risen to almost $2 per barrel.

Does It Thrill You?—Buy Bonds

BOSTON EDISON OPERATIONS UNDER THE WAR CONDITIONS

Cost of Coal Averaged 53 per Cent More per Ton, but by Skillful Operations Kilowatt-Hour Cost Increased Only 20 per Cent

Operating results on the Boston Edison system for the year ended June 30, 1918, afford an interesting example of the effect of war conditions upon the business and handling of a large urban central station.

Compared with 1917, the cost of coal averaged 53 per cent more per ton, yet through skillful operation the manufacturing cost per kilowatt-hour increased only a fraction over 20 per cent. The actual average coal costs per ton were $5.75 and $3.76, and the system manufacturing cost per kilowatt-hour, including labor, fuel, water and supplies, was 8.73 mills in 1918 and 7.27 mills in 1917. A better measure of plant efficiency is the coal consumption per kilowatt-hour generated, which was 1.95 lb. for 1918 and 2.005 lb. the year before. On this system the substations are operated by the generating department, and the net production cost at the company's principal plant is actually lower than is indicated above from the figures drawn from the company's return as a whole. During the past year the company consumed 232,225 long tons of coal, compared with 223,438 the year before. The total kilowatt-hours generated in 1918 were 267,646,180, against 249,235,384 in 1917.

At the beginning of the summer the company had on hand about two months' supply of coal in 1917, but on account of the shortage of last winter it started the summer of 1918 with but four weeks' supply in hand. Vigorous efforts have been made this past summer to accumulate coal to meet the forthcoming winter load, and with some co-operation from customers at the time of the peak in the winter months it is expected that the loads can be carried satisfactorily. In common with other central stations in New England, the company is not actively seeking new business, but is making every possible effort to handle the war service which it is constantly being called upon to supply. Some of the most important army and navy plants in eastern Massachusetts are now operated on central-station service.

In 1918 the total income from sales of electrical energy was $9,623,605, or 4.75 cents per kilowatt-hour sold. The company's service was rendered at a lower average price to the community than in 1917, notwithstanding the fact that its total expenses increased from $5,457,924 to $5,769,449 in the period. The average income per kilowatt-hour was 5.03 cents in 1917. Even in power sales the customers received a lower average unit price, namely, 2.69 cents in 1918 against 2.98 cents last year. The principal increase in energy sales came in the power business. In 1917 the company sold 63,595,719 kw.-hr. for power only, and this year it sold 83,385,453 kw.-hr. for power service exclusively. The street railway consumption fell off about 700,000 kw.-hr., and the revenue from street lighting dropped off somewhat. The company succeeded in cutting down its distribution expenses by about $39,500 this year and reduced its office and management costs by about $102,000.

Good management is reflected in the increase of the system load factor from 35.8 per cent in 1917 to 37.2 per cent this year and in the improvement of the ratio of the connected load to the yearly peak. Last year the connected load was 3.46 times the peak; this year it was four times the peak. Doubtless the development of the industrial war load is a vital factor in this result, but there has clearly been a creditable selection of business from the standpoint of available facilities.

COMPARATIVE DATA BOSTON EDISON COMPANY

	1918	1917
Average income per kw.-hr. sold, cents	4.75	5.03
Average income per kw.-hr. power sales, cents	2.69	2 98
Cost of manufacture per kw.-hr. generated, cents	0.873	0.727
Pounds coal per kw.-hr. generated	1.95	2.005
Average cost of coal per ton	$5.75	$3.76
Average cost of coal per kw.-hr.	$0 005	$0.0034
Income per kw. connected load	$28.70	$33.20
Ratio, connected load to yearly peak	4 to 1	3.46 to 1
Income per customer	$91.50	$96.00
Total income from sale of electricity	$9,623,605	$9,235,778
Income from commercial lighting	6,191,153	6,143,310
Income from street lighting	874,134	885,296
Income from power sales	2,241,472	1,897,286
Income from street railway power	200,072	202,147
Income from energy sold other companies	116,771	107,737
Total expenses	5,769,449	5,457,924
Expenses of manufacture	2,336,146	1,814,533
Expenses of purchased energy	34,692	22,263
Expenses of distribution	1,103,167	1,142,663
Expenses of offices and management	1,094,471	1,196,032
Taxes	938,178	1,022,564
Miscellaneous	262,793	259,866
Dividends declared, total per cent	12	12
Dividends declared, amount	$2,703,360	$2,703,066
Kw.-hr. generated	267.646.180	249,235,384
Kw.-hr. generated and purchased	273,102,645	252,732,114
Kw.-hr. sold by company	202,481,467	183,642,995
Kw.-hr. sold for power only	83,385,453	63,595,719
Kw.-hr. sold for street railways	10,699,780	11,437,494
Maximum load in fiscal year, kw	83,966	80,539
Coal used in year, tons	232,225	223,438
Coal cost per ton, average	5.75	3 76
Number of employees	2106	2186
Total connected lighting load, kw	149,258	141,246
Total connected load in kw	335,198	278,051
Total number customers	105,011	97,323
Coal on hand June 30, tons	22,241	40,885
Average load in kw	31,200	28,840
Yearly load factor in per cent	37.2	35 8

In recent years the growth of business has led to a continual increase in the number of employees, but this year the company lists 80 fewer persons on its payroll, the 1918 total of employees being 2106. The average load throughout the entire year was 31,200 kw. in 1918 and 28,840 kw. in 1917, and the number of customers increased during the past year from 97,323 to 105,011. The income per customer was $96 in 1917 and $91.50 this year. The company declared the usual 12 per cent dividends.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Electrical League of Cleveland.—The regular Thursday meeting of the Electrical League of Cleveland was held Oct. 10 at the Statler Hotel. Congressman H. I. Emerson spoke on the topic "War-Time Washington."

San Francisco Electrical Development League.—At the luncheon of this league on Sept. 25 an address was given on "The Mons Retreat" by Sergeant Fred Greene of the Canadian Expeditionary Forces, recounting his personal experiences.

Institute of Radio Engineers.—On Oct. 9 the Institute of Radio Engineers held a meeting at the Engineering Societies Building, New York City, at which a paper was presented by Dr. Edwin F. Northrup, Princeton University, on "Special Heating Effects of Radio Frequency Current."

Technical Publicity Association.—The October meeting of the Technical Publicity Association held Oct. 10 in New York City was addressed by George F. Lord, director of advertising, Du Pont de Nemours Company, on "Advertising in War Times." Roy F. Soule, editor of *Hardware Age*, spoke on "Force to the Utmost."

N. E. L. A., Philadelphia Section.—On Tuesday, Oct. 1, the Philadelphia Section of the National Electric Light Association held its first meeting of the year. It has been decided that the first Tuesday of each month will be given over to the main or general section meeting. The second Tuesday will be given to the meter department, the third to the engineering department, and the fourth to the commercial department branch of the section.

A. S. M. E.-Indianapolis Section, A. I. E. E.—The council of the American Society of Mechanical Engineers meets in Indianapolis on Oct. 25 and 26, and in connection with this meeting an elaborate gathering of the Indianapolis, Cincinnati, St. Louis, Chicago, Milwaukee, Detroit and Cleveland sections has been arranged. The Indiana Engineering Society, the Indianapolis-Lafayette Section of the A. I. E. E. and the Indianapolis Section of the American Society of Automotive Engineers have also been invited. The headquarters of the meeting will be the Claypool Hotel, where also the two professional sessions scheduled and the committee meetings will be held. Members intending to go to Indianapolis should get in touch with their local committee and secure reservations. The program includes symposiums on fuel conservation and research.

Jovian League of Kansas City.—At its annual meeting held Oct. 1 the Jovian Electric League of Kansas City elected the following officers: President, W. M. Hand, manager General Electric Company; secretary-treasurer, J. D. Todd, manager Missouri Valley Electric Company.

National Safety Congress.—"Ways and Means of Reducing Industrial Accidents and Conserving Man Power in the Strenuous Times of War" were discussed during the week of Sept. 16 at St. Louis, where several hundred safety engineers, works managers and insurance men met in convention at the National Safety Congress. Among the speakers was Charles M. Schwab of the Emergency Fleet Corporation, Dr. Thomas Darlington of the American Iron and Steel Institute and Frank E. Norris of the American Rolling Company.

International Association of Municipal Electricians.—An address by A. M. Schoen, engineer of the Southeastern Underwriters' Association, was a feature of the convention of the International Association of Municipal Electricians held Sept. 25 at Atlanta, Ga. The subject of Mr. Schoen's address was "The Application of Science and Engineering to the War." Other papers at the meeting were on "Municipal Safety Rulings," by A. MacLachlan of Detroit, and "The History and Development of the Fire-Alarm Telegraph," by J. B. Yeakle, superintendent of fire alarm at Baltimore, Md. The convention was also addressed by Morton G. Lloyd of the National Bureau of Standards, A. L. Pierce of Wallingford, Conn., R. A. Smith of Norfolk, Va., and Major K. B. Ferguson of the British Royal Artillery.

A. I. and S. E., Philadelphia Section.—The program for 1918-19 of the Philadelphia Section, Association of Iron and Steel Electrical Engineers, has been announced as follows: Oct. 5, "Electric Furnaces," by George H. Schaeffer, Carpenter Steel Company, Reading, Pa., and I. B. Lindemuth, Bethlehem Steel Company. Nov. 2, "The Employment of Female Labor in the Electrical Departments of Large Industrial Works"; a general discussion in which prominent engineers have been invited to take part. Dec. 7, "Plate-Mill Drive," by G. E. Stoltz, Westinghouse Electric & Manufacturing Company. Jan. 4, 1919, "Machine-Tool Drives," by H. W. Tice, Bethlehem Steel Company. Feb. 1, "Electrical Features of Hog Island," by John H. Anderton and H. W. Osgood, American International Shipbuilding Corporation of the United States Emergency Fleet. March 1, a joint meeting with the American Institute of Electrical Engineers; lecture by Dr. W. S. Franklin, Massachusetts Institute of Technology. April 5, "Power Transmission," by H. B. Vincent, of Day & Zimmerman, Inc., Philadelphia. May 3, general discussion. June 7, annual outing. The meetings will be held in the Engineers' Club.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

California Rate Increase.—The California Railroad Commission has authorized the East Counties Gas & Electric Company, Santa Cruz, to increase electric rates on account of higher costs. The advance is 1.5 cents per kilowatt-hour for energy sold for lighting purposes, 0.5 cent per kilowatt-hour for energy sold for power purposes, an increase of 10 per cent for energy sold for street lighting and an increase of 20 per cent for energy sold for railway purposes. The increased charge will be shown separately on the bills. The surcharges apply on all regular meter readings taken on and after Sept. 20. The increase is due to increased cost of material of all kinds and wages. During the last few months the company has also had to generate a great deal of power by oil on account of the shortage of hydroelectric power in central California due to the very dry winter. As indicative of its increase in cost of material, the company now pays in Santa Cruz County $2 per barrel for oil, whereas one year ago the company was able to purchase this commodity for 79 cents a barrel.

Higher Costs Held to Be Offset in Part.—Regarding increased operating costs, the Illinois Public Utilities Commission says in part, in approving higher rates for the Central Illinois Light Company, Peoria: "It appears that the increased cost at present prevailing for fuel alone over that which prevailed in 1916 is at least 0.25 cent per kilowatt-hour, and it further appears that the increase of total production expense has equaled approximately the increased fuel cost. While expenses other than fuel which are involved in production expense have doubtless increased over those which would have prevailed under similar conditions in 1916, it is probably true that these other increases have been absorbed by the increased output which the company has realized due to the increased loads of the manufacturing interests in Peoria. These increased loads have been very material in character, with the result that the company because of them has largely increased its output and thus has been able to assimilate the increased expenses other than fuel to an extent such that, upon a kilowatt-hour basis, these other expenses have not shown a material increase. These facts have also, of course, operated to a similar extent in the distribution expense and general expense incurred by the Central Illinois Light Company."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Rate Increase in California.—The Railroad Commission of California has authorized an increase in electric light and power rates by the Western States Gas & Electric Company, Eureka division.

Lightless Nights Continued in California.—Lightless nights, which were originally intended to be in effect for August and September only, will be continued indefinitely, according to a recent announcement made by Albert E. Schwabacher, California Fuel Administrator. Electric displays on Saturday and Sunday nights, however, will be permitted as heretofore.

Electrical Tricycles Wanted for Wounded Soldiers.—Consul H. D. Van Sant, writing from Dunfermline, Scotland, says that efficient hill-climbing electric tricycles or motors for use by wounded soldiers would meet an urgent need and that if such a machine were ready at the close of the war the sales reached would be beyond any figures yet reported. It is suggested that the price should be below $500.

Rate Increase in Worcester, Mass.—The Worcester (Mass.) Electric Light Company has notified consumers that, owing to increased cost of coal, labor and material entering into the manufacture and distribution of electricity, it has become necessary to make an increase in the power price, effective on all bills rendered on and after Dec. 1, 1918. This is to take the form of a surcharge of 5 mills per kilowatt-hour, which will be added to the regular monthly bill. This surcharge will be discontinued when pre-war conditions prevail.

Revised Central Station List.—The McGraw Central Station List for 1918 has just made its appearance. The present volume contains 800 pages and lists 5776 companies in the United States, Canada, Mexico, West Indies, etc. More than 15,000 changes have been made in the new edition, which, besides giving the officers and equipment of central stations, has statistics on the total number of private and municipal plants, companies selling supplies, companies having day service and towns with a population under 1000 getting electric service elsewhere, information on the state commissions and an index to stations whose names do not indicate their location.

War Service Directory of Electrical Manufacturers.—An official directory of electrical manufacturers, covering both apparatus and supplies, has been issued by the General War Service Committee of the Electrical Manufacturing Industry in co-operation with all of the group committees engaged in war service. It includes, so far as these committees have been able to gather the information, the name and address of every manufacturer in the United States of products so far identified with the war service organization of the electrical industry. The directory was prepared to enable departments, bureaus and other divisions of the federal government to locate readily all manufacturers of any required electrical apparatus or supplies.

Manufacturing Power Plant for War Needs.—The War Department authorizes the following statement: The Construction Division has been authorized to erect a 4000-kw. power plant with all the necessary equipment for the Milton Manufacturing Company at Milton, Pa. This company is manufacturing supplies for the army, and its present power equipment is inadequate to meet the urgent demands. The estimated cost of the buildings and equipment is $350,000. The Milton Manufacturing Company will eventually take over this power plant, paying for it by deducting a certain price per shell in future contracts. In the event that this method of payment does not meet the cost, provision is made to repay the balance within two years after the cessation of hostilities.

Consolidation of Niagara Companies.—Under the plan of consolidation of the Niagara Falls Power Company, Hydraulic Power Company and Cliff Electrical Distributing Company, the Niagara Falls Power Company is to be formed in New York with $26,000,000 authorized stock. The $5,757,700 outstanding stock of the present Niagara Falls Power Company is to be exchanged for $11,515,400 preferred and $984,566 common in the new company, the $500,000 Cliff Electrical Distributing Company stock for $540,000 new common stock, and the $12,000,000 Hydraulic Power Company stock for $12,960,000 new common stock. In compliance with the New York law, the stock "does not exceed the aggregate of the outstanding capital stocks and the surpluses and undivided profits of said corporations."

Great Fuel Saving in Connecticut.—The administrative engineer of the Bureau of Conservation, United States Fuel Administration, in Connecticut reports that those industrial plants which have furnished answers to the fuel-saving questionnaire are in a majority of cases making the changes suggested in the power-plant recommendations. Eighty plants, consuming for the year ended May 1, 1918, practically 337,000 tons of coal, as a result of the conservation changes suggested will save at least 15 per cent, or more than 50,000 tons of coal, annually. This state had previously reported from similar sources an annual coal saving of approximately 31,000 tons. The administrative engineers in Michigan, Kansas, Georgia, North and South Carolina and Florida have reported marked savings of coal in industrial plants as a result of the practical demonstrations of conservation.

Power Restrictions Removed in California.—Restrictions in the use of power by gold dredgers, cement plants and sand, gravel and crushed-rock plants were entirely removed by the Power Administrator of California, H. G. Butler, on Sept. 30. Mr. Butler explains that the order will stand for at least thirty days from that date. It was possible to remove the restrictions because the rains of two weeks ago and heavy mountain rains in the last three days, together with the large decrease in rice and other irrigation, has relieved the reservoir situation considerably. Mr. Butler said that if there were no additional rains within the next thirty days it was probable the restrictions of the past, which have extended since the middle of July, would have to be reimposed. The gold dredgers are pronounced essential industries by the federal government. The cement plants and sand, gravel and crushed-rock plants were not declared essentials, but the restrictions imposed by the government on construction are such as to reduce these industries to a minimum so that their use of power will not be great.

Organized Purchasing in France After the War.—Discussing the importance of collective selling in industrial reconstruction in France, Pierce C. Williams, United States commercial attaché at Paris, writes that the American manufacturer should prepare for a revolutionary change in French methods of purchasing when the war ends. Instead of selling to thousands of individual buyers the materials each will need to rebuild his destroyed or damaged factory, the American manufacturer will deal with a small number of central purchasing agencies, representing groups of French manufacturers engaged in the same or related industries and assisted by the credit of the French government. Unless, therefore, the American manufacturer prepares for coöperative selling he may be under a serious handicap as far as furnishing industrial assistance to France after the war is concerned. Scattered American selling efforts will not be able to meet the requirements of the huge purchasing power of several thousand French consumers exercised through state-aided buying organizations. Estimating the cost of construction before the war of a few of the industries of northern France that are known to have suffered most, Mr. Williams mentions: Central electric stations and distribution, 300,000 kw., 250,000,000 francs: machinery and electrical manufacturing plants, 500,000,000 francs. In 1915 the Central Association for the Restoration of Industrial Life in the Invaded Regions was organized. One of the four groups in this covers mining, metallurgy, heavy machinery and electrical construction.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

Frank B. Steele, power engineer of the Dayton Power & Light Company, resigned on Oct. 1 to become associated with the Charles M. Kelso Company, industrial engineer and contractor, Dayton, Ohio. Mr. Steele was graduated from the Virginia Military Institute in the electrical department in 1905 and later from the George Washington University of Washington, D. C., with the degree of E. E. After completing the two-year engineering apprenticeship course with the Westinghouse Electric & Manufacturing Company he was promoted to be construction engineer, making installations of power plants and substations, particularly on property of the United States government. Later he was a coal operator in West Virginia for three years prior to coming to Dayton, and during the last five and one-half years he was connected with the Dayton Power & Light Company as power engineer. He was a member of the new-business committee of the Ohio Electric Light Association in 1916 and 1917 and chairman of the power and heating section in 1918.

F. B. STEELE

Henry R. Stevens, formerly of the firm of Stevens & Rockwell, consulting engineers, Seattle, Wash., has become electrical engineer for the Stone & Webster Engineering Corporation, Seattle Division.

Robert A. Bachman, for many years connected with the Edison Storage Battery Company, West Orange, N. J., as vice-president and general manager, is now engaging in an executive capacity for the Wright-Martin Aircraft Company, with headquarters at Long Island City, N. Y.

Dr. A. E. Kennelly of Harvard University and the Massachusetts Institute of Technology has recently returned from a trip overseas during the summer on special duty for the United States Army Signal Corps. Dr. Kennelly was appointed civilian liaison officer in the Signal Corps early in June, and after having completed his military duties has returned to Cambridge, Mass.

J. C. McClendon, formerly new-business manager of the Lorain County Electric Company at Elyria, Ohio, has been transferred by the Doherty Organization to a similar position at Lorain, succeeding W. E. Quillin.

W. D. Hart, formerly district superintendent of the Illinois Northern Utilities Company at Belvidere, Ill., has been appointed general contract agent for the Illinois Northern Utilities Company at Dixon, Ill., to succeed D. C. Yontz, resigned.

George H. Smart, whose resignation as commercial manager of the Knoxville (Tenn.) Railway & Light Company was noted in the ELECTRICAL WORLD of May 4, 1918, is now manager of the Nebraska Gas & Electric Company, West Point, Neb.

Louis D. Gibbs, superintendent of the advertising department of the Boston Edison company, has been given a leave of absence to become associated with the statistical division of the War Industries Board, with headquarters at Washington. Mr. Gibbs is a past-president of the New England Section of the National Electric Light Association.

James T. Hutchings, vice-president and general manager of the Rochester (N. Y.) Railway & Light Company, has been appointed a member of the State Advisory Board in the United States Employment Service organization and as such will assist in the government labor distribution program. Mr. Hutchings was recently elected a director of the lighting company.

George L. Erwin has been appointed district manager at Grand Rapids, Mich., of the Consumers' Power Company, succeeding the late Samuel A. Freshney. Mr. Erwin was at one time president of the Grand Rapids Edison Company and manager of the Grand Rapids-Muskegon Power Company. In 1912 he became associated with the Michigan United Traction Company, with headquarters at Kalamazoo.

Obituary

William J. Waltham, a member of the electrical manufacturing firm of Henry Cole & Company, South Boston, Mass., died at Boston Oct. 7 as the result of an automobile accident. He was born in Chicago forty-three years ago and was a graduate of the Massachusetts Institute of Technology in the class of 1896.

Ely H. Norris, Morristown, N. J., superintendent of the test department at the plant of the Edison Storage Battery Company, West Orange, N. J., died on Oct. 6 at the Morristown Hospital, of pneumonia, aged twenty-seven.

Theron Pardee, who until his resignation in July to enter the Officers' Training Corps at Columbus Barracks, Ohio, was in charge of sales of automobile batteries in the Chicago office of the Electric Storage Battery, died of pneumonia on Oct. 5 at Camp Humphreys, Va., where he had been transferred to the Engineer Officers' Training School. Mr. Pardee was a graduate of the Lewis Institute, Chicago, and had been in the service of the company for three years.

Robert B. Corey, president of the R. B. Corey Company, New York City, and one of the pioneers in the supply sales branch of the electrical industry, died at his home in Plainfield, N. J., on Oct. 7 at the age of fifty-seven years. Mr. Corey, who had a host of friends, was particularly well known for his efforts to stabilize the electrical industry, to which work he devoted considerable time. "Bob" Corey, as he was familiarly known, will be genuinely missed at all meetings where electrical manufacturers or supply jobbers are wont to congregate. Mr. Corey was born in 1861. He entered Yale College with the class of 1882, but left before graduating to become associated with his father in the banking business in Bradford, Pa. In 1899 he entered the electrical industry as general manager of the Electrical Construction & Supply Company, New York. It was during his connection with this concern that he developed and placed on the market the Ward constant-potential arc lamp. He later went into business for himself under the firm name of the R. B. Corey Company. Mr. Corey was a member of a number of clubs and associations, including the Engineers' Club, the Machinery Club, the Plainfield Country Club, the Building Trades Association and the Merchants' Association of New York.

R. B. COREY

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

PRIORITIES ON EMPLOYED LABOR ARE DISCUSSED

Manufacturers of Dry Cells Meet Labor Board to Determine on Labor Assistance for One Plant Engaged on Important War Contracts

An interesting discussion on labor priorities, the first of its kind, was held last week in New York City under the direction of the New York branch of the United States Employment Service, Priorities Division, of which Dean Kirchway, Columbia University, is chairman. At that time the United Battery Corporation, which holds contracts for over a million dollars' worth of dry-battery parts for the Aircraft Production Board, stated that it was short of skilled labor and found that unless assistance was given in securing this labor it would be impossible to meet the government requirements on deliveries.

All of the other manufacturers of dry cells in and around New York were invited to appear before the Labor Priorities Board for a hearing. At this time it was shown that the battery parts were sent to France, where they were assembled. The parts had to meet certain other materials from the Middle West for shipment abroad at the same time, and consequently sufficient labor had to be supplied to meet these definite delivery dates.

The Priorities Board did not feel that it wanted to take men from other battery manufacturers, not having government contracts, except as a last resort. It was suggested by the board that a portion of these contracts should be placed with other manufacturers in such a way that delivery dates could be met without disturbing the personnel of the manufacturers. Some of the manufacturers at the conference readily agreed to this proposal. The matter is now under consideration at Washington.

Is case this is not found feasible by the Aircraft Production Board, then the Labor Priorities Board will find it necessary to request other manufacturers of dry cells to supply the United Battery Corporation pro rata, according to size and according to non-war production, with skilled workers. Thus those plants having the least essential production will be asked to contribute more heavily than the others to make up this labor deficiency.

"Our Country, 'Tis of Thee—"

JULY ELECTRICAL EXPORTS REACH A TOTAL OF $5,393,949

Motor Shipments Have Record Value of $943,006— Large Tungsten-Lamp Exports Also Figure in the Returns

Exports of electrical merchandise during the month of July last amounted to $5,393,949. This figure, while large in itself, is all the more surprising because of the extent to which shipping was utilized for war purposes.

Certain items stand out in the month's total. More so than any others is the item of motors, of which $943,006 worth were exported during July last. Another item is that of tungsten lamps, which had a value of $309,919 compared with $198,637 in July, 1917. Although this is more than 50 per cent increase in value, the total number of lamps exported was only 25 per cent more than in July of 1917.

During the first seven months of the current year the value of electrical exports amounted to $33,270,714 as compared with $32,428,145 in the first seven months of 1917 and $19,934,888 in the corresponding period of 1916. Based on the figures for the first seven months of the current year as printed here, the exports of electrical merchandise, should the same average be maintained for the balance of the year, are calculated to reach $56,600,000. While this figure is slightly larger than the record of 1917, it is exceedingly doubtful if the volume of goods exported will be as large. During the past year there have been numerous increases in the price of electrical products, and this condition should be carefully kept in mind when making comparisons of values. However, it is probably true that the volume of exports is greater to-day than prior to the war.

The accompanying figures were compiled from the regular monthly report of the Bureau of Foreign and Domestic Commerce.

	July		Seven Months Ended July	
Articles	1917	1918	1917	1918
Batteries	$290,312	$240,640	$2,137,716*	$1,815,658
Carbons	102,828	100,098	102,828	885,509
Dynamos and generators	96,057	283,407	1,456,192	1,937,064
Fans	41,245	105,823	379,036	651,971
Heating and cooking apparatus	23,295	64,823	23,295*	342,278
Insulated wire and cables	357,953	477,448	4,328,048	2,989,129
Interior wiring supplies, including fixtures	119,994	135,221	753,126	894,854
Arc lamps	1,962	524	11,736	7,188
Carbon-filament lamps	23,349	6,775	112,530	56,617
Metal-filament lamps	198,637	309,919	1,629,525	2,038,848
Magnetos, spark plugs, etc.	269,941	151,821	269,941*	1,561,298
Meters and measuring instruments	68,630	236,019	626,320	1,172,626
Motors	411,687	943,006	3,693,938	4,326,199
Rheostats and controllers	14,201	18,730	14,201*	137,177
Switches and accessories	177,052	186,086	177,052*	1,390,106
Telegraph apparatus, including wireless	14,100	30,710	404,909	160,113
Telephones	180,937	296,970	1,269,936	1,740,661
Transformers	112,022	287,459	854,679	1,626,200
All other	1,325,164	1,518,470	14,183,137	9,537,218
Total	$3.829,366	$5,393,949	$32,428,145	$33,270,714

* Figures cover period beginning July 1.

Do You Help the Men Over There?

SMALL-ORDER BUSINESS IS DECREASING IN AMOUNT

Number of Orders on Jobbers' Books Is Smaller than Last Year, but Volume of Sales Is Practically the Same as Then

Data compiled on the volume of business done by electric supply jobbers in the first nine months of 1918 permit an observer to draw some interesting conclusions. The actual number of orders is less than for the same period of 1917, while the volume of sales is practically the same. Two causes may be assigned for this, namely, that the jobbers' plea to customers to reduce the amount of small-order business has been effective and that government activities are of such a nature as to centralize purchasing power in the hands of the "bigger buyers." Among the jobbers who have analyzed the data the first reason of the two is considered the more important. These wholesalers claim to have noticed many individual cases wherein contractors and central stations are coöperating with the jobbers to reduce the small-order evil. Not much assistance, however, is expected from industrial plants, principally for the reason that they buy largely on requisition.

THE WEEK
IN TRADE

NO REDUCTION in the peak demand for electrical goods can be noticed. The difficulty of supplying this demand, however, is becoming much greater. Stocks generally are lower, and the curtailment of output in many lines will naturally heighten this condition. War business is dominating the industry, and as stocks of non-war material become lower the industry will approach the 100 per cent war-work mark. In the meantime those supply men operating in districts free from war demand will, unless stocks can by some means be kept up, be obliged to suffer a reduction in volume of business.

The Spanish influenza is making considerable inroads upon the industry. Production has as a result suffered, and distribution has been slowed up somewhat. As a result of the epidemic the jobbers' convention scheduled for next week has been postponed.

Prices are still virtually stationary. Collections appear to be holding up well at present.

NEW YORK

Business in the past week has been particularly brisk. Stocks on hand in nearly all lines are exceedingly low. The War Industries Board, as part of the general program for the conservation of material, labor and transportation, has placed additional curtailment on the manufacture of articles not essential to the prosecution of the war and announced on Oct. 10 that during the six months' period from Oct. 1 the manufacture of electric heating appliances will be curtailed to 50 per cent of six months' production during 1917. This, coming as it does on a market practically bare of these stocks, is bound to create an acute shortage. The influenza epidemic in many cases is proving a serious factor in slowing up production. Health officials appear to have checked the disease in the East, and it is hoped that it has nearly run its course.

RADIATORS.—An acute shortage of radiators and all heating appliances has suddenly developed in the market owing to the greatly increased demand caused by the epidemic of influenza and by the recent cold weather. Distributers' stocks on hand are now very low, and deliveries are from five to six weeks behind time.

VACUUM CLEANERS.—Demand in the past six weeks has been very brisk and stocks on hand are very low. Shipments are from a month to six weeks behind. Prices remain about the same with the large dealers. Some slight advances have been made by some of the smaller manufacturers.

WASHING MACHINES.—Owing to the problem of domestic help the washing-machine demand is still increasing. Stocks on hand are very low and shipments poor. Prices have not been advanced in the past month by the large makers, but discounts have shortened.

IRONING MACHINES AND MANGLES.—Demand has heightened during the past month with an advance of about 10 per cent in price. Production has been greatly curtailed for lack of metal essentials, and shipments are very slow, deliveries being about six weeks behind.

ELECTRICAL TOYS.—The manufacture of electrical toys is practically at a standstill through the difficulty of obtaining metal. Only those who had supplies on hand can deliver. No new contrivances are being brought out now, and the industry has turned its attention almost wholly to war work. Stocks on hand in some lines are fair, and prices have not been advanced since last August, when they increased 30 per cent.

LIGHTING FIXTURES.—Large war orders for glass placed with the manufacturers of lighting fixtures have curtailed the output of bowls, basins, shades, etc., considerably. In fact, the production of many decorative styles has ceased entirely. Stocks on hand generally speaking are low. Prices on lighting fixtures have been steady for some time.

FUSES.—Stocks on hand, so far as could be learned, are low, and one jobber reports that it is extremely difficult to fill orders.

PORTABLE LAMPS.—The demand is increasing. There was a slight advance by jobbers last week on the price of table lamps.

SOCKETS.—Business continues good. Supplies on hand are low and shipments are delayed. Few deliveries are being made outside of war orders.

MOTORS AND GENERATORS.—The large manufacturers of motors report an exceedingly good demand. Shipments are slow and stocks on hand pretty well exhausted. No price changes have occurred in the past month.

WIRE.—The situation in bare and weatherproof wire remains practically the same with no price changes since last month.

INSULATION.—The epidemic of Spanish influenza is being felt seriously in the industry. In one plant 50 per cent of the force were sick, and in another instance a plant had to close down for two days. No price change is reported since Sept. 15.

CONDUIT.—There has been no change reported. Conditions governing metal molding are practically the same as for iron pipe. Manufacturers report they cannot supply the demand and that stocks are very low. Only priority orders are being filled at this time. Prices of conduit have not advanced recently.

CHICAGO

It is considered a misfortune that the jobbers' convention at Cleveland called for Oct. 21, 22 and 23 had to be postponed on account of danger from the influenza. This meeting was expected to clear up many troublesome questions on the "pledge system." The chief job of the jobbers' sales-manager now is to answer the queries of salesmen and customers who want to know if such-and-such a product can be sold to Mr. So-and-So to use in a certain way. Jobbers are beginning to express a desire that some of the manufacturers publish in their trade advertising "copy" of a sort which will help educate the dealer as to what is a proper and what is an improper retail function. The statement is made that it is becoming harder to do business every day, not because the material situation is basically worse, but because of the extraordinary amount of education necessary in the trade.

TOOLS.—Heavy tools, such as shovels, pike poles, etc., have advanced about 20 per cent in price.

TELEPHONE WIRE.—On account of the government's demand for small wire the price of telephone wire has increased.

RUBBER-COVERED COPPER WIRE.—This class of wire is scarce to a point which has had a tendency to increase the price. The situation is said to be really critical in No. 14 single-braid. The cause for the scarcity can be readily understood when it is stated that the government has stated it wants 25,000 miles of outpost wire every month for one year. To produce this amount the machines of thirty-two wire manufacturers have been placed on the job on a twenty-four-hour-a-day basis. One of the largest manufacturers of small-sized wires by placing all of his small braiding machines on the job twenty-four hours a day can only turn out 1000 miles a month. It is difficult to conceive of a single purchaser taking enough wire each month to encircle the earth once. That, however, is what is causing the scarcity. As the result of this some jobbers feel that any one who has a stock of rubber-covered wire is entitled to almost any price he sees fit to ask for it. This has been the basis of some price changes. Other jobbers have increased prices in order to hold their existing stocks for regular customers. Still others believe that they should sell what stocks they have at a fair profit and not try to take advantage of this bad situation to take an extra long profit. This difference in ways of viewing the problem has led to a rather scattered price situation.

WEATHERPROOF WIRE.—Weatherproof wire is on a 36-cent base, due entirely to the cotton prices. Stocks are plentiful.

BELL-RINGING TRANSFORMERS.—One manufacturer is producing 10,000 of these small units a month and is behind on orders. The increasing price of dry cells is looked upon as a large factor in creating demand for these goods. The output of toy transformers has been curtailed.

MICA.—A Chicago concern with six carloads of stock en route has already sold the entire lot. This is indicative of the conditions of supply and demand in this field.

FARM-LIGHTING PLANTS.—The business in both the retail electrical and retail automobile fields is reported to be good. Jobbers who sold large quantities of these plants to dealers in August just before a price increase are beginning to see the cash for them come in.

SPECIALTIES.—In this class of goods one of the best movers at present is the heat regulator, sales of which are mounting daily.

CONDUIT.—A customer with a good priority order can get conduit of almost any size by persistent shopping around. The shopping process is necessary, however.

BOSTON

The volume of trade continues to show a decided falling off compared with two weeks ago. The grip epidemic appears to have passed its height, and the outlook is now much more encouraging for the restoration of something like normal office and factory forces. Strenuous efforts on behalf of the fourth Liberty loan are being pushed to completion this week. Office staffs of jobbers and distributers are hard-pressed to fill business already on the books, and in many cases it is probably true that if no new orders were received for a month there would still be enough to occupy the time of jobbing organizations in meeting established needs. Prices are showing little change this week, but the friction tape supply is running short, and a further advance would not be surprising at any time. Jobbers are well stocked with slow-moving products and supplies and are running rather lower on fast-moving material. Collections are fair. Deliveries are better, though there is still room for improvement. A great deal of quiet campaigning for wiring material and fixture sales in connection with the government housing program is under way. Little is heard as yet about Christmas trade in jobbing circles, but it is expected that there will be some movement in fuel-saving appliances and in labor-saving equipment associated with the holiday season.

WASHING MACHINES.—Stocks are low and retailers could dispose of many more machines if available. The rationing system severely restricts sales, and in some cases the volume of trade is but 25 to 35 per cent of what might easily be realized if the machines could be had.

VACUUM CLEANERS.—These are moving well, but sales are considerably below the maximum. This is due to the limited supply of equipments rather than to a falling off in popular interest.

LAMPS.—Stocks are getting back to normal, barring a long-continued shortage in miniatures due to war requirements. One large manufacturer reports a stock of more than 1,000,000 lamps of diverse sizes and types at Boston. The governmental edict regarding metallized filament and carbon lamps is being well received. Practically all New England central stations have now discontinued free renewals of metallized-filament lamps. It is expected that a new tungsten lamp in two sizes, 25 watts and 50 watts, specially designed to meet the conditions of rough service, will soon be introduced into New England manufacturing plants.

MOTORS FOR TEXTILE PLANTS.—Business is reported to be in good volume, although not as much new work is being done as hitherto. Motor manufacturers are offering somewhat better deliveries, subject, however, to extensions by circumstances beyond their control. Prices show little change. There is not much accumulation of motor stocks at the factories, nor is there likely to be in the face of present demands for steel and cotton. Comparatively little so called "efficiency work" in the redesigning of textile-plant motor drives is being done at present, but trade is in good volume in motors specially designed for textile-plant service.

SCHEDULE MATERIAL.—Stocks are about normal at present.

RADIATORS.—The market continues oversold. A recently received consignment lasted the jobber into whose hands they went less than one day. The manufacturers will be busy for some time filling orders now on the books, and the existing shortage bids fair to become still more acute with the advent of colder weather.

WIRE AND CABLE.—Practically no rubber-covered wire in small sizes is now available for general marketing. Local prices on government orders are running at from $11 to $12.50 per 1000 ft. in No. 14. Delivery is the principal factor in the wire market. The government is buying immense quantities of outpost wire, and until these orders are filled the civilian trade must wait. Weatherproof wire is quoted at 32 to 35 cents, according to delivery. One recent order of No. 14 rubber-covered wire for outpost work totaled 1,000,000 ft. at $12.25 per 1000 ft. Jobbers are endeavoring to buy small wire for future use in some cases, but without much success.

FIXTURES.—Old-established houses report a fair business from long-time custom. Prices show little change. A good deal of "gumshoe work" is being done at present in connection with housing proposition orders, but neither jobbers nor dealers are inclined to announce their successes in bidding, probably because not a little competitive work is still to be awarded.

FRICTION TAPE.—The situation is getting acute, with increasing scarcity of material. The number of grades has been cut down about 50 per cent, at the suggestion of the government. White tape is no longer being produced in some plants. Prices are high and a further advance would not be surprising.

ATLANTA

On the whole the demand for all staples remains steady, and there is very little change to be noted in the past two weeks.

The Atlantic Refining Company, Philadelphia, has consummated a deal whereby one of the largest oil refineries will be established at Brunswick, Ga.

The Ocmulgee River, Georgia, on which the Central Georgia Power Company's plant is situated, has reached a very low stage, and a very drastic power curtailment order has been issued by the War Industries Board. Industries will be closed down from 7 a.m. to 10 a.m., and street cars will not be operated between 9 a.m. and 11 a.m. and from 1.30 p.m. to 6 p.m. A like order has been issued for Atlanta, where all industries using more than 5 hp. shall use power from 7 a.m. to 12 noon only. Opinions vary as to the effect of the passage of the so-called emergency power bill on power companies affected by drought.

The Georgia Railroad Commission has declined to take action on the Southern Bell Telephone Company's petition for an increase in rates, since the government took over the control of the company. The commission has allowed the Augusta-Aiken Railway & Electric Company to increase fares from 5 cents to 6 cents and the Montezuma Electric Company to charge 15 cents net per kilowatt-hour for energy. A petition from the Athens Railway & Light Company will be heard shortly.

The Alabama Public Service Commission has granted an increase in street-car fare from 5 cents to 6 cents to the Anniston Traction Company, the Mobile Electric Company and the Montgomery Traction Company.

SEATTLE—PORTLAND

The past week showed no marked increase in electrical business transacted, both jobbers and dealers reporting sales well sustained. Sales to the Puget Sound Navy Yard at Bremerton were a shade heavier. Cantonment business, especially along the line of lamps and wiring devices for improvements and extensions, also shows a slight increase. Seattle jobbers particularly report a slight decrease in the sales of large motors and heavy power apparatus, but as these sales fluctuate more or less little concern is manifested. The Northwest jobbers and dealers have signed pledges to furnish no material unless it is for essential war work. The pledges were signed freely and are being lived up to religiously.

Shortages heretofore mentioned, including larger-sized wire, motors, higher wattage lamps, etc., are becoming more acute. Washing machines, which have been coming through from manufacturers in a fairly satisfactory way, have dropped off in supply and a shortage is threatened which will strike quite hard. Sales, which have been excellent, are not materially diminishing. Northwest jobbers naturally will be hard hit when additional curtailments in manufacture of articles not essential to prosecution of the war become effective. It is noted that curtailments have been made in the output of electrical heating devices and sewing machines, among other things. The former were in heavy demand last fall and winter, and this year's sales were expected to be equally satisfactory. Sewing machines have moved well all year and with continued prosperity were expected to increase. Local jobbers understand that Christmas tree outfits will not be manufactured to any extent this year. The effect will not be noticeable as the Northwest trade has not been extensively educated to this luxury.

The Spanish influenza epidemic in the Northwest is becoming more serious daily and retarding business considerably. Theaters and schools are closed and public gatherings have been forbidden. Traction companies in the larger cities, especially Seattle and Portland, as a result are suffering heavy financial losses. Shipbuilding is being retarded owing to the number of cases among employees. Electrical jobbers and retailers have not gone untouched.

Seattle is going ahead with its seven-million-dollar building campaign. Priority certificates covering materials for the first allotment of 1500 homes for Seattle will be issued immediately. Further allotments are assured. Excellent progress is being made relative to housing conditions in Portland. A blanket permit for 1000 homes has been received and construction work on these will be started immediately.

Portland jobbers report that business during the past week was good, although there was no marked activity along any special line. The bulk of the business was carried on with plants engaged in war work. The Pacific Coast Steel Company, Portland, signed contracts for the erection of the first buildings of a large steel plant. The Columbia Iron & Welding Works, Astoria, will make immediate enlargement of plant. Although the bond drive exceeds all others in intensity, collections are highly satisfactory.

SAN FRANCISCO

The past week has been one of very light business, in which the effect of non-essential building orders has been accentuated by the fact that most jobbers and salesmen have been personally canvassing for the sale of the fourth issue of Liberty Bonds.

Some very big shipbuilding operations, notably those of the Liberty Shipbuilding Company and the Parr-McCormack Steamship Company, are practically past the paper stage, and big business is expected.

WIRE.—Local stocks of standard sizes are very good, especially in the house-wiring sizes, Nos. 14 and 12, and the larger sizes, such as Nos. 6 and 8, as emergency wiring for electric ranges in new industrial quarters. It is difficult to secure any sort of telephone wire, whether outside or inside. Big shipments have been made to the government for service in France. Particularly is this so in the case of No. 17 copper-clad wire, of which about 4,000,000 ft. has been shipped from the Pacific Coast in the past four weeks.

TELEPHONES.—Very little business is reported, and this is in the nature of maintenance and repairs and mostly for items such as batteries and wire instead of the telephone devices. Interphone business, except in big industrial factories, will be wiped out by essential building regulations, and telephone extensions in large cities will be affected by the new government tax, varying from $5 to $15 for every telephone installed even with a minimum of labor.

HEATING DEVICES.—It has been announced that factories making small electrical devices will be asked to cut their output one-half. Further advices are eagerly awaited by Pacific Coast electrical men. Big stocks are ordered or are on the way to replace certain large shipments because of advances in price, and unless orders on factory files are immediately filled, the Pacific holiday trade in such goods will be badly cut.

RANGES.—There are so many essential jobs, such as those at Baypoint, Cal., and Seattle, Wash., and so very little private business on account of the power companies' inability to deliver energy that business will probably go on as before with the exception that some newly awakened Hawaiian business may be indefinitely suspended.

METAL MARKET SITUATION

Copper Imports Reach Record Figure—Reduction in the Price of Tin

Importations of copper in September were phenomenally heavy; in fact, they were the largest for any single month in the history of the industry. The total, according to Custom House reports made through the Metal Exchange, was 71,680,000 lb. Average monthly importations during June, July and August were a little less than 45,000,000 lb., and the average monthly arrivals since the first of the year have been 47,110,000 lb.

In regard to prices no new developments were noted last week. The market is bound to be quiet as 90 per cent or more of our entire output is going into consumption for the war requirements of ourselves and our allies. It is reported that a meeting of the producers and the War Trade Board is called for Oct. 25 to arrange for price to rule after Nov. 1.

The London price on tin on Oct. 15 was £335 for standard prompt and future, and £335 10s. for Straits, which is a reduction over last week. The Singapore price is not allowed to be divulged, but it is possible there may be a modification in this respect before very long when the allied nations' control arrangements get into full swing.

NEW YORK METAL MARKET PRICES

	Oct. 8	Oct. 15
Copper:	£ s d	£ s d
London, standard spot...	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26.00
Casting	Govt. price 26 00	Govt. price 26 00
Wire base	28 75	28.75
Lead, trust price	8.05	8 05
Antimony	14.00	13.62½
Nickel, ingot	40 00	40 00
Sheet zinc, f.o.b. smelter	15 00	15.00
Spelter, spot	9 10	9 00
Tin, Chinese *	No quotations	No quotations
Aluminum, 98 to 99 per cent	Govt. price †33 10	Govt. price †33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	23.50 to 24 00	23.50 to 24 00
Brass, heavy	14 00 to 14 25	14 00 to 14 25
Brass, light	11 50 to 12 00	11.00 to 11.50
Lead, heavy	7 50 to 8 00	7.50 to 8.00
Zinc, old scrap	6 50 to 6 75	6.00 to 6.25

*No Straits offering. † In 50-ton lots or more; carload, 33 10 cents per lb.; 0-ton to 14-ton lots, 33 20 cents per lb.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71 00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160 00
No. 4 stranded	205 00
No. 2 stranded	266.00
No. 1 stranded	315 00

Twin-Conductor

No. 14 solid	104 00
No. 12 solid	135.00
No. 10 solid	185 00
No. 8 stranded	235 00
No. 6 stranded	370 00
No. 4 stranded	575 00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20% to $73 20
Coil to 1000 ft	List

	No. 12 Solid
Less than coil	+20% to $85 20
Coil to 1000 ft	List

Twin-Conductor

	No. 14 Solid
Less than coil	$115.00
Coil to 1000 ft	100.00

	No. 12 Solid
Less than coil	+20% to $162 00
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0 22 to $0.30 each.
Standard packages from 100 to 250

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to 12%
1/5 to std. pkg	+5% to 20%
Std. pkg	18% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 45—$0.46	$0 45—$0 47
12 to 50	40	40— 41
50 to barrel	35— 36	36— 37
Barrel lots	32— 329	33 — 329

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.	$0.40 to $0.45	$0.40 to $0 45
12 to 50	.35 to .39	.35 to 39
50 to barrel	.319 to .362	.329 to 382
Barrel lots	.289 to .332	.299 to 342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5 00
3/8	250	7 50
1/2	100	10 00
3/4	50	13 00
1	50	21 00
1¼	50	26.00
1½	25–50	35 00
2	25–50	45 00
2½	25–50	52 00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
3/8-in. single strip.	$75 00	$63 75— 69 75
3/8-in. double strip	75 00— 82 50	72 00— 75 00
1/2-in. single strip	100 00	85 00— 93 00
1/2-in. double strip	100.00—110.00	96.00—100 00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75 00	$63 75 to $64 25
3/8-in. double strip	78.25 to $90 00	71 25 to 75 00
1/2-in. single strip	100 00	75 00 to 85 00
1/2-in. double strip	105.00 to 120 00	93 00 to 100 00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0.05½	1	$0 25
1/4	06	1¼	33
5/16	09	1½	40
1/2	12	1¾	47
5/8	15	2	55
3/4	18	2¼	65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$25 00–51 70	$24 00–35 20	$23 00–30 25
1/4-in.—	30.00–56.40	28.00–38.40	26 00–33 00

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$44 00–60.00	$30.00–33 00	$26 50–29 15
1/4-in.—	48 00–65 00	32 50–36 00	29 00–31.80

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
1/4	$0 08½
3/8	.08½
1/2	08½
3/4	11½
1	17
1¼	23
1½	27½
2	37½
2½	58½
3	76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
1/4	$0.05	$0.19
3/8	.06	.19
1/2	07	.19
3/4	10	.25
1	13	37
1¼	17	.45
1½	21	50
2	.28	1 10
2½	40	1 80
3	60	4 80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	7% to 7 1%	9% to 9 1%
2500 to 5000 lb.	10% to 10 1%	12% to 12 1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+5.5% to 6.8%	+3.5% to 8.8%
2500 to 5000 lb.	+2.5% to 10.7%	+5% to 12 7%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$6 00 to $7 00
Discount	20% to 30%

CHICAGO

List price	$6.00 to $7 00
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp	100	$0 25
35-amp. to 60-amp	100	.35
65-amp. to 100-amp	50	.90
110-amp. to 200-amp	25	2 00
225-amp. to 400-amp	25	3.60
450-amp. to 600-amp	10	5 50
600-Volt		
3-amp. to 30-amp	100	$0 40
35-amp. to 60-amp	100	60
65-amp. to 100-amp	50	1 50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5 50
450-amp. to 600-amp	10	8 00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41% to 45%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30% to 31%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6 00 to $9 37
1/5 to std. pkg.	5 25 to 7 00

Standard packages, 500. List, each, $0 07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8.00
1/5 to std. pkg	7 00

Standard packages, 500. List, each, $0 07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

	Std. Pkg.	List, Each
Regular, Clear:		
10 to 40-watt—B	100	$0 35
60-watt—B.	100	40
100-watt—B	24	85
75-watt—C	50	70
100-watt—C	24	1 10
200-watt—C	24	2 20
300-watt—C	24	3 25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25	50	60
25-watt—G 25	50	60
40-watt—G 25	50	60
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30	24	82
Round Bulbs, 4⅜-in., Frosted:		
100-watt—G 35	24	1 15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30 47—$40 77
Coil to 1000 ft	27 42— 30 22

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$38 00
Coil to 1000 ft	28 00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24 00

CHICAGO

Net per 100	$21 75 to $30 00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30 00
102—B.A., 6200, S.E., 300, A X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25 00
106—F.A., 7, C.S., 1½, 3 R	20 00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%	20%
$10.00 to $50.00 list	36%	31%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20% to 30%	10% to 20%
$10.00 to $50.00 list	30% to 40%	20% to 30%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	5%
1/5 to std. pkg	15%
Std. pkg	25%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$21 00 to $24 00
1/5 to std. pkg	17 85 to 20.40

Standard package, 2200. List per 1000, $21 to 24

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$16 80–24 15
1/5 to std. pkg	15 80–21 00

Standard package, 2200. List per 1000, $20.00–21 00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.	Std. Pkg. 4000 Solid Nail-it—N.C.
Less than 1/5 std. pkg	$16 00 to $22 00	$32 00
1/5 to std. pkg	13.60 to 18 70	27 20

CHICAGO

Per 1000 Net	Std. Pkg. 3500. 5½ N.C.	Std. Pkg. 4000 —Solid Nail-it—N.C.
Less than 1/5 std. pkg	$11.70–$24 00	$33 85–$35 80
1/5 to std. pkg	10 15– 20 00	26 60– 32 00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
¼-in. cap key and push sockets.	500	$0.33
¼-in. cap keyless socket	500	.30
¼-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List
1/5 std. pkg	10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0.80
60-amp. S. P. S. T	1 20
100-amp. S. P. S. T	2 25
200-amp. S. P. S. T	3 48
300-amp. S. P. S. T	5 34
30-amp. D. P. S. T	1.20
60-amp. D. P. S. T	1 78
100-amp. D. P. S. T	3 38
200-amp. D. P. S. T	5 20
300-amp. D. P. S. T	8 00
30-amp. 3 P. S. T	1 80
60-amp. 3 P. S. T	2 68
100-amp. 3 P. S. T	5 08
200-amp. 3 P. S. T	7 80
300-amp. 3 P. S. T	12 00
Low Grade:	
30-amp. S. P. S. T	$0 42
60-amp. S. P. S. T	74
100-amp. S. P. S. T	1 50
200-amp. S. P. S. T	2 70
30-amp. D. P. S. T	68
60-amp. D. P. S. T	1 22
100-amp. D. P. S. T	2 50
200-amp. D. P. S. T	4 50
30-amp. 3 P. S. T	1 02
60-amp. 3 P. S. T	1 84
100-amp. 3 P. S. T	3 76
200-amp. 3 P. S. T	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15% to 10%
$10 to $25 list	2% to 5%
$25 to $50 list	5% to 10%
	Low Grade
Less than $10 list	+5% to list
$10 to $25 list	8% to 15%
$15 to $50 list	15% to 20%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 15%
$10 to $25 list	List to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15% to 16%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0 28
5-amp. single-pole, ind	250	32
10-amp. single-pole	100	48
10-amp. single-pole, ind	100	54
5-amp. three-point	100	54
10-amp. three-point	50	76
10-amp., 250-volt, D. P	100	66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0 45
10-amp. three-way	50	.70
10-amp. double-pole	50	70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to 10%
1/5 to std. pkg	+5% to 16⅔%
Std. pkg	18% to 25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0 34
No. 160	60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 30%	Net to 30%
$2.00 to $10.00 list.	10% to 35%	5% to 40%
$10.00 to $50.00 list.	20% to 37%	10% to 52%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list.	25% to 50%	20% to 40%
$10.00 to $50.00 list.	25% to 64%	20% to 50%

TOASTERS, UPRIGHT

NEW YORK

List price	$6 00 to 6 50
Discount	20% to 30%

CHICAGO

List price	$6 35 to $7 00
Discount	20% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.51–$0 66
No. 18, full spools	49– 56

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0 65 to $0 72
No. 18, full spools	55 to 605

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$20 00–$25 00	$15 00–$17 00	$15 00–
12	23 58– 27 09	21 62– 29 09	17.68– 23 22
10	30 20– 37 80	27 45– 32 40	23.47– 32 40
8	42 74– 53.34	38 85– 45 72	33.21– 45 72
6	61 50– 84 42	55 35– 72 36	52 58– 55 48

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$22 00–$25 00	$18.00–$22 00	$15 50–$16 50
12	29 46– 31 44	29.46– 31 44	25 54– 31 44
10	41.10– 43.84	41 10– 43 84	34 62– 38.36
8	57 00– 61 76	57 90– 61 76	50 18– 54 04
6	85 31– 97 68	85 31– 85.47	72 21– 85 47

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$39 75 to $44 00
25 to 50 lb	39 75 to 42 00
50 to 100 lb	38 75 to 40 00

CHICAGO

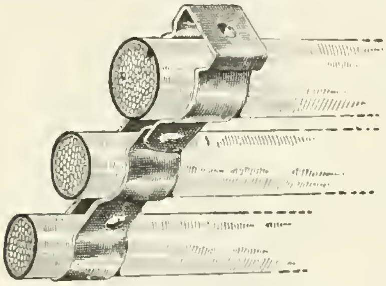
	Per 100 Lb. Net
Less than 25 lb	$37.00 to $41 75
25 to 50 lb	36 00 to 40 00
50 to 100 lb	35 00 to 39 00

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Cable and Conduit Hanger Saves Time

Where parallel cable or conduit runs are to be put up, the Minerallac Electric Company, 1045 Washington Boulevard, Chicago, claims its new multiple hanger will prove a considerable time saver. With these units two, three or more lines of iron conduit or cable can be suspended from the same set of toggle or expansion bolts, thus saving the expense of drilling duplicate lines of holes and using extra toggle or expansion bolts. The new hanger consists of three types of clips. The first is the regular Minerallac hanger, which has been on the market for some time. The second is an intermediate clip which attaches to the regular hanger and also has bolt holes for supporting the third or terminal clip. Another advantage of these devices is that additional lines of conduit or cable can be added to existing runs without great expense. Porcelain bushings can be used with cable in the intermediate and terminal pieces just as they are used in the regular hanger. Regular hangers are made in sizes between ⅜ in. and 2½ in. (9.5 mm. to 63.5 mm.); intermediate hangers are made in sizes from ½ in. to 2½ in. (12.7 mm. to 63.5 mm.), and terminal hangers are made in ½-in. and ¾-in. sizes (12.7 mm. to 19 mm.). The Underwriters' Laboratories and the Chicago Department of Electrical Inspection have approved the hangers.



NEAT AND CONVENIENT HANGER FOR SUSPENDED CABLE RUNS

Fiber Fuse Plugs

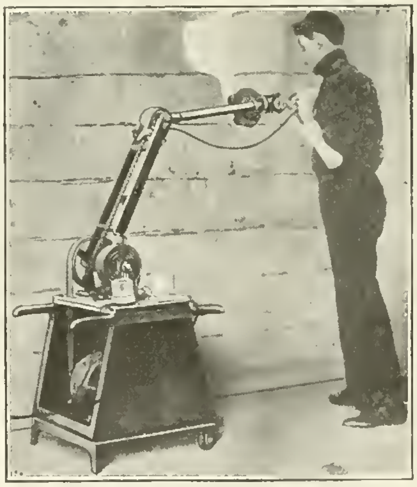
Fiber has been substituted for porcelain in a fuse plug being placed upon the market by the Chelten Electric Company, 4859 Stenton Avenue, Germantown, Philadelphia, Pa. This plug is made in standard capacities up to and including 30 amp. and has been approved by the National Board of Fire Underwriters. The fuses are much lighter in weight, the makers say, and fuse wires make a permanent connection, the wire itself being tested and the fuse so calibrated that it will blow in accordance with the Underwriters' recommendations.

Tumbler Switches

Quick make-and-break mechanism is the feature of the tumbler switches manufactured by the Duncan Electrical Company, Ltd., Montreal, Canada. The base of this device is the same size as with the standard 5-amp. switches and can be easily attached to every standard fitting. Wire holes in the base are sufficiently large to allow the loom to enter. The binding posts are according to the new code and the contacts are double, making the latter positive. The switch is very low in height and presents a neat, serviceable appearance, according to the makers.

Motor-Operated Rubbing Machine

To meet the demand for a speedy machine with a good range of action for rubbing and polishing side walls, columns, bridges, subways, etc., the Cavicchi Polishing Machinery Company of Quincy, Mass., has developed a portable motor-operated machine said to do the work of ten manual laborers.



SPEEDY MACHINE WITH WIDE RANGE OF ACTION

The rubbing wheel is on a jointed arm and has a radius of action of 6.5 ft. (2 m.) vertically from the floor and 8 ft. (2.4 m.) horizontally. The rubbing wheel and the water pump, which eliminates dust, are driven by a motor made by the General Electric Company, Schenectady, N. Y.

Springs in the arm counteract its weight and keep the carborundum wheels of the various kinds suitable for different classes of work pressed against the wall regardless of its irregularity. An ample supply of water is provided by a reservoir in the body of the machine.

Fittings for Double Push-Button Switches

Fittings that have been designed as a means of protection for push-button switches against vapor, gas and dust have been brought out by the Appleton Electric Company of Chicago, Ill. The bodies have four ears, to which a cover is fastened, and as the cover is flanged, the fitting is absolutely vapor-proof, it is claimed. The cover is furnished complete with stems, and one button has a white insert so as to show whether the current is on or off. Gaskets and necessary fastening screws are furnished with the cover. This is known as the "GEP" series of "Unilet" bodies.

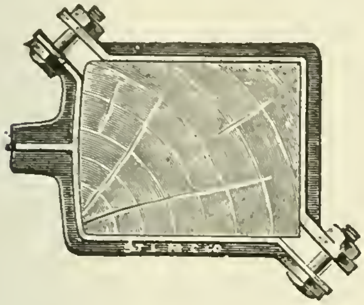
PROTECTION AGAINST VAPOR, GAS OR DUST

Insulating Cement

Quick motor repair by means of an insulating cement called "Porce-Lute" is being manufactured by Wilkins U. Greene, Ridgewood, N. J. With this cement, it is said, pitted commutators can be repaired without facing, and flashing over can be stopped. It is suitable, besides, for general use on all electrical work. In addition, it will repair porcelain and other articles not affected by heat. Dried in the air, this material will neither expand nor contract, and it is not affected by high heat, say the makers. It is very useful in curing trouble with collector rings in alternating-current machines and for insulation in places that cannot be reached with tape or other forms of insulating material. If, after applying the cement, the articles are placed in a warm place, the cement will harden in a short time, this depending on the amount of cement used. "Porce-Lute" insulating cement hardens to a glassy hardness resembling porcelain.

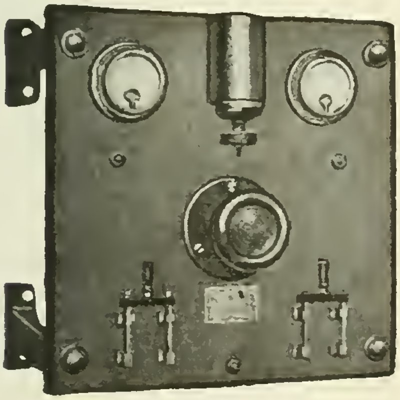
Clamps for Wood Cross-Arms

Clamps manufactured by the St. Louis Malleable Casting Company, St. Louis, Mo., for attaching insulators to cross-arms are asserted by this company to be very strong. These clamps will lengthen the life of the wood arms many times, the makers say, because they strengthen arms whereas holes bored in the arms for attachment weaken them. These clamps are adjustable and will fit any arms 3 in. to 3½ in. (76 mm. to 89 mm.) wide or 4 in. to 4½ in. (101 mm. to 114 mm.) high. This attachment also provides a simple and inexpensive means of repairing arms that have been split by a strain on the wires or by the action of the weather, thus saving the cost of new arms. The attachments designed to support a screw-type insulator are equipped with the "Ette" patent insert head, whereby all liability of insulator breakage arising from unequal expansion and contraction present in ordinary metal insulator supports is overcome. These cross-arm attachments are made in various forms and weights to meet every requirement of telephone, telegraph, electric light and power and electric railway line necessities.


LENGTHENS THE LIFE OF CROSS-ARMS

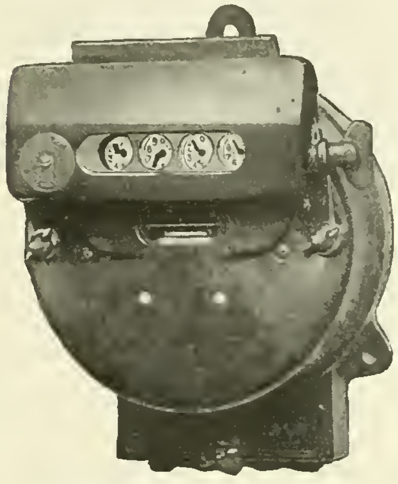
Automatic Battery-Charging Panels

Automatic cut-in and cut-out switches which will not close the charging circuits until the generator voltage has reached the proper value and which will open the circuits immediately upon reversal of the current are features of battery-charging panels made by the General Electric Company of Schenectady, N. Y. These panels are furnished for 1250, 1500, 2000 or more watts and for 35 volts. They are made of black marine-finished slate and are arranged for wall mounting. The proper generators for use with this panel are also furnished by the company.


AUTOMATIC PANEL FOR CHARGING BATTERIES

Device Simplifies Meter Reading

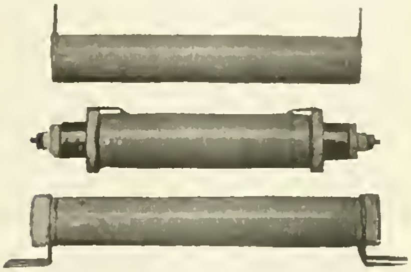
An improved meter-reading and recording device for attachment to the ordinary house-type Westinghouse single-phase watt-hour meters has been brought out by the Economy Appliance Company of Waterloo, Iowa. The device is easily applied to these meters, the change being made by removing the old cover and replacing it with the new one, which has the device mounted upon it. The ordinary pointer hands are also removed and are replaced by hands with knife-blade attachments. To read his meter the customer inserts a card in a slot provided for the purpose, turns the lever at the side of the meter and withdraws the card. Turning the lever marks the position of the knife-blade hands upon dials printed on the card so that this record can be mailed to the central-station office.


SPECIAL COVER AND HANDLE FOR RECORDING METER READINGS

Enameled Resistance Units

Enameled resistance units for regulating current have been developed in various forms and sizes by the General Electric Company of Schenectady, N. Y. Some of the applications to which these units have been put are railway and fire-alarm signals, fractional-horsepower motors and locomotive headlights. They are also used in series with relay, contactor and circuit-breaker coils on panels and switchboards. They are made to be particularly applicable in mines and similar places where a great amount of moisture is present. It is said that these units are unique in their ability to withstand unusually high temperatures as well as sudden changes in temperature from one extreme to the other. The resistance wire or conductor is wound upon a steel body coated either with a special refractory enamel or paint and high heat-resisting silicate compound. The steel body is preferred for extreme lengths where strength for a long span is required and is stated to be especially serviceable where the unit might be subjected to severe vibration or shock.

The refractory silicate body is used for most of the ordinary types of resistance. The manufacturers say that the compound employed is far superior to porcelain or any equivalent ceramic products, which are easily cracked or weakened mechanically by repeated and extreme temperature fluctuations. These units have been standardized but may also be obtained in special forms.

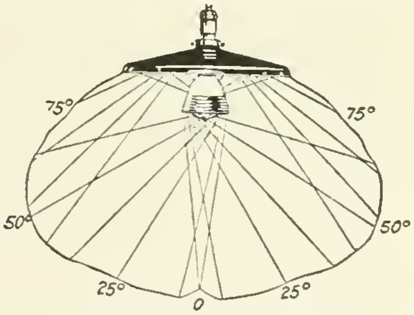

STANDARD UNITS OBTAINABLE WITH DIFFERENT METHODS OF ATTACHMENT

Push-Button Flush Switch

Because these switches are very shallow, being only 1 in. (2.5 cm.) deep, they are provided with an easy, short ⅜-in. (9.5-mm.) push. No pins or bushings can work loose according to the makers, because of the rigid construction of the parts. Outside of the bearings all parts are riveted firmly together. This is known as No. 200 single-pole or 203 three-way switch of the Duncan Electrical Company, Ltd., Montreal, Canada.

Lamp Shield Minimizes Glare

In addition to a porcelain-enamel metal reflector for properly directing the light distribution a shield may also be used for prevention of glare. Such a combination of devices is made by L Plaut & Company, 432 East Twenty-third Street, New York City. The distribution obtained from the combined reflector and shield with a 110-watt gas-filled lamp is shown in the illustration, affording fairly uniform illumination under the lamp.



REFLECTOR AND SHIELD IMPROVE DISTRIBUTION AND REDUCE GLARE

Trade Notes

PROCEDURE GOVERNING EXPORTS TO SWEDEN.—The War Trade Board announced on Sept. 23 the adoption of regulations governing the procedure with respect to the issuance of licenses for the exportation of commodities to Sweden. Former announcements with respect to such regulations (W.T.B.R. 191, Aug. 9, 1918) are withdrawn, and the new regulations adopted may be found in W.T.B.R. 236.

VALIDITY OF FRENCH IMPORT LICENSES.—The term of validity of all import authorizations and licenses has been increased to six months. This measure applies to all existing authorizations and licenses. Licenses which have expired, being more than three months old, and the renewal of which has not been applied for, are extended under the new regulations up to the expiration of a term of six months from their respective dates.

EXHIBITION OF INVENTIONS, DESIGNS AND TRADEMARKS IN JAPAN.—The Department of Agriculture and Commerce of Japan has decided to hold an exhibition of inventions, designs and trademarks in the coming fall. Important inventions, designs and trademarks will be exhibited. The exhibition is now being held at Uyeno Park, Tokyo, from Oct. 10 to Nov. 30. Many important electrical inventions among others will be given publicity at the exhibition.

LIBERTY BOND NOTES.—Employees of the Splitdorf Electrical Company, Newark, N. J., have subscribed $125,000 to the fourth Liberty loan. Employees of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., have arranged a quota of $5,000,000 for the fourth Liberty loan and have subscribed over $4,423,800 of this amount. Employees of the Union Switch & Signal Company, a subsidiary organization, with a quota of $579,000, have subscribed $609,000, exceeding their quota.

REGULATIONS GOVERNING EXPORT TO DENMARK.—The War Trade Board announces that, in consequence of the conclusion of a general commercial agreement with Denmark, applications for licenses to export all commodities (with the exception of cereals and fodders) to that country are now being considered. Previous announcements with respect to exports to Denmark are withdrawn. Exporters should apply for licenses to the Bureau of Exports, Washington, D. C., using Application Form X, attaching thereto Supplemental Information Sheet X-105 and such other supplemental information sheets concerning the commodity as are required.

EXPORTS TO RUSSIA.—The War Trade Board announces, in a new ruling (W. T. B. R. 257) that applications will now be considered for the exportation of all commodities to Russia. Exporters are requested to file their applications with the Bureau of Exports, War Trade Board, Washington, D. C. A limited amount of cargo space may be available for shipments from the Pacific Coast direct to Vladivostok, and in allocating space preference will be given to material covered by licenses issued on and after Oct. 7, 1918, under conditions which the War Trade Board in Washington is prepared to define and discuss with exporters, giving due consideration to the particular transactions in question. In order to facilitate the consideration of applications, exporters are requested to state definitely on each application whether or not the material is made up and ready for shipment, and, if so, the location thereof.

LARGE DEVELOPMENT IN SWEDISH MANUFACTURE OF ELECTRICAL GOODS.—At the Goleborg (Sweden) fair, July 8 to 13, the first exhibition of Swedish industry since the outbreak of the war, goods from all parts of Sweden and of many kinds of manufacture were exhibited. In speaking of the electrical exhibits the *Svenska Handelstidning* said: "The manufacture of electrical material has grown enormously during the war. In a number of articles, especially installation material and armature, foreign competition had the upper hand before the war, and at the prices then prevailing there was no chance for Swedish manufacture. Now Swedish manufacture has taken the market entirely, owing to increased demand, the disappearance of foreign competition and the change in prices. Before the time when foreign competition will again have to be met Swedish manufacturers should be able to meet it. Even electrical measuring instruments, which formerly were made only abroad, were exhibited at the fair, but these are not yet perfect."

IMPORTATION OF VARNISH GUMS RESTRICTED.—The importation into the United States of varnish gums is restricted as to shipments made after Oct. 10, 1918. All outstanding licenses have been revoked as to ocean shipment after that date and no new licenses will be issued except to cover the following: (1) Shipments made from abroad on or before Oct. 10, 1918; (2) shipments for the use of the United States government; (3) shipments from Mexico or Canada by other than ocean transportation; (4) shipments from Europe or Mediterranean Africa when coming as return cargo from convenient ports where loading can be done without delay; (5) shipments of copal or manila gum when shipped from the Philippine Islands, and (6) shipments of Kauri gum not to exceed a total of 3,000,000 lb. during the calendar year 1918. Licenses for the amounts of varnish gums permitted to come forward, pursuant to the foregoing, will be allocated by the Bureau of Imports of the War Trade Board in accordance with the recommendations as to distribution and price of the War Industries Board.

EXPORT LICENSE.—The War Industries Board and the War Trade Board announce in a new ruling (W.T.D.R. 258) that they have jointly adopted rules and regulations for the purposes of simplifying the procedure of obtaining export licenses from the War Trade Board, priority certificates from the Priorities Committee of the War Industries Board and permits from the Director of Steel Supply of the War Industries Board. This refers to iron and steel products, and on and after Oct. 14, 1918, applications for licenses to export these articles should be filed with the War Trade Board. The Priorities Committee of the War Industries Board has awarded priority classifications to all articles on which priorities are issued which are on the export conservation list of the War Trade Board and are covered by export licenses issued on and after Oct. 16, 1918. No certificates will be issued with such licenses. If the article specified on the license is one on which priorities are issued, and if no individual priority certificate accompanies the export license, the license itself will be evidence that the article covered by it has been automatically awarded priority classification.

EXPORTERS' ENCYCLOPAEDIA.—The fourteenth (1918-19) edition of the Exporters' Encyclopaedia, which has just been issued by the Exporters' Encyclopaedia Company, 80 Broad Sreet, New York City, should be of great value to the American manufacturer who is getting his first experience in handling export inquiries and orders, as it covers every question that comes up in making an export shipment, from the initial step of packing to the arrival of goods at final destination. The arrangement of the information is such that all the shipper needs to know is the country or port to which the goods are to be shipped. The various regulations that apply as to packing, documentation, etc., are covered separately for each country, thus preventing confusion. Every practical shipping route from the United States is shown for each country; also the frequency of sailings, loading piers and other data required by the shipper. Fac-similes of the consular documents required, with translations into English, are shown; also the costs of certification, etc. A series of maps (sixty-four all told)—separate maps being shown for each country or grand division—is also a valuable feature. With the encyclopaedia at hand, an American manufacturer can direct his export business without danger of fines for non-attention to important custom-house details that must be observed and with full satisfaction to his foreign customers.

BOSCH MAGNETO PLANT ACTIVE IN WAR WORK.—Until a few months ago the Bosch Magneto Company, Springfield, Mass., was enemy-owned and controlled. It had built a strong business throughout the United States during the few years of its existence here, and its progress kept pace with the swift growth of the automobile industry. While the United States was at peace it was neither possible nor practicable to take official notice of the fact that the company was out of sympathy with the Allied cause. The United States could not then prevent the company's refusal to sell to motor manufacturers whose products were going to the Allied armies. The prosperity of the concern accordingly was based on its sales for domestic use of magnetos. Control of the company is now in the hands of the Alien Property Custodian. The company is working for Uncle Sam with might and main, and 85 per cent of its output is going into the equipment of the United States Army and the armies of our allies. Seventeen out of every twenty magnetos made by this company are going into service on motors for trucks and airplanes, to transport our food and ammunition from the French bases to the front, and to send our aviators up and over the battle lines. As a recent press advertisement puts it, "The Bosch is carrying our war to the Boche." Every dollar of profit Uncle Sam makes from the manufacture and sale of the Bosch magneto is being invested at once in Liberty bonds.

THE CUTLER-HAMMER MANUFACTURING COMPANY of Milwaukee has moved into its new factory buildings.

THE ACME WIRE COMPANY, New Haven, Conn., has awarded the contract for a 30-ft. by 60-ft. two-story addition to its plant.

Y. A. VOWELL, formerly with the Vancouver (B. C.) branch of Crane Limited, is now in charge of the company's new office at 402 Lumsden Building, Toronto, Canada.

HORACE N. TRUMBULL, advertising manager of the S K F Ball Bearing Company of Hartford, Conn., has entered the reserve officers' training camp at New Haven, Conn.

THE CHICAGO PNEUMATIC TOOL COMPANY of Massachusetts announces the appointment of B. H. Tripp as district manager of sales, Pacific Coast territory, succeeding M. W. Priseler.

DALE B. SCARBOROUGH, for the last seven years Pennsylvania representative of the Hygrade Lamp Company, Salem, Mass., on Oct. 1 established himself as Hygrade distributer or jobber in the Pennsylvania district.

LANDERS, FRARY & CLARK, New Britain, Conn., manufacturers of the "Universal" line of electric heating devices, has secured a permit to build an addition to its plant, one-story, 80 ft. by 108 ft.

THE HIGH GRADE LAMP COMPANY, Salem, Mass., announces the appointment of L. H. Pike as factory manager. Mr. Pike has been with the company for about six months as its mechanical engineer and has had many years of training as a manufacturing executive.

WARREN A. PETERS, for many years with the Ames Iron Works, Oswego, N. Y., and recently New England sales manager with office in Boston, has been appointed sales manager of the Star Expansion Bolt Company, New York and Chicago, with factory at Bayonne, N. J.

THOMAS A. EDISON, INC., announces that A. C. Emery, having resigned as general purchasing agent in order to devote his entire time to the Edison International Corporation, William Dykeman has been promoted and will assume the duties of general purchasing agent for the Thomas A. Edison industries.

THE EDISON LAMP WORKS OF THE GENERAL ELECTRIC COMPANY have leased the Sandusky (Ohio) plant of the Libbey Glass Company. This plant manufactures incandescent-lamp bulbs at the rate, it is reported, of 175,000 per day. For some time the entire output of this plant has been furnished to the Edison works.

THE K. C. ELECTRICAL CONSTRUCTION COMPANY, Kansas City, Mo., has bought the storage-battery and starter business of Hayes & Murrill, retaining L. O. Hayes and F. E. Murrill for this department. The company will move by Nov. 1 to 1409-11 McGee Street. It is agent for the General battery and handles also the Ever Ready.

STEVENS & ROCKWELL, consulting engineers, Seattle, Wash., announce the dissolution of the firm Henry R. Stevens has become electrical engineer for the Stone & Webster Engineering Corporation, Seattle Division. Robert L. Rockwell will continue in consultation work at Suite 955 Empire Building, taking over the organization and equipment of the firm.

GEORGE McD. JOHNS, formerly chief electrical engineer of the city of St. Louis, in charge of the fire and police telephone and telegraph system, has joined the organization of W. N. Matthews & Brother, Inc., in the capacity of production manager. He is now for the third successive term secretary and treasurer of the St. Louis Jovian League of Electrical Interests.

THOMPSON & CASTLETON, INC., electrical dealers, Seattle, Wash., have recently been organized and opened for business with offices and shops at 316 First Avenue South. The company handles electrical, mining and hydraulic machinery, also buys, sells and exchanges new and used machinery.

B. NORDRUP of the firm of Aage Havermanns Ests., Copenhagen, Denmark, has recently arrived in this country on a buying trip and is ready to place orders and make agency arrangements with American manufacturers for representation in the Scandinavian countries for all kinds of electrical supplies. For the next few months he will be at Apartment 34, 2102 Broadway, New York City.

THE MOHAWK ELECTRICAL SUPPLY COMPANY, Syracuse, N. Y., is distributing the *Mohawk News Service*, a monthly bulletin, to customers in an effort to place its business on as near a war basis as possible. The best utilization of electrical supplies in accordance with rulings from Washington appears to be the theme of the bulletin. In the current issue considerable emphasis is placed on good lighting.

THE PETTINGELL-ANDREWS COMPANY, Boston, on Oct. 14 issued War Bulletin No. 4, containing the latest ruling of Priorities Commissioner Edwin B. Parker, relative to the pledging of all dealers, contractors, retailers, repairmen and others buying electrical goods for resale, and also the rules and regulations governing priority in production as authorized by the War Industries Board. The bulletin contains a compact and convenient compilation of priority classifications and their explanation and in a note to the trade sets forth the necessity of accompanying orders with affidavits of priority data in purchasing iron conduit and steel fittings. This house, in accordance with its pledge to the Priorities Division of the War Industries Board, cannot accept at present any orders for iron conduit unless accompanied by affidavit showing automatic rating of B-2 or higher, or covered by priority certificate. On all steel fittings, such as condulets, V. V. fittings, iron boxes, etc., in the fabrication of which steel is principally used, the company requires the government order number, affidavit covering automatic rating or priority certificate. Such orders will be filled in exact accordance with the rank of the automatic rating or priority certificate, and orders received from industrial plants where only the government order numbers covering materials in process are given cannot be sure of prompt shipment.

MILLIKEN BROTHERS MANUFACTURING COMPANY, INC., New York City, has been organized to succeed Milliken Brothers, Inc., established 1857, taking over certain assets, including patent rights, good will, etc., of the former company. The new company will specialize in the manufacture of galvanized-steel transmission towers. Milliken transmission towers for high-tension power systems have long been a feature of the extensive business of the former organization. More than 40,000 Milliken towers, embracing approximately 4000 miles of transmission system, have been constructed in all parts of the country for such power companies as the Southern Power Company, North and South Carolina; Utah Power & Light Company, Utah and Idaho; Great Western Power Company, California; Portland Railway, Light & Power Company, Oregon; Columbus Power Company, Georgia; Great Falls Power Company, Montana; Pacific Light & Power Company (recently merged with the Southern California Edison Company), California. The new organization will also manufacture galvanized-steel wireless towers, special steel poles for distributing and interurban railway lines, as well as the standardized truss unit system, a patented system of construction for steel buildings, designed by J. E. Jennings, vice-president and secretary of the company and for many years in charge of the power transmission department of the former company. C. T. Clack, for many years connected with the United States Steel Corporation, is president of the company, and Robert Grant, iron and steel merchant, is treasurer. General offices will be in the Woolworth Building.

THE BOSTON WOVEN HOSE & RUBBER COMPANY at the annual meeting held at the executive offices at Cambridge, Mass., on Oct. 7, elected George E. Hall, formerly vice-president and general manager of the company, president and general manager, succeeding Henry B. Sprague, treasurer, who served as president during a portion of the year pending the annual election. Mr. Sprague continues as treasurer and assumes the additional duties of vice-president. Mr. Hall has been associated with the Boston Woven Hose & Rubber Company for eleven years, taking charge as general manager in July, 1907, at which time the company's annual volume of business averaged only about $2,000,000 and its plant at East Cambridge, Mass. comprised only three comparatively small buildings. The fiscal year just completed on Sept. 1 has been the largest in the company's history, the sales totaling well over $10,000,000. The plant, now entirely composed of modern reinforced-concrete buildings, includes a total of more than 20 acres of floor space, being recognized as one of the largest and best equipped plants, if not indeed the very largest, in the world devoted exclusively to the manufacture of mechanical rubber goods. Mr. Hall's election to the presidency comes as a fitting tribute to the irrepressible energy and enthusiasm with which he has led his organization in the upbuilding, of a business which may easily rank as one of New England's leading industries.

GEORGE E. HALL

Trade Publications

UNDERFEED STOKERS.—Illustrations giving a good idea of the operation of Riley underfeed stokers may be found in publication No. 31 of the Sanford Riley Stoker Company, Worcester, Mass. The advantages of these stokers are set forth.

INDUSTRIAL TRUCK TRAILERS — Rugged trailers for use with electric industrial tractors are illustrated and described in a bulletin, No. 330, being distributed by the Automatic Electrical Devices Company, 120 Opera Place, Cincinnati, Ohio.

MAGNETIC TESTING APPARATUS.—Herman A. Holz, Metropolitan Tower, New York, has issued a booklet entitled "Magnetic Testing Apparatus," setting forth the usefulness of the Fahy permeameter and the magnet meter for the determination of magnetic properties.

WIRING DEVICES.—A catalog of wiring accessories for both inside and outside construction, showing sizes, prices and discounts, may be obtained from the Julius Andrae & Sons Company, Milwaukee, Wis. This catalog also lists some domestic appliances.

MOTOR - DRIVEN SIGNAL CONTROLLERS —A four-page pamphlet from the Reynolds Electric Company, 422 South Talman Avenue, Chicago, describes motor-driven controllers for the operation of a great variety of automatic light and sound signals such as fire alarms.

METER-READING DEVICE.—A leaflet is being distributed by the Economy Appliance Company, Waterloo, Iowa, illustrating an attachment for a watt-hour meter which permits taking a record of the reading at any time. The applications and method of using this device are explained in the leaflet.

HOUSEHOLD APPLIANCES..—A booklet from the J. B. Terry Company, Cedar Rapids, Iowa, illustrates various domestic electric appliances, giving the advantages of the various devices illustrated.

LAMP GUARD.—W. N. Matthews & Brother, St. Louis, Mo., have issued a folder describing guards for incandescent lamps and an adjustable device for attaching fixtures to conduit in any position desired.

OZONIZED WATER.—In a booklet entitled "The Water Problem Solved," being issued by the Ozone Company of America, Milwaukee, Wis., may be found an account of apparatus by means of which drinking water is treated Hygienic advantages of water thus treated are also set forth.

FUSE AND DISCONNECTING SWITCH.—A leaflet issued by the Fisher-Chase Manufacturing Company, Columbus, Ohio, shows a cartidge fuse mounted in a box with a handle attached so that the fuse may be operated as a disconnecting switch. There is also an indicating device to show whether the fuse has been blown.

GRAPHITE LUBRICATION.—A treatise on the use of graphite as a lubricant is contained in General Catalog No. 20 published by the United States Graphite Company, Saginaw, Mich. The various forms in which graphite is made up for lubricating purposes are described, and the usefulness of each type is explained.

AUTOMATIC BATTERY - CHARGING DEVICES.—Bulletins 329 and 331 have been received from the Automatic Electrical Devices Company, Cincinnati, Ohio. These bulletins describe battery panels equipped for charging Edison and lead cells, giving detailed descriptions of auxiliary devices such as the chargometer, ammeter and voltmeter switches, indicating lamps and automatic control switches.

MOTION PICTURE PROJECTORS.—The Argus Lamp & Appliance Company, 815 Prospect Avenue, Cleveland, Ohio, is sending out Catalog A-1, dated Sept. 1, 1918, advocating the use of incandescent lamps for motion-picture machines and showing how the incandescent-lamp apparatus may readily be adapted to carbon-arc motion-picture projectors already in use. Necessary accessories for motion-picture projection machines are handled by this company.

New Incorporations

THE CITIZENS' UTILITIES COMPANY of Durand, Ill., has been incorporated with a capital stock of $5,000 by Henry Graham, W. E. Johnson and others.

THE WOODSTON (KAN.) LIGHT & POWER COMPANY has been chartered with a capital stock of $10,000 by Frank Shutts, Fred Shutts and E. C. Parmer.

THE FARMERS' ELECTRIC LIGHT COMPANY of Aberdeen, S. D., has been incorporated with a capital stock of $25,000. Fred P. Tosch is interested in the project.

THE ELECTRIC ANNEALING & MACHINE COMPANY of Bakersfield, Cal., has been incorporated with a capital stock of $30,000 by W. W. Miller, H. E. Edington and Paul McCracken.

THE PALM UTILITIES COMPANY of Palm Beach, Fla., has been incorporated with a capital stock of $50,000. The officers are: A. Blair Ridington, president and treasurer; George A. Lowry, vice-president and F. L. Ridington, secretary.

THE SIMPLEX FARM & PUMP COMPANY of Atlanta, Ga., has been incorporated with a capital stock of $50,000 to install isolated electric lighting and pumping plants. The incorporators are Rollin W. Hutchinson, Jr., Egbert Allen and others.

THE PAGE BATTERY COMPANY of Springfield, Mo., has been incorporated by F. C. Page and Warren L. White. The company is capitalized at $5,000 and proposes to deal in, repair and charge electric batteries; also to buy and sell automobiles and other vehicles.

THE STRAIGHT LINE REGULATOR CORPORATION of New York, has been incorporated by J. Rawls, 715 West 170th Street; W. Asbury, 1105 Amsterdam Avenue, and G. W. Dunn, 261 Broadway, New York City. The company is capitalized at $50,000 and proposes to manufacture motors, engines, machinery, cars, vehicles, etc

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

BOSTON, MASS.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 21 for extension and alteration to machine-shop building No. 42, at the local yard, to cost approximately $770,000. (Specification 3318.) Bids received Sept. 3 were rejected.

BOSTON, MASS.—Bids will be received by the Commission on Waterways and Public Lands, Room 473, State House, Boston, Mass., until Oct. 28 for furnishing and installing one large size and six smaller electrically driven capstans, complete with motors and all operating apparatus, at the capstan pits constructed adjacent to the dry dock by the Commonwealth. Frank W. Hodgdon is engineer.

FALL RIVER, MASS.—The Fall River Electric Light Company has been given permission by the committee on non-war construction to proceed with the construction of a new boiler house at the foot of Hathaway Street. The cost is estimated at about $163,500.

NEW LONDON, CONN.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 21 for extension to boiler house at the local navy yard, to cost about $23,000 (Specification 3499).

Middle Atlantic States

ARGYLE, N. Y.—Bonds, it is understood, have been authorized for the installation of a municipal electric light plant in Argyle.

BROOKLYN, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department Washington, D. C., until Oct. 21 for elevator for building E at the Brooklyn Navy Yard, to cost about $5,000 (Specification 3484).

FAIRPORT, N. Y.—The Douglas Packing Company is reported to be considering the construction of a power house, 336 ft. by 50 ft., in Fairport.

FULTON, N. Y.—The Fulton Light, Heat & Power Company has applied to the Public Service Commission for permission to issue $361,666 in bonds, the proceeds to be used for improvements to its plant and system. The company contemplates the installation of a 2500-kva. turbo-generator set, two 500-hp. boilers, extension to power station, excavations in the pond for boiler water, etc., at its steam plant on the lower dam, to cost approximately $209,850. Improvements involving an expenditure of about $151,816 are contemplated at the water-power plant.

GENESEO, N. Y.—Bids will be received by Dr. Thomas E. Finegan, deputy commissioner of education, Education Building, Albany, until Oct. 21 for electric work and electric lamps in Practice School, State Normal School, Geneseo. Drawings and specifications may be consulted at the above school, at the New York office of the Department of Architecture, Room 1715 Tribune Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

JAY, N. Y.—The Ausable Forks (N. Y.) Electric Company has petitioned the Public Service Commission for permission to operate in the town of Jay and to issue $25,000 in capital stock. The company has made an agreement with the J. J. Rogers Company of Ausable Forks whereby it is to have all available sources of electrical supply and to carry out certain obligations of the Rogers company.

LOCKPORT, N. Y.—Plans are under consideration by the City Council for improvements to the municipal waterworks at North Tonawanda, including the installation of an electrically operated pumping equipment of 3,000,000 gal. capacity.

MARTINSBURG, N. Y.—The Northern New York Utilities, Inc., of Watertown has petitioned the Public Service Commission for permission to erect an electric transmission line from Lowville to Martinsburg to supply electricity in the latter town. The company was granted a franchise here in April, 1917.

NEW YORK, N. Y.—No bids were submitted on Oct. 2 for installing an extra set of 2300-volt busbars and replacing the existing set; also installing additional panels, switches, bus work, etc., in connection with changes on the 2300-volt switchboard and changes in gallery in substation on Blackwell's Island. The cost is estimated at $10,000. New bids will be asked for. N. B Lewis, Municipal Building, is engineer.

NIAGARA FALLS, N. Y.—Plans have been prepared by the Republic Carbon Company for the construction of four factory buildings at its local plant, consisting of three one-story structures, one 80 ft. by 340 ft., one 90 ft. by 144 ft., one 48 ft. by 100 ft. and a four-story building 32 ft. by 80 ft. A. D. Smith, Ellicott Square Building, Buffalo, is chief engineer.

NIAGARA FALLS, N. Y.—Plans for the proposed merger of the Hydraulic Power Company and the Niagara Falls Power Company of Niagara Falls have been approved by the Public Service District. The plans of the combined organization call for the immediate construction of a hydroelectric generating plant in the Niagara Gorge, to cost about $16,000,000. The initial installation will consist of two 33,000-hp. generating units. With the proposed construction of diversion channels for water it is proposed to increase the generating capacity of the two companies from 255,000 hp. to 400,000 hp. The new company will be capitalized at $66,000,000 and will be known as the Niagara Falls Power Company. Paul A. Schoellkopf will be vice-president and general manager.

ROCHESTER, N. Y.—Bids will be received by John S. Maxwell, president of board of trustees, New York State Soldiers and Sailors' Home, Bath, until Oct. 23, for construction, including heating, sanitary and electrical work, of barracks H and I at the New York State Soldiers and Sailors' Home. Drawings and specifications may be consulted at the above home, the New York office of the Department of Architecture, Room 1715 Tribune Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

SYRACUSE, N. Y.—Bids, it is reported, are being received by Gaggin & Gaggin, architects, University Block, for construction of an addition, 40 ft. by 60 ft., to the power house on Wolf and Seventh Streets of the Crouse-Hinds Company, 1910 Park Street, to cost about $30,000.

GLOUCESTER, N. J.—The Common Council has granted the Emergency Fleet Corporation a franchise to construct and operate a double-track electric traction system in various portions of the city to provide additional transportation for the workers engaged in the various shipbuilding plants and other war plants in this section.

PERTH AMBOY, N. J.—Plans are being considered by the Water Board Commissioners for extensions and improvements to the pumping station at Runyon. The cost of the proposed work is estimated at $60,000 and will include the installation of two pumping units, engines and auxiliary equipment. S. J. Mason is superintendent.

RIVERSIDE, N. J.—The William F. Taubel Company is considering the erection of a boiler plant, 25 ft. by 90 ft., at its hosiery manufacturing plant. The cost is estimated at $10,000.

HARRISBURG, PA.—Arrangements are being made by the Public Service Commission for stock and bond issues for the different light and power companies to provide for extensions and improvements as follows: Jefferson Electric Company of Punxsutawney, $50,000 in stock; Penn Central Light & Transmission Company of Altoona, $82,000 in bonds; Penn Central Light & Power Company of Altoona, $125,000 in bonds; Kane (Pa.) Electric Light & Power Company, $100,000 in bonds and $254,712 in stock; Penn Electric Service Company of Johnstown, $500,000 in bonds; Topton (Pa.) Electric Light & Power Company, $50,000 in bonds; Lycoming Edison Company of Williamsport, $67,500 in notes; Pennsylvania Water & Power Company of Holtwood, $400,000 in bonds; Citizens' Light, Heat & Power Company of Johnstown, $700,000 in bonds; Penn Public Service Company of Philadelphia, $139,000 in bonds; Susquehanna Transmission Company of Holtwood, $32,000 in bonds; Philadelphia Suburban Gas & Electric Company of Philadelphia, $27,000 in bonds; Duquesne Light Company of Pittsburgh, $15,000,000 in bonds and $10,000,000 in notes; Williamsburg Electric Company of Huntingdon, $30,000 in bonds; Lehigh Valley Transit Company of Allentown, $185,000 in bonds, and the Boyertown, Pa., Electric Company, $20,000 in bonds.

LEWISTOWN, PA.—Ground has been broken by the Susquehanna Silk Company for the erection of a new one-story power house, 50 ft. by 100 ft., at its plant.

NOXEN, PA.—A new boiler plant will be erected at the new tanning plant of Armour & Company, to cost about $50,000. The new tannery will replace the plant recently destroyed by fire, and will cost about $1,000,000. Westinghouse, Church, Kerr & Company, 37 Wall Street, New York, N. Y., are engineers.

PHILADELPHIA, PA.—The William Cramp & Son Ship & Engine Building Company, Beach and Ball Streets, is considering the construction of a two-story engine plant, 305 ft. by 400 ft., at its works, to cost about $100,000.

PHILADELPHIA, PA.—The Philadelphia Quartz Company, 121 South Third Street, has acquired a site of about 30 acres on the Pennsylvania Railroad near Rahway, N. J., for a new plant. The cost of the proposed plant, including housing development for employees, it is reported, is estimated at about $1,000,000.

PHILADELPHIA, PA.—The War Department has authorized additions to the plant of the Hero Manufacturing Company, Gaul and Adams Streets, including three buildings, each about 200 ft. wide, the lengths not decided upon, and a boiler plant, 30 ft. by 30 ft. The cost is estimated at $150,000. The company manufactures brass, bronze and aluminum products.

PITTSBURGH, PA.—Plans are being considered by the Ward & Mackey Biscuit Company for the erection of a bakery on Penn Avenue, near Lexington Avenue, to cost about $125,000.

PITTSBURGH, PA.—Zantzinger, Borie & Medley, architects, of Philadelphia, have been engaged by the United States government to prepare plans and take charge of the housing project on Neville Island, near Pittsburgh. The island is to be the home of workers in the government ordnance plant which is to be erected on the island and will employ from 20,000 to 25,000 men. The plans call for the construction of 15,000 dwellings. The cost of the entire project is estimated at about $50,000,000.

PITTSBURGH, PA.—Preparations are being made by the Duquesne Light Company of Pittsburgh for the construction of an electric generating plant at Cheswick to develop not less than 120,000 kw. The cost of the proposed plant is estimated at between $16,000,000 and $18,000,000, of which amount between 30 and 40 per cent will be contributed from federal funds. The Duquesne Light Company owns the mines of the Equitable Coal Company at Cheswick, which produce 2000 tons daily. An overhead trestle will be erected to carry coal from the mine to the power plant. Work will begin on construction of the plant at once.

WILKES-BARRE, PA.—Plans are being prepared by the Vulcan Iron Works, Main Street, for the erection of a power plant.

BALTIMORE, MD.—The United Railways & Electric Company has awarded contract for the construction of a service station at Carroll and Monroe Streets to the Singer-Pentz Company, Continental Building, Baltimore.

CLAY, W. VA.—Plans are being prepared by O. L. Hall, engineer, Clay, for the erection of an electric transmission line from the plant of the Hartford Power Company at Hartland to Clay, a distance of 5 miles, to supply electricity for illuminating purposes. The cost is estimated at about $10,000.

WHEELING, W. VA.—The United States government has taken over the control of the Manufacturers' Light & Heat Company, which supplies fuel to West Virginia, western Pennsylvania and eastern Ohio cities. The company is capitalized at $50,000,000.

NORFOLK, VA.—The Virginia Railway & Power Company is reported to be considering the installation of two boiler units in its power plant.

NORFOLK, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 21 under Specification 3483 for elevators for laundry and power house, to cost about $5,000.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 30 for furnishing and installing lighting fixtures in the United States Treasury Annex at Washington. For details see Searchlight Section.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 6422½, refrigerating outfit; Schedule 6448½, 23,250 pairs searchlight carbons; Schedule 6454½, 500 battery-charging panels; Schedule 6474½, binding wire for turbines and blading material. Eastern and Western yards, Schedule 6425½, 15,000 lb. insulating tape, conduit, cord and cable; Schedule 6165½, 42 circuit breakers. Eastern yards, Schedule 6436½, telephone switchboards. New York, Schedule 6448½, 1000 radio masts. Washington, Schedule 6453½, sheet brass, magnetic sets and magnet cases; Schedule 6471½, one motor-generator set; Schedule 6497½, four traveling cranes. Brooklyn and Detroit, Schedule 6456½, 224 lenses for signal system. Charleston, Schedule 6476½, ammeters, bells, electrical material and wire rope thimbles. Mare Island, Schedule 6477½, 23,500 flashlight batteries. Applications for proposals should designate the schedule desired by number.

North Central States

DETROIT, MICH.—General contract for the construction of a power house for the Murphy Iron Works at the foot of Walker Street has been awarded to the Cooper & Widermann Company.

DETROIT, MICH.—The Central Forge Company of Detroit is planning to erect three one-story factory buildings, 96 ft. by 192 ft., 60 ft. by 301 ft. and 63 ft. by 301 ft. respectively, on Euclid Avenue, to cost about $300,000.

AKRON, OHIO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 7 for extensions to conduit and wiring, lighting fixtures, etc., in the United States post office at Akron. For details see Searchlight Section.

CLEVELAND, OHIO.—The Cleveland Electric Metal Company, 2391 West Thirty-eighth Street, is contemplating the construction of a new building, to cost about $50,000.

CLEVELAND, OHIO.—The construction of a new factory, 80 ft. by 400 ft., one story high, is reported to be under consideration by the Electric Steel Forge Company.

CLEVELAND, OHIO.—Bids, it is reported, will soon be asked by the Bissinger Magneto Company, 1613 Prospect Avenue, for construction of a new factory on East Twenty-first Street, to cost about $50,000. S. H. Weiss, Schofield Building, is architect.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, 219 City Hall, Cleveland, until Oct. 24 for construction of a garage for the division of water at St. Clair Avenue and East Third Street, as follows: (1) General contract; (2) heating; (3) plumbing; (4) electrical equipment. Specifications may be obtained at the office of the city architect, 604 City Hall.

DAYTON, OHIO.—Additional equipment is being installed in the plant of the Dayton Electrical Manufacturing Company on Fourth Street.

SALEM, OHIO.—Bonds to the amount of $15,000 have been issued by the city of Salem for equipping the waterworks pumping station for electrical operation. The proposed improvement includes the installation of a large triplex pump, three deep-well pumps and a small motor-driven compressor.

SANDUSKY, OHIO.—Work has begun on the installation of new Riley stokers in the power house of the Sandusky Gas & Electric Company.

SMITH'S GROVE, KY.—The capital stock of the Smith's Grove Light & Ice Company has been increased from $5,000 to $10,000, the proceeds, it is understood, to be used for extensions.

INDIANAPOLIS, IND.—The Ross Power Company of Indianapolis, it is reported, would like to receive prices on a 100-200-kw., 240-480-volt, 60-cycle, three-phase engine-driven generating set; 500-1000-gal. per minute boiler-feed pump; one 100-kw., 175-volt turbine, non-conductor exciter unit; one 100-80-hp. gas engine, belted, and two 500-hp. boilers.

CHICAGO, ILL.—Plans are being prepared by William P. Whitney, architect, South Dearborn Street, Chicago, for a manufacturing plant to be erected at Clearing, Ill., which will include a machine shop, 100 ft. by 210 ft., and a one-story foundry with provision for a traveling crane in the future. The cost is estimated at $96,000. The name of the owner is not made public.

KEMPTON, ILL.—Plans are being considered for the purchase of a municipal electric light plant for which bonds have been voted.

RED BUD, ILL.—The City Council has purchased the electric equipment, consisting of an engine, generator, switchboard, etc., which has been in operation at Washington, Mo., for the municipal electric light plant.

BEAVER DAM, WIS.—The Western Malleable Company of Beaver Dam expects to install electrical equipment, consisting of one 300-kva., 2300-volt, 60-cycle, 240-volt, direct-current, and one 200-kva., 2300-volt, 60-cycle, 240-volt direct-current synchronous motor-generator, with switchboard and control apparatus, in its plant in the near future. L. S. Weiner, electrical engineer, will have charge of the installation.

MILWAUKEE, WIS.—Plans are being considered by the Allen-Bradley Company, Greenfield Avenue and Clinton Street, Milwaukee, for the erection of an addition, 65 ft. by 90 ft., at its plant, to cost about $35,000. The company manufactures electric controlling apparatus. Alexander C. Eschweiler, Goldsmith Buidling, is architect.

UNION GROVE, WIS.—The Electropure Dairy Company of Burlington is contemplating the construction of a milk-condensing plant in Union Grove, to cost about $30,000. It will be equipped with electrically operated machinery.

ST. LOUIS, MO.—The Dielectric Manufacturing Company, 224 South Vandeventer Avenue, St. Louis, it is reported, is contemplating the purchase of electric motors and rubber-compounding machinery. J. J. Kessler is president.

ST. LOUIS, MO.—Contracts have been awarded for the erection of two steel-manufacturing plants in connection with the plants of the Laclede Gas Light Company in St. Louis to the Austin Company of Cleveland, Ohio. The cost is estimated at $3,830,300.

ST. LOUIS, MO.—Plans, it is reported, have been prepared by G. P. Wuest, Wainwright Building, St. Louis, for the construction of a laboratory and administration building, 60 ft. by 100 ft., for the Pan.-Electric Manufacturing Company, 735 South Fourth Street. W. B. Botts of St. Louis is contractor. The cost is estimated at $50,000.

SIOUX FALLS, S. D.—A petition has been filed with the City Council asking that the proposal to issue $300,000 in bonds for the construction of a new municipal electric light plant be submitted to the voters. The petition states that for the present the city could use the present lighting system to furnish service in the downtown district if the water were pumped by steam instead of electricity.

KIRWIN, KAN.—The City Council has entered into a contract with the Phillipsburg (Kan.) Mill & Elevator Company to furnish electricity in Kirwin.

Southern States

GADSDEN, ALA.—The National Pipe & Foundry Company is planning to rebuild its machine shop, steam-fitting shop, pipe-fitting department and warehouse, recently destroyed by fire, causing a loss of about $100,000.

GENTRY, ARK.—The local electric light plant, it is reported, was recently destroyed by fire.

HOWE, OKLA.—At an election held recently bonds to the amount of $5,000 were voted for the installation of a municipal electric light plant.

KIEFFER, OKLA.—The high-tension transmission line of the Oklahoma Gas & Electric Company connecting the systems of Sapula and Kiefer has been completed. The local electric generating plant will be dismantled.

TULSA, OKLA.—The Atchison, Topeka & Santa Fé Railway Company is reported to have awarded contract for the construction of a passenger depot, freight station and terminal yards at First and Second Streets from Elgin to Grove Avenue, to cost about $2,000,000. The terminal yards will have about 10 miles of trackage and an electrical interlocking system will be installed. H. W. Wagner of Topeka, Kan., is chief engineer.

McKINNEY, TEX.—The Texas Electric Railway Company of Dallas has purchased a site between Kentucky and Tennessee Streets on which it expects to erect an express terminal and build extensive trackage to take care of its increasing express and freight business. The cost is estimated at about $25,000.

Pacific and Mountain States

EVERETT, WASH.—The Pacific Coast branch of the Fordson Tractor Company, it is announced, will be located in Everett. About 8000 people will be employed at the proposed plant.

SEATTLE, WASH.—The Standard Electric Company of Seattle has secured the contract to install the electrical equipment in the large mills of The Puget Mill Company at Hoods Canal. The equipment will include a 1000-kw. turbine, two 300-hp. motors for the headsaws in two of the mills, and over 70 motors varying in size from 3 hp. up. The entire plant will be wired for an electric lighting system and a new alternating-current system installed for lighting the town of Port Gamble. The motors and turbines were purchased from the Allis-Chalmers Company. The company is also installing an entirely new lighting system in the machine shops of the Washington Iron Works. About twenty motors will be rewired, a conduit system installed, in addition to a new alternator and switchboard.

LOS ANGELES, CAL.—Bids will be received by the Board of Public Service Commissioners, Room 1002 Knickerbocker Building, Los. Angeles, until Oct. 25 for furnishing the Department of Public Service with 33,000-volt and 1100-volt oil switches in accordance with Specification No. P-181. Howard Robertson is president of board.

NEWPORT, CAL.—The City Council is planning to install an electrically operated pumping plant in connection with the proposed new sewerage system, to cost about $172,370.

OROVILLE CAL.—Plans are being considered by the Pacific Gas & Electric Company for increasing the capacity of its hydroelectric plant at Oroville.

SAN DIEGO, CAL.—Plans have been completed by the San Diego & Arizona Railroad Company for the erection of new locomotive and car repair shops in the vicinity of Sixteenth Street and Newton Avenue. A new engine will also be built.

BUTTE, MONT.—The Butte Electric Railway Company is double-tracking its system in the city of Butte, at a cost of about $86,000. J. R. Wharton is manager.

CHOTEAU, MONT.—The Montana Power Company is erecting a high-tension transmission line (50,000 volts) from Choteau to Conrad, a distance of 32 miles. The cost of the line is estimated at about $50,000.

LEWISTON, MONT.—The Cook County Transit Company, it is reported, is preparing plans for the construction of an electric railway from a point near Gardiner along the Yellowstone River to the Lamar River and Soda Butte Creek. Richard Zahniser of Livingston is secretary.

Canada

GRANBY, B. C.—Preparations are being made for the installation of an electric lighting system in the new town of Granby, near Cassidy's Siding. An air shaft has been completed preparatory to installing a permanent air fan.

NEW WESTMINSTER, B. C.—The Lumber Products, Brunette Street, is considering building an addition to its plant and installing new machinery, at a cost of about $120,000.

VANCOUVER, B. C.—The Tudhope Electric Metals Company is contemplating the construction of a new foundry, 50 ft. by 100 ft.

DALHOUSIE, N. B.—The Dalhousie Lumber Company is contemplating the construction of an addition to its mill. New equipment, including steam engines, boilers, sprinklers, feed pump, motors, etc., will be required.

GALT., ONT.—Plans are being considered by the City Council for extensions to the municipal electric-light plant, to cost about $25,000. W. H. Fairchild is engineer.

TORONTO, ONT.—The Ontario municipalities connected with the Hydro-Power Union, it is stated, will soon hold a meeting to consider the question of establishing a telephone system in those districts served by the Ontario Hydro-Power Union.

UNIONVILLE, ONT.—The ratepayers of Unionville are considering securing an extension of the Hydro-Electric system from Agincourt to Unionville, a distance of 5 miles. The plans provide for the installation of 35 street lamps. The cost of the project is estimated at $10,000.

ESTEVAN, SASK.—The Estevan Board of Trade has been reorganized under the name of the Estevan Chamber of Commerce for the purpose of interesting similar organizations in a coöperative power scheme. It is proposed to develop either gas or electricity from the vast lignite coal deposits at Estevan and transmit it to the Soo line towns and the cities of Moose Jaw and Regina.

Record of Electrical Patents

Notes on United States Patents

1,278,266. Tire-Wrapping Machine; Park E. Welton, Cuyahoga Falls, Ohio. App. filed April 5, 1915. Spirally wraps narrow strip of paper or fabric around pneumatic-tire casing.

1,278,282. Telephone System; George A. Yanochowski, Chicago, Ill., and Harry E. Hershey, White Water, Kan. App. filed Dec. 5, 1913. For operating measured service devices or supervisory signals in automatic or semi-automatic systems.

1,278,308. Manufacture of Sulphuric Acid; Joseph F. Cullen, Midvale, Utah. App. filed Sept. 13, 1917. Sulphur dioxide utilized in treatment of manganese and zinc ores.

1,278,322. Inclosed Safety Fuse; Alfred L. Eustice and John B. Griffith, Chicago, Ill. App. filed Aug. 2, 1915. Relates to knife-blade cartridge fuses of non-renewable type.

1,278,324. Typewriting Machine; Hubert P. Fraenzl, Tacoma, Wash. App. filed Oct. 1, 1917. For shifting carriage of typewriter and operating or turning platen.

1,278,330. Telephone-Exchange System; Charles L. Goodrum, New York, N. Y. App. filed Dec. 2, 1916. For notifying subscriber whose line has been found busy that another subscriber is awaiting connection with his line.

1,278,331. Telephone-Exchange System; Charles L. Goodrum, New York, N. Y. App. filed Sept. 17, 1917. Circuit arrangements for selector switches employed in automatic or semi-automatic telephone exchanges.

1,278,339. Plug Socket and Fuse Box; Harold P. Hastings and Floyd C. Smith, Syracuse, N. Y. App. filed Aug. 6, 1915. Accessible in simple and efficient manner.

1,278,357. Shell and Projectile; Laurence S. Lachman, New York, N. Y. App. filed Dec. 7, 1915. Nose or cap secured by welded rivets or pieces.

1,278,365. Aotomatic Telephone System; Anders M. Malmberg, Chicago, Ill. App. filed April 27, 1914. Amount of apparatus in the exchange can be greatly reduced.

1,278,368. Welding Controller; Theodore D. Montgomery, East Orange, N. J. App. filed April 17, 1916. Holds its automatic switch closed independently of switch-operating windings.

1,278,410. Automobile Attachment; David L. Winters, Philadelphia, Pa. App. filed May 22, 1917. Applied to steering wheels of automobiles for sounding horn or actuating some other signal.

1,278,441. Spark Intensifier; William J. Cunningham, Toledo, Ohio. App. filed May 28, 1917. Easily and quickly applied to spark plug.

1,278,448. Electromagnetic Switching Device or Relay; Samuel H. Everett, Brooklyn, N. Y. App. filed March 11, 1915. Operates on direct current alone or on direct current upon which are superimposed alternating currents of widely different frequencies, but will not operate upon any of those alternating currents alone of values experienced in service.

1,278,467. Thermal Cut-Out for Electrical Circuits; Henry A. Hoeschen and William G. Hoeschen, Omaha, Neb. App. filed March 21, 1917. Automatically compensates for temperature changes caused by means other than current.

1,278,480. Composite Metal Work; Laurence S. Lachman, New York, N. Y. App. filed Feb. 8, 1918. Tube projecting from one face of plate and united therewith by welded union.

1,278,484. Electric Heater Unit; Leslie V. Leonard, Richmond, Victoria, Australia. App. filed Dec. 8, 1917. Radiant and reflected as well as convective heat is concentrated and given off in one direction.

1,278,492. Signaling System for Motor Vehicles; Max A. Miller, Maywood, Ill. App. filed July 23, 1917. For indicating change of direction of movement of vehicle.

1,278,505. Transmitter; Charles A. Reifel, New York, N. Y. App. filed Nov. 10, 1917. Of microphone type, for use in audiphones.

1,278,507. Radio-Telegraph Transmitting System; Oscar C. Roos, Allston, Mass. App. filed July 14, 1917. Discharge of oscillating circuit condenser may be readily controlled over wide tone range.

1,278,508. Radio-Telegraph Transmitting System; Oscar C. Roos, Allston, Mass. App. filed July 14, 1917. Effect of auxiliary source of electrical energy is augmented by resonance, and interaction between circuit of source and other parts of system is prevented.

1,278,509. Block Signal System; John J. Ruddick, Newton, Mass. App. filed March 19, 1913. Plurality of cars may follow each other into the block in same direction without disturbing signals.

1,278,522. Oscillating Safety Switch; Horatio S. Tittle, San Francisco, Cal. App. filed Nov. 16, 1916. For use in starting motors where very heavy starting current is required.

1,278,530. Electrothermal Robe; Howard H. Wallace, Salt Lake City, Utah. App. filed Jan. 23, 1918. Fastened about person to be medically treated with electrically generated heat.

1,278,535. Wireless Signaling Apparatus; Roy A. Weagant, Roselle, N. J. App. filed April 5, 1915. For detecting and amplifying electrical impulses or variations.

1,278,610. Automatic Controller; Garrett B. Downs, Mauch Chunk, Pa. App. filed March 6, 1915. Causes resistance to be gradually cut down before direct or main line current can pass through driving motors of electric car or other vehicle.

1,278,635. Electric Furnace and Method of Supplying Current Thereto; James H. Gray, New York, N. Y. App. filed July 20, 1918. Prevents excessive surges in fluctuations of current and interruption of arc during melting-down period.

1,278,652. Railway-Signaling Track Instrument; Henry A. Hoeschen and Joseph A. Hoeschen, Omaha, Neb. App. filed March 5, 1914. Different electrical circuits may be established in accordance with direction of movement of train along track.

1,278,661. Carbon Holder of Electric-Arc Lamps; William L. Humphries, Patricroft, England. App. filed Jan. 19, 1918. Carbon is held near end while clamp supports holder.

1,278,675. Electrotherapeutic Apparatus; Yoshinao Kawakita, Kamoto-Gun, Kumamoto-Ken, Japan. App. filed Nov. 24, 1916. Current of very high frequency and voltage and second current of low frequency and voltage flow in "operating" circuit at same or different times.

1,278,697. Telephone-Exchange System; Alben E. Lundell, New York, N. Y. App. filed Nov. 2, 1917. Small number of auxiliary switches needed to control connections between operator's head set and cords at her position.

1,278,709. Signal System; Louis W. Miller, Rochester, N. Y. App. filed Aug. 25, 1915. For police signaling in cities and municipalities.

1,278,723. Electrolytic Cell; Frank H. Nickle, Midland, Mich. App. filed Aug. 19, 1914. For electrolysis of alkali-metal chloride, particularly sodium and potassium chloride.

1,278,724. Electrolytic Cell; Frank H. Nickle, Saginaw, Mich. App. filed March 28, 1917. For electrolysis of alkali chloride, production of caustic alkali and chlorine.

1,278,738. Signaling Device; Edward G. Petrie, Irvington, N. J. App. filed Jan. 21, 1918. Illuminated hand-signaling device wherein semaphore-like signaling movements of hand and arm are employed.

1,278,757. Winding Machine; Claes Ryden, Cranston, R. I. App. filed June 8, 1914. For disconnecting guide-traversing means from power-driven mechanism of electrical coils.

1,278,770. Controller for Dynamo-Electric Machines; Arthur Simon, Milwaukee, Wis. App. filed June 5, 1915. For direct-current dynamo having alternating-current stator and rotor whereby it is driven as an induction motor.

1,278,775. Electrical Apparatus for Heating Liquids; William H. Smith, Falkirk, England. App. filed Dec. 12, 1916. Surfaces of plugs of heating tube are maintained at a distance apart equivalent to height of column of granules.

1,278,780. Electric Switch; Clarence C. Stirling, Hartford, Conn. App. filed Jan. 11, 1918. Of particular advantage when incorporated in pendent snap switches.

1,278,781. Electric Switch; Clarence C. Stirling, Hartford, Conn. App. filed Jan. 11, 1918. Compact; provides for efficient action of circuit-controlling member.

1,278,815. Panotograph Trolley; Christian Aalborg, Wilkinsburg, Pa. App. filed Feb. 17, 1915. Adapted to collect large amounts of current under high-speed operation and to be operated in places where lateral space is limited.

1,278,824. Electric Lantern; Frank T. Baird, Blue Island, Ill. App. filed Dec. 4, 1918. Uses recharge battery or ordinary dry battery.

1,278,842. Machine for Marking Shoe Uppers; Arthur W. Brice and Irving E. Booth, Rochester, N. Y. App. filed April 19, 1916. Electrically heated cauterizing device places indication marks upon material to designate locations for subsequent operations.

1,278,847. Telephone Signal Relay; Earl Buker, Butte, Mont. App. filed May 26, 1917. Will not cause a vibratory movement of the contacts of local circuit.

1,278,850. Train-Service Coupling; Albert J. Campbell, Marion, Iowa. App. filed April 20, 1918. Provides complete electrical circuit by way of the train pipe, instead of depending upon ground connections to complete circuit.

1,278,860. Welding Controller; Leonard P. Coulter, Milwaukee, Wis. App. filed May 6, 1915. To provide welding controller having an automatic switch which will not be subjected to the full welding current.

1,278,864. Repeating Coil; Hiram D. Currier, Chicago, Ill. App. filed April 9, 1914. U-shaped core permits easy mounting of the windings in efficient relation to core.

1,278,865. Dynamo-Electric Machine; James F. Curtis, Pitcairn, Pa. App. filed April 25, 1914. Integrally combined wiper ring and set of fan blades provided for rotors.

1,278,893. Inclosed Safety Fuse; Alfred L. Eustice, Chicago, Ill. App. filed Aug. 2, 1915. New link cannot be inserted in fuse without destroying parts thereof.

1,278,911. Cartridge Fuse; John B. Griffifth, Chicago, Ill. App. filed Aug. 2, 1915. Has end caps to inner faces of which ends of the fusible link of fuse are soldered.

1,278,917. Control System; Arthur J. Hall, Wilkinsburg, Pa. App. filed Dec. 10, 1914. Is of remote-control, multiple-unit type and adapted to govern operation of fluid-actuated mechanisms.

1,278,920. Fire-Detecting Wire; Charles Harsch, New York, N. Y. App. filed July 27, 1917. When alloy is heated it is forced outward and perforates the insulating coating, making electrical contact with armor.

1,278,921. Electrical Measuring Instrument; Stephen Q. Hayes, Pittsburgh, Pa. App. filed June 5, 1916. Indicates power factor, power and reactive components of energy and volt-amperes traversing circuits to which they are connected.

1,278,923. System and Method of Control; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Jan. 7, 1914. For commutator type or similar machines, whereby good commutating and general operating conditions are obtained, particularly during starting period.

1,278,924. Motor for Pulsating Current; Rudolf E. Hellmund, Swissvale, Pa. App. filed Aug. 7, 1916. Of commutator type, particularly designed for operation upon pulsating supply circuits.

1,278,936. Centrifugal Switch; John T. Janette, Chicago, Ill. App. filed June 16, 1917. Used in connection with alternating-current motors for introducing and cutting out split-phase starting coils.

1,278,940. Liquid-Level Gage; Leon Le Compte, McKittrick, Cal. App. filed July 27, 1916. Annunciator acts with circuit-completing arrangement to turn indicating member when a circuit is completed.

Electrical World

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Dawdling on Water Power

IT IS gradually dawning on the consciousness of legislators and the general public alike that coal is hard to get and that what there is of it will not last forever. Yet no one in authority seems to be worrying over the outlook. True, we have admonitions from the Fuel Administration to save coal by curtailing non-essential production and by burning the fuel efficiently, yet water-power legislation which would make immense coal savings possible still awaits action. Valuable water power is still running to waste and fuel more precious is being burned to obtain the power which the wasting water might supply. Meanwhile, there is the insistent cry of power shortage, but senators are obviously taken up with the sound of their own voices so that they cannot hear it, or if they do hear it, they are so out of touch with the actual conditions that they do not appreciate how acute the situation is. The Senate is opposed to many of the features of the administration water-power bill now in its hands, but it is quite dilatory in making its opposition known and enacting a measure for which the country is patiently awaiting. While its committee dawdles along with the measure committed to it, there are in almost every district object lessons setting out the folly of inaction. Power companies can make bricks if the straw and clay are not withheld.

Utilities and Daylight Saving

WHILE it undoubtedly would have been to the advantage of many lighting companies to have daylight saving extended throughout the year, it would be very difficult to prove that it would have been of any advantage whatsoever to the hundred million inhabitants of the United States. Any suggestion, therefore, to extend it beyond the last Sunday in October would be bound to be unpopular, and electric lighting companies were wise in not appearing openly as ardent advocates of Senator Calder's proposed resolution. Certainly, any slight advantage would never compensate a company for the prestige it would lose through such espousal or for the actual hindrance it would encounter in all directions owing to popular prejudice. Good will is very hard to get and is too valuable an asset to throw away on such a trifling matter as daylight saving. No public utility wishes to deny to the general public any great advantage because it would entail some sacrifice on the part of a utility. All must work for the general good, and what is not for the general good of the nation is not, in the long run, for the general good of any industry.

Developing Engineers of Character and Judgment

DR. CHARLES R. MANN in his report on engineering education suggests that 95 per cent of the engineers think the character and judgment of the young men they are to employ more important than knowledge and technique. It is worth while, then, to consider the remedies which he proposes for any deficiencies along these lines apparent in educational training. One of the most valuable of these remedies lies in the suggestion that certain tests be applied to a student before matriculation which will show whether he has the mental ability required. Professor Thorndike applied such tests to a group of thirty-four men entering Columbia University and discovered that it was quite possible to forecast the records which these students subsequently made. Teachers, too, commonly find that it usually does not take long to "size up" a student. Instead, therefore, of permitting young men from the high schools to enter college on the basis of certain subjects studied, it would seem better to set about taking the measure in a businesslike way to see whether they are on the right track. This would save much of the effort required and grief incurred in weeding them out. Men who lack common sense can scarcely acquire it and should be eliminated at the start, and the same scheme of examination is advocated for use with the upper classmen as well.

It is Dr. Mann's opinion also that colleges are missing a real opportunity in overlooking the possibility of using industrial shops for engineering laboratories. He points out the work being done by certain coöperative engineering schools, notably the University of Cincinnati, where the student mixes with the workmen and gets their point of view as he might never get it in any other way. This is certainly of the highest importance if, as Dr. Mann believes, the chief object of the engineer is to increase production. It is further suggested that engineering problems, including the important elements of value and costs, be assigned to the classes. Students in electrical engineering, for instance, should be asked to decide which is the best of three motors for the price rather than to measure the efficiency of a motor. Unquestionably one would prefer to employ a man who could choose the best motor for the price, but it is not certain that he could do so without first learning to measure the efficiency of a motor. Whether the coöperative scheme be correct or not, the value of actual engineering work along with a college education cannot be doubted since men with this experience make the best students.

The matter of developing character has so far been entirely independent of the curriculum. Much may be done to inspire the students individually and a great deal may be accomplished by developing high ideals. The humanistic studies, so sadly neglected in many engineering schools, will do much to strengthen character and broaden the concepts of students. It is a pleasure, therefore, to note the increase in the emphasis placed upon the humanities and humanistic studies. Above all else we need broad-minded men and not narrowed mechanicians, and the present report is especially welcome because it is wider in its concept of these matters than its title would imply. Educators of all kinds will find Dr. Mann's report very profitable reading.

A Notable Steam Transmission Plant

ONE of the interesting features of the growth of electric power transmission has been the steadily increasing use of steam plants as a secondary source of supply in connection with the hydroelectric plant originally developed. It is hardly fair to call many of the steam plants now in use by the title of auxiliary plants. They are not auxiliary in the usual sense of being merely used in an emergency or turned on to eke out failing water. They are rather for the purpose of enabling hydroelectric resources to be utilized to the fullest extent. The weak point of all hydroelectric propositions is the variation of the flow, which many times exceeds for short periods the average flow and still more the low-water flow. The earlier hydraulic engineers have been wont to divide their possible output into primary and secondary power—the former that which was available all the time, the latter that which was generally available but subject to interruption or reduction for a material portion of the year's run. Now, a hydroelectric plant to take the best advantage of its flow must include a considerably larger capacity than is available purely as primary power, and the modern steam stations—secondary stations we have here called them— are intended to deal fully and efficiently with the upkeep of secondary power and not merely to serve in case of breakdown or to defend the system against complete collapse at times of exceptionally low water. They are therefore planned for the efficient production of large quantities of energy for a considerable portion of the year's running time and have to be designed for high efficiency rather than for minimum overhead like the auxiliary plants of earlier days.

We describe this week an excellent example of such a steam plant built to operate in conjunction with the hydroelectric system of the Turners Falls Power & Electric Company, which operates in the central Connecticut valley. This is now about to be placed in operation, with 30,000 kw. in two units. A few years ago the operation of only two units in a steam plant would have been frowned upon, but here, as in all other cases of transmission networks, the advantageous size of units is determined, not by the theoretical requirements of any one station, but as a part of the equipment of the whole system. The new plant, situated at Chicopee Junction, is designed with high efficiency especially in view. Its boiler units are big—eight mechanically stoked boilers furnishing the whole output, and the condensing and coal-handling systems are planned to get the most possible out of the fuel. There is extensive use of motor-driven auxiliaries, and every precaution has been taken to bring the plant to the highest point of economical operation. The requirements of coal supply and water condensation made it advisable to build the plant on a site where especial care had to be taken with the foundations, another instance of the wisdom of adjusting conditions for economical operation, even at extra first cost. Good judgment, too, was shown in giving liberal space for all the apparatus. Crowding is sometimes necessary, but never desirable. An important feature of the plant is an ample amount of coal-storage capacity, sufficient to operate the plant at its rating for three months when fully utilized. Electrically the plant represents a design entirely coherent with the existing system, generating at 13,200 volts and transmission at 66,000 volts, Y-connected with grounded neutral. The transmission voltage is derived from an outdoor substation, sufficient evidence that the day of costly and complicated transformer houses is near its end even in our northern climate. Altogether the new plant is a capital example of advanced practice and should prove extremely valuable to the great transmission system which it feeds.

The Power-Factor Problem

IN THESE times, when generating capacity is being taxed to its utmost, the ever-present but sometimes half-forgotten matter of power factor comes to the front. Will Brown's paper in the current issue puts very forcibly before the reader the real gravity of the situation which arises from the thoughtless or ignorant use of machines which keep the power factor of the system so low as to cause grave reduction in its working capacity and considerable increase in the losses. As Mr. Brown pictures it, a great and increasing pile of electric machinery, line wire and equipment lies practically useless by reason of operating at reduced power factor. A 1000-kw. generator at low power factor may be capable of doing no more than 500 kw. or 600 kw. worth of actual work, and that at lowered efficiency. The case would be just as bad as if a 400-kw. or 500-kw. generator were crippled and lying idle. Mr. Brown quotes half a dozen cases in which the power factor was actually found to be down to 50 or 60 per cent, and on plants operating considerable motor load this condition is actually a common one. The worst of it is that not only is the central station hampered but the motors themselves are working at comparatively low efficiency, else in most cases they would not be showing low power factor.

As a rule, the power factor of modern induction motors operated at or near load can be held up to the neighborhood of 80 per cent, often exceeding it. Low power factor is not due to poorly designed motors so much as to poor engineering in their installation. In earlier days bad induction motors were common, but at present there is no excuse for their use at all. Indeed, save for exceptional cases of abnormally low speed or very peculiar load conditions, it is not easy to find a motor which really performs badly at full load. Most of the trouble comes from running unnecessarily large motors with badly distributed load, and this means loss to the consumer as well as to the producer of electric power. There are, of course, some familiar remedial measures, like the use of synchronous motors and of synchronous condensers, which will permit the correction of power factor without the delay incident to replanning the existing induction-motor drives.

Mr. Brown believes—and many central-station men will agree with him—that more restrictions ought to be placed on load involving low power factor. It was a mooted question in the early days of electrical transmission whether, considering the seriousness of the matter, it might not be wise to furnish energy for induction motors on an ampere-hour basis. The same question in a somewhat modified form arises to-day, and it has not infrequently been found necessary to enforce by one means or another measures penalizing low power factor, or, what amounts to the same thing, favoring the customer with high power factor. There is, however, no general agreement as to the best way of dealing with the difficulty, and we hope that Mr. Brown's articles on the subject will lead to definite and widespread action to relieve the situation.

War-Time Lighting Economies

THE report on this topic by the committee on war service of the Illuminating Engineering Society is a most suggestive and important discussion of real economic measures as contradistinguished from those chiefly concerned with catching the public eye. The recommendations made by the committee with respect to the elimination of waste and the more effective use of daylight are in themselves amply sufficient to accomplish all the saving really advantageous to the community in the matter of artificial lighting. A possible exception may be made with respect to the use of artificial light for advertising purposes, but, as the committee plainly states, this is intrinsically merely a part of the general situation with respect to the waste of money and material in garish competitive displays which the powers that be have as yet shown no symptoms whatever of attempting to curtail. If the users of artificial light set themselves rigorously to follow the recommendations of the I. E. S. committee, they will not only very materially reduce the amount of fuel needed for the sum total of artificial lighting, but will also reduce their personal bills to a very perceptible extent.

Perhaps the strongest single practical point made in the report is that which deals with the desirability of using only such lamps as are necessary, cutting down, not the illumination, generally none too high, but the area lighted. A very casual inspection of any residence region shows that to-day, even in war time, many unnecessary lamps are in use, illuminating a much greater area than anything which can be fairly held to be actually required.

Turning from this matter, we reach another to which the committee directs attention in the waste of light in shops. The experience of the last few years has very clearly proved that store lighting is a competitive rather than a utilitarian proposition. The enterprising shopkeeper sets his windows ablaze and his bargain counters into bold relief by lighting sometimes excessive in the hope that thereby he may strike the consumer's eye more vigorously than his competitor. We ought by this time to be far enough from the "business as usual" point of view to realize the nature of this situation and to settle down upon a strictly businesslike basis of illuminating for practical usefulness rather than for display.

In industrial work opportunities for saving artificial light are rather meager. Most factories are now underlighted rather than overlighted, and, aside from the general suggestions made by the committee on using efficient illuminants skillfully, not much is to be accomplished, especially in these times when night shifts are increasingly common. To tell the truth, we look with some disapproval on the minimum illuminations suggested by the committee for manufacturing purposes. For certain kinds of work 3 foot-candles may be and doubtless is enough, but, taking the higher grade of industrial operations as a whole, we are convinced that reduction of light to this amount would materially impede production, probably to an extent which would more than offset, when reduced to actual fuel consumption, anything that would be gained by approaching a minimum of 3 foot-candles in the lighting.

In industries necessary to the carrying on of the war results are of the first order of importance, and it is far better to save fuel if necessary by the elimination of non-essential industries than by crippling even to a small extent those that are essential. The actual saving in coal by the reduction of lighting after the ordinary sources of waste are eliminated is so trivial as hardly to be worth considering when one bears in mind the very probable losses of human efficiency. The most that can be said for the somewhat extreme measures aimed at by the Fuel Administration is that, from the conspicuousness of the deficit, they make a brave showing of an immaterial conservation; and, frankly, we do not believe in the methods of the publicity manager in solving technical and financial problems of the most serious importance to the community. In our alleged efforts at conservation there has been far too little of careful analysis of the conditions and forceful remedial measures. The war is not over, despite the made-in-Germany scare headlines, and this is the very time at which persistent and unostentatious hard work has the greatest value to the nation.

The Coming Issues

ADDITIONAL features of the new Dayton steam station will be described in an early issue. Particular attention will be given to the electrical part of the plant, which has been designed to permit great flexibility of operation. Another article will describe an interconnection in the Far West that makes possible the most economical use of water power. Different measures of economy are being taken by the Southern California Edison Company, and these will also be outlined. A brief account will be given of steps taken by another company to develop water power hitherto not utilized by installing induction generators. Problems involved in improving power factor, the urgency of which is discussed in this issue by Will Brown, will be discussed in further detail in later issues.

Plant Arrangement and Costs of Construction—I

Features of Latest Station of Turners Falls Power & Electric Company, Which Bids Fair to Be One of the Most Important Steam Plants in the New England States

A NEW steam plant, to cost $2,215,000, with an initial installation of 30,000 kw. in two turbo-generators, will soon be placed in operation at Chicopee Junction, Mass., by the Turners Falls Power & Electric Company, which operates nearly 500 miles (800 km.) of transmission and distribution lines in the central Connecticut Valley. The Montague City hydroelectric plant of this company, previously described in the Electrical World, has now been developed to its full capacity of 45,000 kw., but the growth of load on the system has been so rapid during the last two years that the establishment of a steam station was seen to be necessary even before the completion of the former. The company supplies energy to many important industrial concerns, to central stations and electric railways, the Springfield Street Railway having recently entered into a contract for service over a thirty-year period.

Investigations showed that the steam plant should logically be situated at the southerly end of the system, and four different sites were considered, taking into account particularly the growth of load, connection with the existing transmission system, availability of water for condensing and feed purposes, transportation of coal, coal storage and cost of site. The site finally selected is at the junction of the Connecticut and Chicopee Rivers, about 4 miles (6 km.) from the center of Springfield. It includes about 40 acres (16 hectares), is well provided with railroad facilities and is almost ideally situated for the future delivery of coal by water when the Connecticut River is made navigable to Holyoke or points adjacent thereto. The site is also well situated with respect to the existing transmission lines of the company and center of its present load, and it is in the heart of an important industrial district which is an excellent field for future development. Immediately upon the grant of authority to purchase the necessary land equipment orders were placed on a priority basis, excavation and development of the site were started, and work on the design and plans was rapidly carried forward. Construction was begun in May, 1917, and was practically completed by June 1, 1918. The site was cleared of timber, access roads were constructed, foundations were built, and the structural steel frame was erected to allow for the installation of boilers after a period of seven months. The structure of the building was inclosed sufficiently to protect workmen engaged in installing equipment after a period of nine months. The substructure and building were carried forward almost simultaneously with the plans and designs, which was necessary to secure the completion of the project when needed. The first generating unit was put into service in September of the present year.

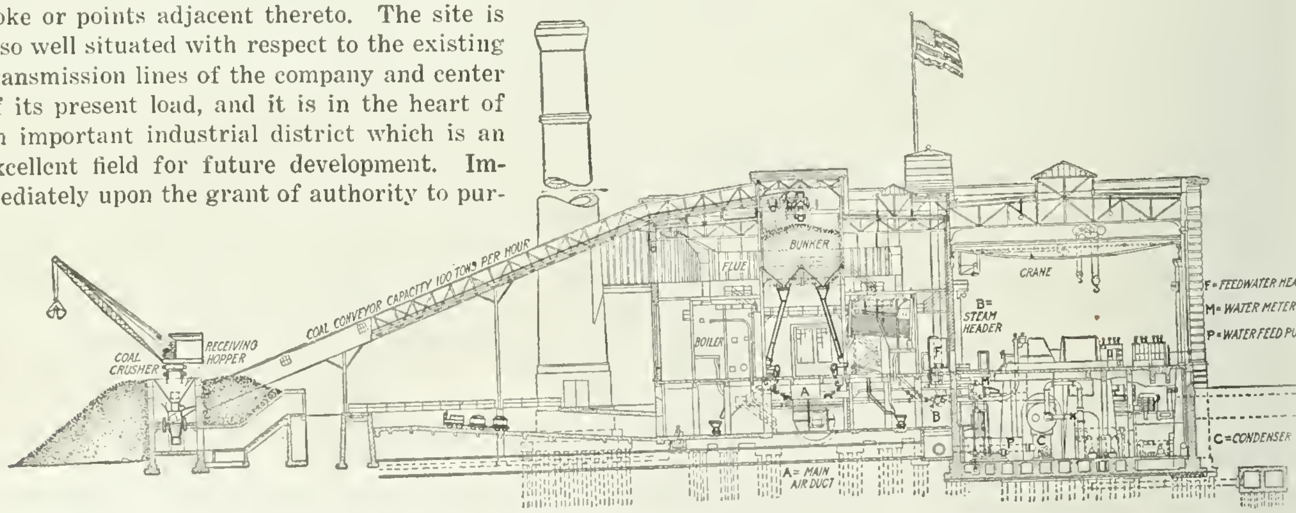


FIG. 1—COAL AND ASH HANDLING EQUIPMENT AND GENERAL ARRANGEMENT OF STATION APPARATUS

Description of Equipment

The principal equipment of the plant consists of eight 652-hp. Edge Moor water-tube boilers equipped with Riley stokers; two 15,000-kw. General Electric turbines designed for 200 lb. (14 kg. per sq.cm.) working pressure and driving three-phase, 60-cycle generators rated at 13,200 volts; jet condensing equipment furnished by the C. H. Wheeler Manufacturing Company and including "Radojet" ejectors; a coal-handling system of the Stephens-Adamson Company's design; an Alphons-Custodis chimney; two Warren Webster feed-water heaters and purifiers; six 6250-kva. Westinghouse outdoor-type transformers, which raise the potential of the generator output for transmission to 66,000 volts; a Brown-hoist electrically operated locomotive crane for yard service; a forced-draft system operated by Green fans driven by Terry turbines and by motors; a 60-ton Whiting electric crane for turbine-room service; a Merrick weightometer for coal service, and various auxiliary apparatus.

Points of special interest in the station design are the provision for coal supply and storage; the coal-handling system, condensing system, arrangement of the station for expansion; extensive use of motor-driven auxiliary equipment; protection of the station against high water in the Connecticut River, and the outdoor substation by which the plant is tied into the 66,000-

volt transmission system of the company. The plant is by no means a mere stand-by installation which will be operated only at seasons of low water in the Connecticut River; it is to be handled in connection with the other stations of the company so as to secure the best all-around efficiency of the system, and is accordingly designed for economical service along the lines of the best modern practice. This station bids fair to become one of the most important steam plants in Massachusetts in relation to future load developments and system interconnections.

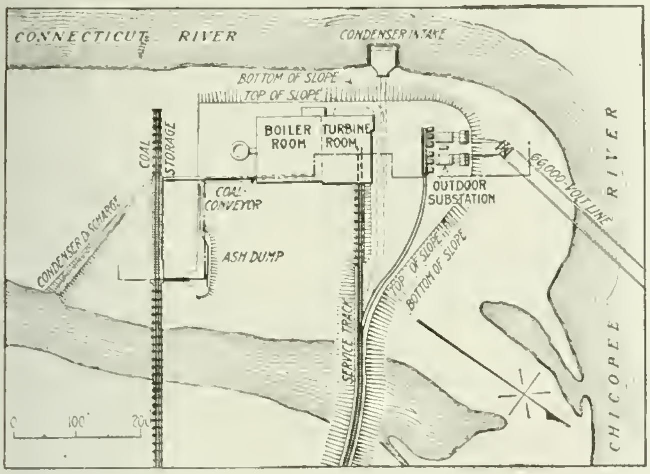


FIG. 2—CONDITIONS AND FACILITIES SURROUNDING HAMPDEN STATION

The station is in the city of Chicopee and is known as the Hampden plant of the company. It is about 2000 ft. (610 m.) from the Chicopee Junction station of the Boston & Maine Railroad. For construction a single-track connection was made with the railroad, branching on the property into two lines, one being carried over a timber and concrete trestle for the storage of coal, and the other, a service track on a roadway embankment and wooden trestle, connecting with the turbine room of the station and used in the transportation of machinery and supplies. About 7000 ft. (2150 m.) of tracks, turnouts and spurs were constructed, and a standard-gage Boston & Maine locomotive and crew have been required for switching in cars of building material, equipment and coal. The general arrangement of railroad tracks is shown in the accompanying plan of the station property, the coal trestle being shown at the right of the station and the machinery, material and general supply line near the north end of the building. A trestle 1077 ft. (3290 m.) long was required for the free dumping and storage of coal, and the entire cost of wooden and concrete trestle, service track to the turbine room and construction railroad used during the period of erection was about $132,000. The total storage capacity of the present coal field is about 36,000 tons at a depth of 10 ft. (3 m.).

A portion of the land on which the plant and its connections are built is flooded at times of high water in the Connecticut River. The grounds around the station and a permanent highway connection on which there is a service railroad track have been brought to an elevation above the highest known water level. Filling was obtained from a borrow pit across the Chicopee River and cinders for this purpose were obtained from the railroad company.

Owing to the character of the material underlying the plant it was necessary to support the station structure on a concrete pile foundation. About 1000 Raymond concrete piles were driven, each of which is designed to carry 30 tons of building load including its equipment. Beneath the turbine-room operating floor is a basement with floor at an elevation just above extreme low water in the Connecticut River. At times of high water this basement would be entirely surrounded by ground water, which necessitated the most careful construction. Between the tops of the piles and the basement floor is a system of heavy concrete beams reinforced with steel, carrying the downward loads of the building and sustaining the pressure of water from beneath. Water is excluded by a membrane similar to that used in the subway construction in the cities of New York and Boston. The operating floor of both the boiler and turbine rooms is 30 ft. (9 m.) above the turbine-room basement floor; below this concrete construction has been used throughout. The total cost of excavation, concrete pile foundation, underdrains, floors, concrete building walls, etc., was about $237,000. About 1400 ft. (425 m.) of borings were made in studying the site. The pressure beneath the basement floor at the maximum stage of the Connecticut River is about 1400 lb. per square foot (6850 kg. per sq.m.).

Above the concrete foundation and the operating floor has been constructed a superstructure consisting of brick walls, with a concrete roof and a structural steel frame. A panel of tile is provided just above the operating floor of the turbine room. The total cost of the superstructure was about $247,000.

While the station design follows the usual practice, it is unusually liberal in spacing. The boiler room is about 102 ft. (31 m.) square, the turbine room being 79 ft. by 109 ft. (24 m. by 33 m.) in plan. Condensing equipment, feed pumps, sump pumps and an air-compressor are installed in the turbine-room basement, which is high enough to provide good spacing for piping and accessories. The fan system for stoker service and the ash-handling equipment, main air duct and steam header are in the boiler-room basement, the feed-water heaters being within the boiler room close to the turbine room wall and near the floor level. The condensing water supply and discharge is carried through the station in an unusually direct run of piping and conduit, as shown in the accompanying cross-sec-

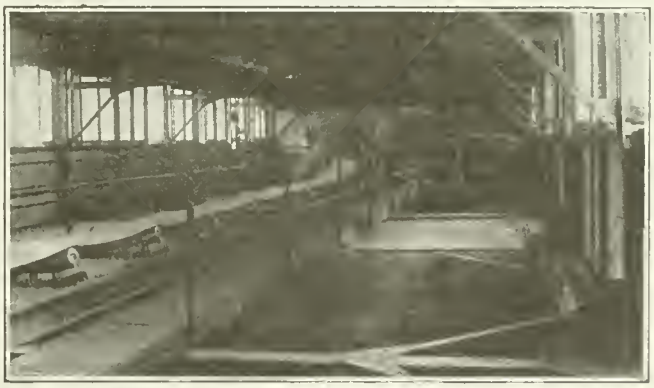


FIG. 3—CONVEYOR THAT DISTRIBUTES COAL IN OVERHEAD BUNKER

tion. The location of the boiler-feed pumps between the condenser hot wells and the feed-water heater units, as shown, enabled short pipe runs to be provided. A noteworthy feature of the station design is the running of the main high-pressure steam piping from the boiler outlets downward across the basement to a header from which the turbine supply is taken. This arrangement leaves the boiler room clear and results in minimum cost for pipe of the larger diameters.

The coal-handling system includes ground storage facilities and a trestle, approximately 1200 ft. (365 m.) long and from 15 ft to 30 ft. (4.5 m. to 9 m.) high. This storage is filled by gravity from bottom-dump cars. A locomotive crane operated on the trestle is used for spreading the coal and for reclamation purposes. The capacity of the storage yard, in which fuel is piled to a depth of 10 ft. (3 m.), is sufficient to operate the present plant of 30,000 kw. rating for about three months at 100 per cent load factor, assuming an efficiency of 2 lb. (900 gm.) per kilowatt-hour. The locomotive crane will haul two loaded cars on the trestle and has a capacity of 60 tons to 75 tons per hour. It is operated by 550-volt, three-phase energy.

System of Handling Coal

Coal is delivered from the cars or from the hoist bucket into a receiving hopper in the trestle, and thence is delivered to a crusher beneath by a reciprocating roller-plate feeder designed to regulate the flow of fuel at the desired rate. The crusher is driven by a 30-hp. motor, a 4-hp. motor operating the feeder. At the lower end of the feeder is a hinged bar designed to pick out the "fines" and deliver them to a cross-belt conveyor leading to the main conveyor, thus reducing the work required of the crusher. The sized coal is fed to a 24-in. cross-belt conveyor driven by a 10-hp. motor. This conveyor runs through a concrete tunnel under the trestle, carrying the coal a distance of approximately 150 ft. (45 m.) and adding 150 ft. (45 m.) of storage for empty cars on the trestle as they are dumped into the receiving hopper. At the end of the cross belt the coal is fed into a main belt conveyor also 24 in. (60 cm.) wide and driven by a 20-hp. motor. This conveyor carries the fuel to the top of the boiler house and in turn delivers it to a horizontal belt conveyor driven by a 10-hp. motor and distributing coal by a belt tripper into the bunkers. The crusher and belt conveyors have a maximum capacity of 100 tons per hour, and the overhead bunkers have a capacity of 1000 tons. On the first section of the belt conveyor is an automatic weightometer which records the weight of all entering fuel. From the bunkers the coal flows by gravity through the bunker gates and stoker spouts into the stoker hoppers, as indicated in the cross-section diagram. The conveyor belts are made of rubber.

There are eight boilers, each being equipped with an Edge Moor mechanical intra-baffle soot blower and designed to operate at 225 lb. (15.75 kg.) steam pressure with from 125 deg. to 150 deg. Fahr. (52 to 65 deg. C.) superheat. The boilers are set in four batteries of two each; the usual tube-dusting doors have been omitted, thereby saving losses from air leakage. Chain-operated corrugated doors are provided across the boiler fronts. Numerous diagonal pipes installed among the tubes and connected to a header within the setting supply steam to the soot-blowing nozzles. The latter discharge high-velocity superheated steam along the tubes and in general parallel to them, effectively dislodging the soot. In the first two passes these pipes are installed within and are protected by the baffles themselves; in the third pass the pipes are placed aginst the rear-header tube plate and are protected by thick layers of hot-blast cement. A drain is provided for each header to insure that all moisture has been removed before reaching the soot-blower nozzles. Foster superheaters are provided.

Each boiler is furnished with a seven-retort, extra-long underfeed stoker capable of supplying fuel to the boiler at 300 per cent of its rating when using coal of 14,000 B.t.u. (1600 calories per kg.) quality. At this rating each stoker requires about 25,500 cu.ft. of air per minute. The boiler and furnace have a combined efficiency guarantee of 76 per cent at from 100 to 150 per cent rating; 73 per cent at 200 per cent, and 70 per cent at 250 per cent boiler rating, using 14,000 B.t.u. (1600 calories) coal. Air for the stokers is furnished by two forced-draft fans, either of which will supply the necessary volume to drive six boilers at 300 per cent rating. One fan is driven by a variable-speed slip-ring motor and the other by a Terry turbine. Both are installed in the boiler-room basement directly below the duct lines from which branches are taken to the stoker wind boxes. Air from the generator casings and turbine room is available for furnace service. Either fan will deliver 100,000 cu.ft. (2800 cu.m.) of air per minute against 6 in. (125 mm.) static pressure.

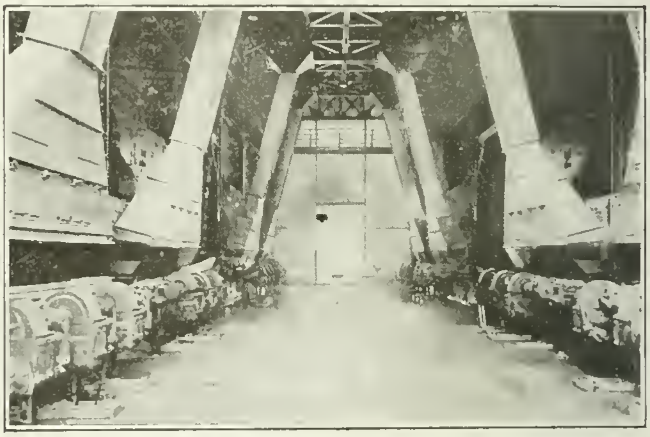


FIG. 4—UNDERFEED-STOKER EQUIPPED BOILERS IN NEW ENGLAND PLANT

The ashes and refuse from the stokers fall by gravity into large hoppers directly under the stokers and from these are discharged into 1-ton steel tip cars. These are hauled out of the boiler-room basement and up a ramp to a temporary trestle leading to portions of the property needing filling, the haulage being by an Elwell-Parker industrial tractor of 2 tons rating.

The products of combustion are carried away from the boilers by uptakes connecting with a horizontal flue discharging into the stack at the bunker level. The stack, which is 250 ft. (76 m.) high and 13 ft. (4 m.) in diameter, was built upon a concrete pile foundation, and its cost was $28,230, itemized as follows: Excavation, $240; concrete piles, $4,477; base, $5,856; brick shaft, $17,657.

Education Needed for Present Engineering Demands

Abstract of Dr. Mann's Report on His Three-Year Study of Engineering Education—Standard Curriculum Is Not Proposed, but Rather a "Common Core" on Which Courses Can Be Built

For more than three years Dr. Mann has been making a study of engineering education under the joint auspices of the Carnegie Foundation for the Advancement of Teaching and the joint committee on engineering education of the national engineering societies. In 1907 the Society for the Promotion of Engineering Education invited the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the American Chemical Society to join it in the formation of a joint committee to examine into all branches of engineering education. The next year the Carnegie Foundation was invited to appoint delegates to the committee, and subsequently the Carnegie Foundation undertook to carry out the investigation on a large scale and bear the expense of it. Dr. Mann was retained to give his entire time to it. The committee has been closely associated with Dr. Mann during the work.

The following signers of the introduction constitute the committee: Desmond FitzGerald, Onward Bates and Daniel W. Mead, for the American Society of Civil Engineers; F. H. Clark and Fred J. Miller, for the American Society of Mechanical Engineers; C. F. Scott and Samuel Sheldon, for the American Institute of Electrical Engineers; Clifford Richardson and Henry P. Talbot, for the American Chemical Society; J. R. Withrow, for the American Institute of Chemical Engineers; Henry M. Howe and John Hays Hammond, for the American Institute of Mining Engineers, and D. C. Jackson, G. C. Anthony and C. R. Richards, for the Society for the Promotion of Engineering Education. Henry S. Pritchett is president of the Carnegie Foundation.

ENGINEERING education in its primary conception is a means by which production can be increased. This, the belief of Dr. Charles R. Mann, dominates the comprehensive report he has just made on engineering education. From that principle he argues that knowledge of the human factor in production is as important as that of materials, and his investigation indicates that engineering schools treat of materials extensively but not of the human element. He also finds a need for much more instruction in the appraising of values and costs. What he proposes is not a standard curriculum, but a method by which engineering schools can construct courses to meet present-day demands, coupled with a more rational means of testing and grading the abilities of the students before admission and throughout the courses, thus directing them with greater certainty to the specialty for which they are best fitted.

The method Dr. Mann proposes for the actual formulation of the courses is to have in each school a standing committee which shall decide what he calls the "common core" of all engineering education, no matter what the specialty. This "core" being defined with reference to the needs of the engineer, the committee would determine the time necessary to cover it adequately and would shape the courses accordingly, instead of arbitrarily parceling off to the different departments the time predetermined as available and letting each department crowd as much as possible into its allotted time. The "common core" would have studies under four main heads: (1) Participation in real industrial work; (2) engineering laboratory work, including drawing and descriptive geometry; (3) mathematics and science, and (4) humanistic studies. Participation in industrial work would best be interwoven with the three classroom and laboratory divisions of the student's work, and as an example of what can be accomplished in this line, Dr. Mann indorses emphatically the coöperative system of engineering education developed at the University of Cincinnati and since applied at other institutions.

At the beginning of the course and while giving the "common core" studies the testing and grading methods already referred to would be given.

Comprehensive Committee System

In addition to the standing committee to take care of the "common core" studies, there should be additional committees, one for each of the semi-specialties offered at the school, such as civil, electrical and chemical engineering. Here the same method would apply; that is, the committee, having a clear-cut conception of the demands of present-day engineering, would determine first the equipment needed by young graduates and then the time required to obtain that equipment, and would develop the courses accordingly. This semi-specialized work would follow the "common core" studies, and again grading and testing methods would be used which would indicate the relationship between academic attainments and the qualities needed for success in engineering work and would be a guide in choosing further specialization.

A clear conception of the spirit of Dr. Mann's study and of the line of reasoning which has led to his conclusions can best be obtained from the chapter of his report entitled "The Professional Engineer." From this chapter the following paragraph is taken:

> Because the engineering schools have always made it their chief aim to impart the technical information needed in industrial production, and because both scientific knowledge and industrial practice have grown so rapidly, the attention of technical schools has been focused chiefly on keeping up to date in science and practice. The university emphasis on research in natural science has also tended to magnify the importance of technique and to minimize the importance of personality. . . . Therefore it seemed necessary to consider the question whether this emphasis on technique is producing a new and higher type of engineer, or whether the engineering profession still stakes its faith on the fundamental thesis that personal character is, after all, the real foundation for achievement.

To arrive at the requirements of the engineering profession an extensive inquiry was made. Circular letters were sent to engineers throughout the country, asking them what they deemed the most important factors in determining probable success or failure in engineering. In the replies received personal qualities were mentioned seven times as frequently as knowledge of engineering science and the technique of practice. Of six groups of qualities headed respectively "character," "judgment," "efficiency," "understanding of men," "knowledge" and "technique," the summarized votes of more than 7000 engineers placed character at the head of the list by a majority of 94.5 per cent, and technique at the bottom by an equally decisive majority.

Thus it appears that even before our entry into the war—for the inquiry described was completed in 1916—there was keen appreciation of the importance of the personality of the engineer. Since then Dr. Mann thinks events have brought out that need even more clearly. Further quotation from his chapter on "The Professional Engineer" indicate this tendency:

> The training of men for the solution of human problems connected with industrial work cannot be carried out in the schoolroom alone. The students must have some vital, first-hand, personal contact with labor and workmen's conditions, either by a coöperative system, as at the Universities of Cincinnati and of Pittsburgh, or through the industrial service movement, or in some other real and living way. Hence meeting this demand requires some form of closer coöperation between the engineering school and the industries, better understanding of their mutual relations, and willingness on both sides to approach the problem with the true research spirit. Such coöperation is needed not only to give the students a vital conception of the workman's point of view, but also to furnish that intimate personal knowledge of the details of production which cannot be secured in college laboratories and shops. The lack of this sense of the physical properties of materials is one of the chief reasons why less than 5 per cent of the production managers in this country are college-trained men.
>
> It is, however, in the matter of estimating values and costs that this problem assumes its most far-reaching consequences. The following are some of the typical problems now pressing for solution in this field:
>
> What is the effect of good housing on the development of the men, the efficiency of production and the size of the profits? What is the most effective incentive to maximum output—the bonus system? opportunity for coöperation in management? opportunity for creative work? or shorter hours? Does the assurance of justice and a square deal always tend to increase output and also to foster the growth of a social spirit and of patriotism? Does a plant pay better when profits and output are increased by efficiency methods which give workmen no chance for self-expression, or when the development of the workmen is made an aim as well? . . .
>
> The organization of curricula proposed is suggested as one practical method of harmonizing the conflicting demands of technical skill and liberal education. It coördinates the results of numerous individual experiments in a consistent program. It recognizes all the essential elements and factors of engineering as well as the educational requirements of motivation and interrelation. It is not a utopian dream, but a summation of the best that has been thought, said and done in education during the past two centuries. Finally, it embodies the modern conception of the professional engineer, not as a conglomerate of classical scholarship and mechanical skill, but as the creator of machines and the interpreter of their human significance, well qualified to increase the material rewards of human labor and to organize industry for the more intelligent development of men.

Present Systems of Admission Faulty

Discussing the problems of engineering education as he sees them, Dr. Mann points it out as evident that when 60 out of every 100 of those admitted to engineering schools fail to continue through the course the present systems of admission, whether by examination or by certificate, are not satisfactory. Obviously, a fairly large number of students who ought not to try to become engineers are permitted to undertake studies for which they have little natural ability.

The determination of a candidate's fitness to enter college depends ultimately, Dr. Mann concedes, on tests of some sort; and as tending to eliminate the fallacies and vagaries of individual personal judgment and make grading more a measure of ability and less an expression of conformity to the conviction of an individual, Dr. Mann cites a series of experiments made by Prof. Edward L. Thorndike of Columbia University. Thirty-four students were asked, among other things, to read paragraphs and answer questions as to their meaning, to supply missing words in sentences, to solve mathematical problems, to draw graphs from given data, to match each of a series of pictures with one of a series of verbal statements, and to construct simple mechanical devices from their unassembled parts. Each test was constructed as a series of graded steps of increasing difficulty, the first being so easy that every one was sure to accomplish it and the last so difficult that only the ablest could master it. The questions as a rule could not be answered from memory and were of a kind that had to be answered by a short, unambiguous statement. Independent scorers in the tests repeatedly gave practically identical ratings.

The records of the thirty-four men tested have been followed for three years. Five of the seven who stood highest received general honors, while five of the seven lowest in the test failed in more than half of their work and left school.

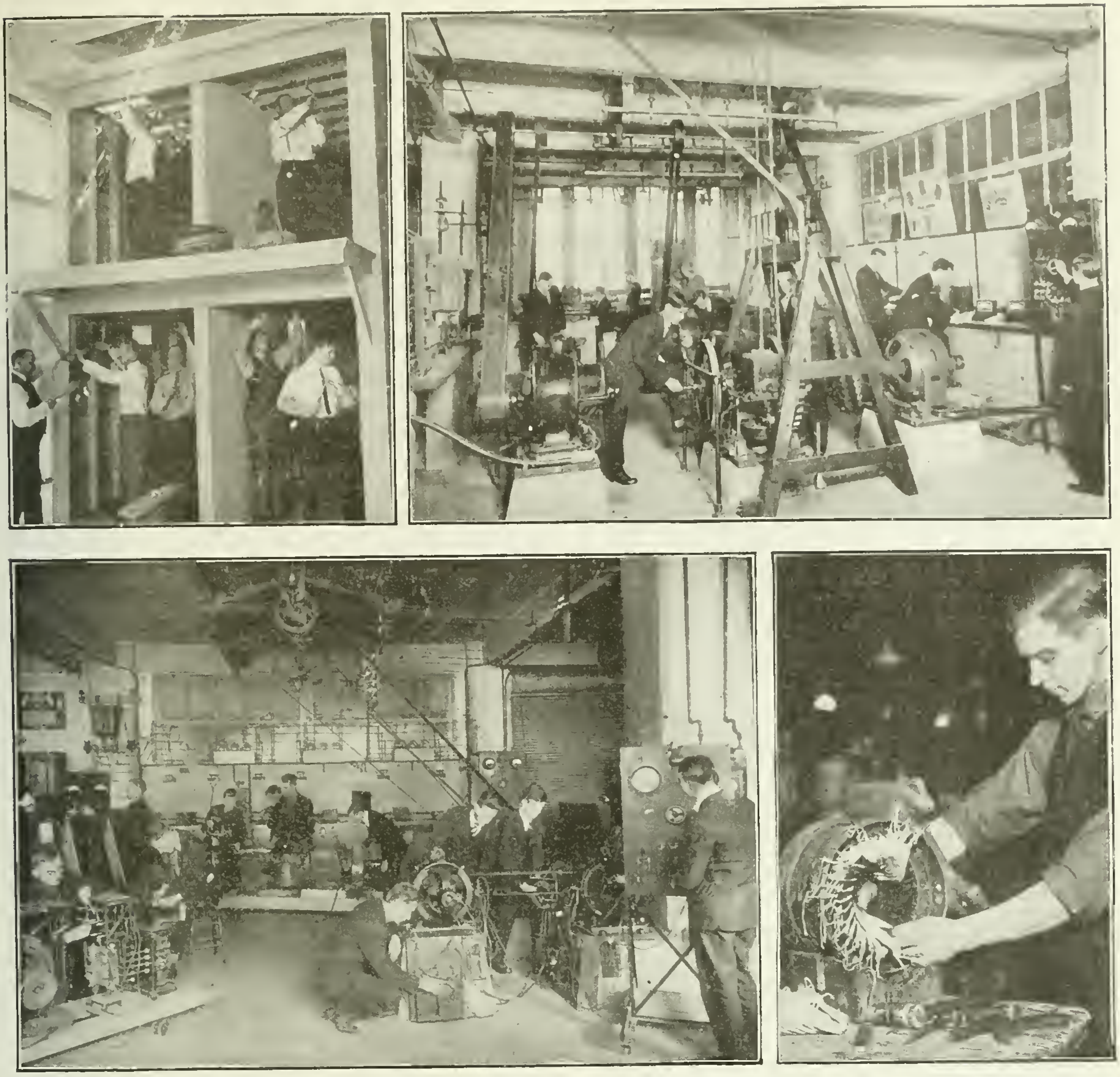
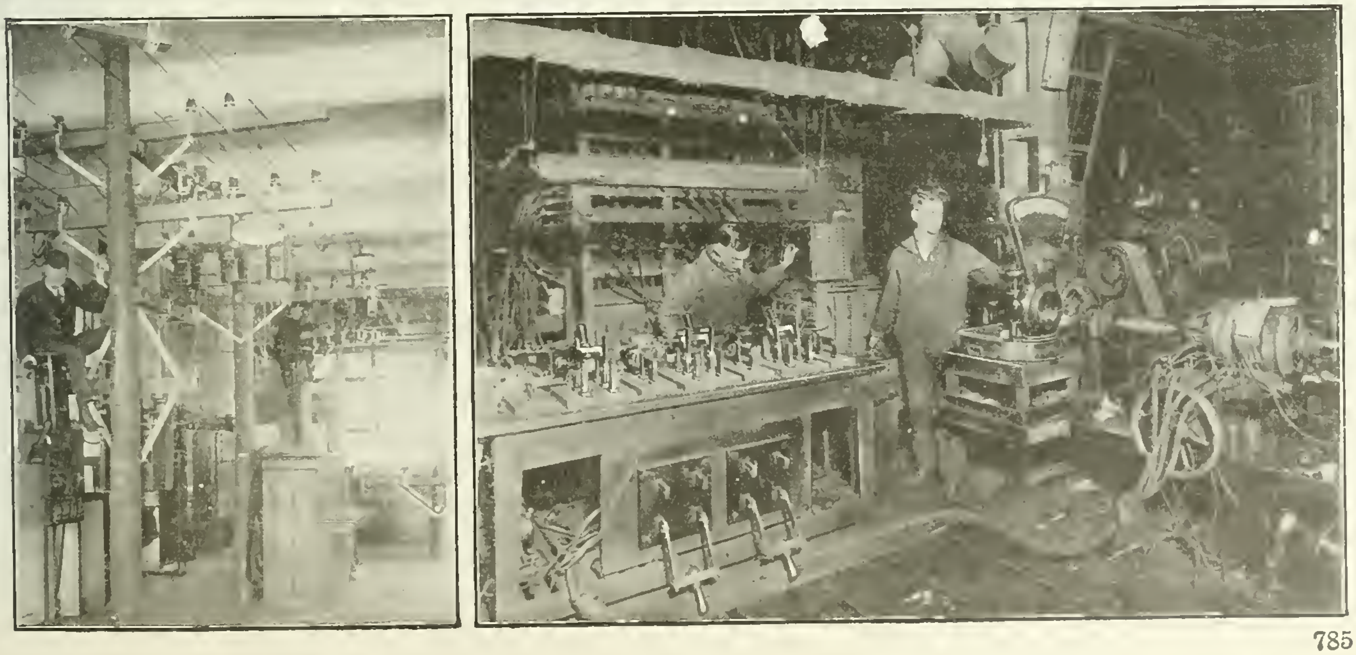
Similar tests were made by Professor Thorndike at other schools, with results that prophesied academic achievements as accurately as the college ratings for one year prophesied those for the succeeding year.

Department Coördination Essential

As coördination between departments is necessary with reference to the time schedule, so Dr. Mann finds it absolutely essential with respect to the content of courses. He lays emphasis on the need for more logical and coherent sequence of topics and a better adaptation of modern scientific theories. He urges the use of practical problems and commends in this connection Prof. R. H. Fernald's course on power plants at the University of Pennsylvania. Dr. Mann says:

> While the topics of this course follow one another in a logical sequence, they are chosen largely from engineering practice and include much of the practical information every engineer must have when he goes to work. Many of the problems are actual cases that really occur in engineering, so that they appeal both to professional instinct and to the senses of values and costs—in fact, many of them are openly problems that deal with costs of operation and maintenance in working plants. Yet the course is not a mere mass of useful information; rather, useful information is the vehicle for conveying to the student a firm grasp of fundamental principles and engineering methods of attacking and analyzing problems, not only from the point of view of scientific theory, but also with due consideration to the limitations imposed by practice and by costs. . . .
>
> There has always been and still is a strong aversion on the part of colleges to placing emphasis on the material and financial aspect of the engineer's work. Yet it is a burning question whether the commercial bearings of each subject cannot be introduced into every course in such a way as to increase enormously its use and its vitality without in the least impairing its inherent scientific value. The enrichment of the content of courses by judicious appeal to practice and costs is a problem that offers rich opportunity for further experiment.

EXAMPLES OF INDUSTRIAL EDUCATION IN COLLEGES AND MANUFACTURING PLANTS

The two serious obstacles to coöperation in the content of courses, Dr. Mann finds, are reverence for department autonomy and the lack of generally intelligible and transferable details and methods of testing. The latter emphasizes again the need for a better system of testing and grading.

To this subject of testing and grading Dr. Mann gives much attention. For the purpose of making a beginning at removing some of the ambiguities of current examination practice, Professor Thorndike devised for seniors in electrical engineering a series of objective tests analogous to those used in his experiments with freshmen. Quoting Dr. Mann:

> Each test is intended to measure a specific ability, such as arithmetical computation, geometric construction, paragraph reading, understanding of words, mechanical dexterity or comprehension of diagrams. Each of these is a single activity, although requiring a complicated coördination of psychological processes. Then the tasks are so selected that their accomplishment can be indicated with little or no use of words, so that ability to perform the task is not confused with powers of verbal expression, and the errors of personal judgment in deciding whether an answer is right or wrong are reduced to a minimum. Because of this independence of the personal equation the results obtained by these tests at different schools, or at the same school at different times, are comparable with one another. . . . Cramming for any one set test may be avoided, since after the successful type has been found it is a relatively simple matter to construct ten or twenty alternate tests on the same pattern. Again, the successive tasks on each test are arranged in the order of difficulty, beginning with one that can be correctly met by almost all students of the degree of training in question and progressing gradually to one that can be done by only a few of the most gifted. Such a test is a scale up which the student climbs to the extent of his ability in the particular type of activity under scrutiny; so that, when the test is well constructed, his relative rank is determined without ambiguity by the difficulty of the task he can successfully master, rather than by an estimate of how much credit must be given for a partially completed task.

Tests in the National Army

Similar tests are being tried on a very extensive scale on the members of the new National Army by Majors Yerkes and Watson, psychologists, who have accepted commissions in the army for this purpose. Industries, too, are beginning to look to these tests to guide them in the selection and placing of workmen, in the hope of reducing the labor turnover that is costing the country several hundred million dollars a year. Although the movement is still in its infancy, enough has been done, Dr. Mann thinks, to forecast what may be accomplished by further scientific work in this field:

> In engineering it is conceivable that before long admission to college and achievement in college may be liberated from the bondage of personal equations as grading becomes less a matter of individual bias and more of valid records of actual accomplishment. Then college grades may be transferable among colleges; then academic marks may become significant to employers; then the results of educational experiments may be stated in convincing terms, and then students may come to respect their records and strive to beat them without artificial stimuli in the way of academic honors and credit bonuses.

Shopwork forms the last of Dr. Mann's problems of engineering education. "In American technical schools," he says, "shopwork still occupies a rather anomalous position. Few teachers of the mechanic arts have been granted the title 'professor,' and the work itself is seldom recognized as being of 'university grade.' Yet no one denies that it is an essential element in the equipment of every engineer, and therefore it has been tolerated by engineering faculties and allowed to develop as best it could. As a result there is no agreement as to the purposes and methods of shopwork. Nearly every school has a shop philosophy and a well-organized shop method of its own."

The Purpose of Shopwork

The purpose of shopwork Dr. Mann conceives to be to aid in bringing to the student a conception of what is meant by production and what are its fundamental problems. Numerous forms of shopwork, as conducted by the schools, are described by Dr. Mann, but he gives most attention to the coöperative plan in operation at the University of Cincinnati, inaugurated by Dean Herman Schneider.

The students at the University of Cincinnati are divided into two groups, one of which is assigned to work in industrial plants while the other goes to school. At the end of each biweekly period the two groups change places, so that the shops and the school are always fully manned. In the shops the students work as regular workmen for pay, but the nature of their work and the length of time each stays on any particular job are subject to approval by the university. The emphasis of the school work is on theory and principles, but these are related to the shopwork by "coördinators," who visit the students during each shop period and then meet the several groups during the university period in special coördination classes.

About 100 of the industries of Cincinnati and vicinity are now coöperating with the university. The companies represent every important phase of engineering, so that the university is able to arrange the work schedules in such a way that each student progresses regularly through every phase of his specialty, from the crude and rough work to the more difficult and responsible positions.

Financially, this coöperative plan is very economical both for the university and for the students. The university has access without expense to shops and shop equipment that are worth millions of dollars and are never allowed to deteriorate or become antiquated. The total cost to the university per student per year is about $130, compared with $250 to $600 at schools of equal grade. The money earned during shop periods makes possible an engineering education to many a boy who could not otherwise afford it.

In addition to the financial advantage, however, Dr. Mann points out many educational advantages. The work, he says, has three marked points of superiority over that done in college shops: (1) It is real commercial production that must succeed or fail on its merits; (2) the variety is much greater than is possible in any college shop, and (3) the student is thrown in personal touch with workmen, thus coming to know their point of view in a systematic way and securing a conception of the human problems of industry and the appraisement of human values and costs that cannot be acquired so well in any other way.

Another educational advantage pointed out is the use of "work observation sheets." Because it is obviously impossible for an industrial plant to permit its workmen to spend time giving instructions to green college boys, each student when he begins a new job is given a work observation sheet containing from 50 to 200 questions concerning the details of the job and directing him to sources of information where he can find the answers. He is required to be able to answer and discuss these questions during the coördination periods. Shopwork thus becomes a series of exercises in defining and solving problems. Dr. Mann observes:

> With such rich opportunities for education lying plentifully about in every industrial plant, it is a striking anomaly that the schools make so little use of them. . . . The neglect of the possibilities of shopwork is responsible in large measure for the professional criticism that the graduates cannot apply theory to practice, for the establishment by large corporations of apprentice schools where their engineering graduates may complete their training on the practical side, for the preference shown by many firms for shop-trained rather than college-trained men, and for the insignificant percentage of production managers who are college graduates.

Some Proposed Solutions

The concluding part of the report is entitled "Suggested Solutions." As previously stated, Dr. Mann does not propose a standard curriculum, but rather a method by which engineering schools can work out courses to meet present-day engineering demands. As to the curriculum, the suggested solutions can be summarized as follows:

1. The number of required credit hours per week should be less than eighteen—preferably sixteen. This is not to decrease the hours of work done by the students, but to enable them to do all of their work more thoroughly. It necessarily involves extensive changes in the content of the courses.
2. Not more than five subjects should be studied at a given time.
3. Orientation, contact with real engineering projects and practical experiences are essential.
4. Interrelation between the concrete and the abstract is necessary throughout the entire course.

To reorganize its curriculum along these lines, the first step for any school is the appointment of a small standing committee composed of men interested in the problem of better teaching and able and willing to give considerable time to the work. The committee must first study the relations of the school with the adjacent industries, and, having selected the type of coöperative industrial work best fitted to the environment, it may proceed to formulate a curriculum for the school work itself.

If it is agreed that the chief function of school work is to give the greatest possible mastery of the essential principles of engineering science, then there is a common foundation on which all curricula must be built. The first step, therefore, in framing a course of study is to define this common basis of all engineering as clearly as possible: that is, to make a list of all the facts, principles and processes that are essential elements in the equipment of every engineer. This will constitute a "common core" made up of three distinct parts: (1) Science (mathematics, chemistry, physics and mechanics); (2) mechanic arts (drawing and shop), and (3) humanities (English and foreign languages).

The current organization of the "common core" recognizes no inherent or intrinsic relationship among these parts. The sciences are usually treated as sciences pure and simple, without regard to their function in engineering; in the mechanic arts the instruction shops are as a rule purposely separated from the construction shops, and the humanities generally strive consciously and vigorously to get away from engineering in order that the student may get at least a glimpse into the mysteries of language and of literature, and a touch of culture. Before a more effective "common core" can be constructed it is necessary to adopt a classification of the subject matter that obviously expresses the intrinsic relationship of the several component parts to the needs of every engineer.

A curriculum that satisfies all of the requirements mentioned would include at least four types of work as follows:

1. Actual participation in real industrial work, either during summer vacations or, better, through continuous coöperation with industries. This industrial experience must be supervised by the school and used as a source of problems and projects for scientific analysis in the classroom.
2. Engineering laboratory work, including drawing and descriptive geometry. Here the student would make the measurements and carry out the operations needed to enable him to solve the problems and projects that originate either in his industrial work or in his class work.
3. Mathematics and science, developed systematically in logical order, to furnish the backbone of the course.
4. Humanistic studies. The professional criticisms of the schools indicate that this field offers the greatest opportunity for effective changes in current practice, because lack of good English, of business sense and of understanding of men are most frequently mentioned by practicing engineers as points of weakness in the graduates of the schools.

The Humanistic Studies

The difficulty in present school practice evidently lies in the exclusion from the technical work of all consideration of the question of human values and costs; and, conversely, the isolation of the humanistic studies from all technical interest. But experiments show that technical work is more impelling and is, therefore, more fully mastered when it includes the consideration of values and costs, while humanistic work becomes significant, and therefore educative, when it starts from and builds upon the professional interest.

After the essential topics have been selected, as much time as is necessary for their mastery must be taken for this purpose. Two years may be enough, but if this is found to be inadequate, more time should be assigned. The important thing is that the essential elements be first selected, and then that time enough to master them be given, instead of the current practice of assigning the time and then covering as much as possible within the set limit.

The first step toward successful specialization is intelligent sorting of the students so that each is led as definitely as possible into that type of work for which he is best fitted temperamentally. This requires that while the students are working through the "common core" every effort be made to discover the particular abilities and specific bent of each, not only by means of ordinary examinations and academic grading, but also through objective tests of graded ability, personality estimates by members of the faculty, consideration of boyhood interests, and observations of each student's reactions to the different portions of the "common core." The work in the latter offers an excellent chance for vocational guidance.

To summarize, the plan of curriculum proposed differs from curricula as at present constructed in seven important ways:

1. The subject matter essential to the equipment of the engineer determines the time schedule, instead of arbitrary time limits determining the amount of this subject matter that can be given.
2. The proposed plan calls for the student's participation in real industrial work and the utilization of his experience there as a source of problems for the classroom.
3. Engineering laboratory work is proposed for the first two or three years instead of the last years.
4. Close coördination is required between the scientific courses of the "common core" and the practical work.
5. Emphasis is laid on the problems of values and costs.
6. For short independent courses in the technique of composition, literature, history, economics and so on are substituted humanistic studies extended into a consecutive course carried through the entire curriculum and consisting of live discussions and study of the best that has been thought and said concerning the immediate and the ultimate values in life.
7. Specialization is subordinated to vocational guidance. Because the "common core" gives a student a chance to choose his specialty on the basis of experience, and furnishes the faculty with a broader range of activities on which to base judgment of special aptitudes for particular work, the attention of the faculty is diverted "from the construction of specialized grooves down which the student may be shoved by routine administrative mechanisms to the study of the personalities, the temperaments and the capacities of young men eager to do the work for which they are best fitted."

As soon as it is possible to measure the results of teaching by impersonal means, successful teaching will be as easy to recognize as profitable research. Objective records of achievement have been found in industry to be one of the best incentives to creative work. Hence the line of progress in education does not lie in the direction of making arbitrary distinctions between research and teaching, but rather in the direction of removing the limitations placed upon the spirit of inquiry, so as to encourage its expansion to include education and human relations generally.

Reconstruction of a Two-Phase Station—II

How Some Engineering Problems Brought About by Rapid Growth of the System Were Tackled by an Iowa Company—Efficiency Instruments Employed in Boiler Room—Unusual Features of Electrical Construction

IN THE ELECTRICAL WORLD for Oct. 5, 1918, it was explained how the Iowa Railway & Light Company of Cedar Rapids provided for rapid growth in load so far as the coal-handling and stoking equipment was involved. Among the interesting things done were to provide for burning several grades of fuel available and to furnish steam for district heating in the most economical manner. Other mechanical features will be discussed in the present article, which will also give an account of how the electrical problems were handled.

Without rearranging the entire layout of the plant it was impossible to install the new boilers along the central firing aisle of the older section, owing to limitations imposed by railways on either side. Consequently in the new section the layout was duplicated, a central firing aisle with four boilers on a side. Seven of these boilers have been installed and the other is on order. When it has been placed in service there will be in the entire boiler room, measuring 80 ft. by 142 ft. (24 m. by 43 m.), four rows of four boilers each, with two firing aisles and duplicate coal and ash handling facilities with cross-over connections. The operating pressure is 200 lb. (14 kg. per sq.cm.) and the superheat 100 deg.

Each row of boilers is served by a concrete stack. In each case a straight smoke flue connects the four boilers with their respective stack, being suspended over the boilers from the beams of the ceiling. A 16-in. (41-cm.) thimble is provided between the flue and each boiler uptake. Per 1000 sq.ft. of steam-making surface there are on the chain-grate side of the plant 2.2 sq.ft. of smoke flue area, 2.1 sq.ft. of stack area and 20.1 sq.ft. of connected grate (2.2 sq.m., 2.1 sq.m. and 20.1 sq.m. per 1000 sq.m. of surface). On the underfeed stoker side the areas in the same order are 1.9, 1.6 and 15.1.

To the completed row of four boilers in the new addition forced draft is supplied by engine-driven fans having individual capacities of 21,000 cu.ft. (600 cu.m.) per minute. Each fan has the capacity to supply two boilers, leaving one in reserve. All three fans discharge into a single duct so equipped with dampers that any fan may be used on either pair of boilers. On the uncompleted row of boilers there are two fans, each having a capacity of 26,000 cu.ft. (about 750 cu.m.) per minute. It is the intention to install a third fan that will have capacity to care for the four boilers, leaving the other two in reserve. The fan engines are controlled by pressure governors.

It had been the practice to drive the stokers from the fan engines through a line shaft and chain connections, but with changing fuels, requiring different ratios of air, it was found desirable to separate the two services. Stoker engines are now being installed on the boiler-room floor, with chain connections to line shafts in the basement and driving chains from shaft to stoker. One engine will serve two boilers.

On account of the two firing aisles and two delivery tracks, one perpendicular to the firing aisles and the other parallel, the coal and ash-handling equipment is rather complicated. Primarily the system consists of two continuous bucket conveyors, one serving each firing aisle, with two cross-over belt conveyors, so that coal may be transferred from one bucket conveyor to the other and desposited in the bunkers over either aisle regardless of the track on which it is delivered. At the end of each aisle there is a track hopper, with a shaking feeder underneath delivering into the continuous bucket conveyor which transfers the coal to overhead 200-ton steel bunkers, one for each pair of boilers, with a division at the center making two compartments. At the track end of each aisle is a large concrete ash hopper which is filled by the continuous bucket conveyor and delivers through a chute to the railway coal cars. On the other track at the side of the boiler room is a third hopper delivering by means of a pan conveyor to the nearest continuous carrier. There is also a large ash bunker exterior to the plant. Delivery of ash is effected by a belt conveyor receiving its load from one of the cross belts. All conveyors are motor-driven.

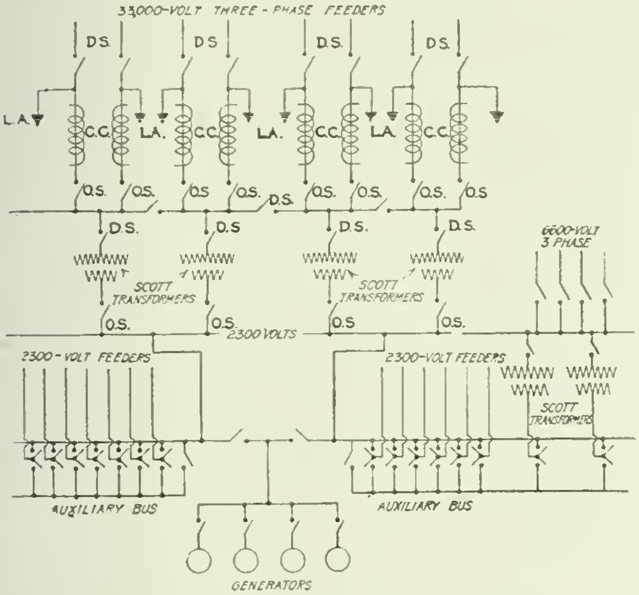


FIG. 8—SWITCHING ARRANGEMENTS IN A RECONSTRUCTED IOWA PLANT

Depending upon the season, condensate from the generating units and the Quaker Oats plant forms a varying proportion of the boiler feed. With the latter make-up water from the river is returned to the boiler room through the same pipe and is delivered to an open feed-water heater or to a large supply tank at a higher level. The condenser circulating-water tunnel is a second source for make-up which is delivered to the supply tank. For boiler feeding there are one direct-acting and two turbine-driven centrifugal pumps having ratings of 450 gal. and 600 gal. (1700 l. and 2300 l.) per minute. The pumps are interchangeable and deliver to double feed lines, cross-connected so that either may be used to feed any particular boiler. The feed to the various boilers is controlled by hand-operated valves.

Throughout the boiler room numerous instruments are employed. For each row of four boilers there is an automatic recorder of CO_2 and draft at the uptake, with piping connections so that readings may be taken from any one boiler. Differential draft gages for each boiler show the draft over the fire and at the uptake and incidentally the drop through the setting. A U-tube attached to the gage gives the air pressure in the wind box of the stoker. A pyrometer with a twenty-four-point switch gives temperature readings at the top of the first pass and at the uptake from twelve boilers. There are a recording pressure gage on the steam header, recording and indicating pressure gages on the steam line to the Quaker Oats plant, and on the main feed line a flow meter to record all water supplied the boilers and a recording thermometer to give the temperature. The steam-heating main has indicating and recording pressure gages, and on the steam supply lines to the large turbine and the two bleeder units there are steam-flow meters.

In the generating room the three larger turbines have each a gage panel. Those for the bleeder turbines are duplicates containing gages giving the steam pressure at the throttle and in the first stage, a vacuum gage, a barometer and a speed indicator. The board serving the large turbine has an indicating and recording flow meter of the electrical type and an integrating wattmeter, with provisions to switch either instrument onto any one of the three machines just referred to. There are also a temperature indicator with a plug switch to give the temperature at four different points in the field, a mercury column for the vacuum, and a recording thermometer on the throttle and the exhaust.

Features of Electrical Equipment

The electrical part of the plant is unusual in that the generation is all two-phase, 2300-volt, and the distribution three-phase with the exception of numerous feeders for city service. Fig. 8, a single-line diagram, will give an indication of the general arrangement of the circuits. There are a main and an auxiliary bus. All 2300-volt feeder circuits are connected to the central studs of double-throw disconnecting oil switches serving as feeder switches and may be thrown onto either bus at will. The oil switches are solenoid-operated with remote control and on the feeder circuits are equipped with overload inverse-time-limit relays. The bus structure is mounted on 1½-in. iron-pipe framework, each bus being set in an individual compartment made up of ⅜-in. "Transite" board.

Out-of-town service is three-phase at 33,000 volts. The current is stepped up by two sets of 600-kw., two-phase-three-phase T-connected transformers in multiple. Between the 2300-volt circuits and the transformers are oil switches with inverse-time-limit overload relays, and on the high-tension side between the transformers and the bus are disconnecting switches of the air-break type.

Each high-tension feeder circuit, of which there will soon be eight, has its oil switch and inverse-time-limit overload relays. The circuits are protected by aluminum-cell lightning arresters with the horn gaps mounted on the roof and the arrester tank inside the building. The circuits pass out through roof bushings to one tower line and three pole lines. On the latter wood-arm construction is used within the city, but beyond the city limits bow-and-arrow and wishbone cross-arms are employed.

For the National Oats Company and other nearby customers 6600-volt service is drawn from the main bus through two banks of 1000-kva. T-connected transformers operating in parallel, with switches on each side of the transformers. Two-phase-three-phase differential reverse-current relays are used here. As shown in Fig. 9, there is a current transformer in each phase on the 2300-volt side of the transformer. The high-tension side has a current transformer on each leg of the three-phase circuit. With any reversal of current or defects within the transformer the relay becomes unbalanced and through the trip coils throws out the switches on each side of the T-connected transformer.

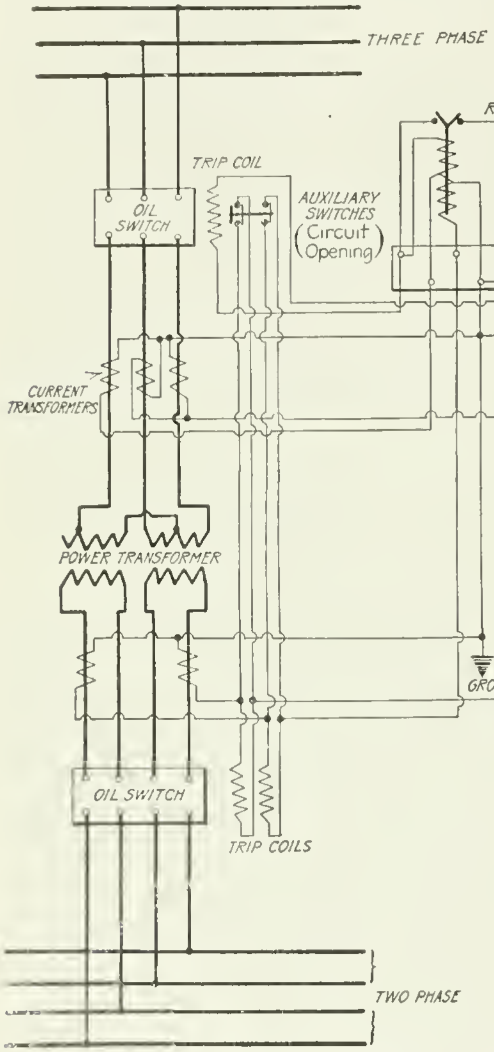


FIG. 9—RELAY CONNECTION OF CURRENT TRANSFORMERS ON EACH SIDE OF T-CONNECTED TRANSFORMER

The System Operator's Room

An interesting feature of the electrical plant is the system operator's room, from which all high-tension lines are controlled. It contains a benchboard equipped with synchronizing apparatus, ammeters, voltmeters and reactive factor meters for each high-tension circuit, pull buttons for remote control of the oil switches, and red and green pilot lamps to indicate their position. On the opposite side of the room is a panelboard containing watt-hour meters, curve-drawing wattmeters, voltmeters and frequency meters, and induction-type relays and testing plugs for each circuit. At one end of the room is a telephone switchboard with connections to the city system and to a private line to the various stations operated by the company. This switchboard also affords communication with the boiler and turbine rooms. By wearing a head telephone receiver with an especially long cord the operator is able to reach the benchboard controlling the transmission lines, and he can look down into the turbine room through the glass front of his office. Above his desk is a map showing the transmission lines, the various generating stations and substations, the sectionalizing switches, etc. The operator is thus enabled to control the entire system in much the same way as that in which a train dispatcher runs his division.

All transformers in the station are grouped in a transformer room on the main floor. They are of the oil-insulated, water-cooled type. On the gallery above are all 6600-volt and 33,000-volt oil switches and the lightning arresters. Direct current for operating the oil switches may be supplied from three different sources—a 550-cell, 320-amp.-hr. storage battery, a 5-kw. motor-generator set used to charge the battery, and the exciter bus. Connections are made to each source so that the battery cannot by any possibility be thrown onto the exciter bus.

For 600-volt direct-current railway service there are two motor-generator sets, one rated at 1500 kw. and the other at 500 kw. To serve the small direct-current power load there is also a 100-kw. commercial set. On the direct-current switchboard arrangements have been made to throw the two railway motor-generator sets in series, so that current at 1200 volts may be supplied to outlying towns and at the same time 600-volt service to the company's system in Cedar Rapids.

Supplying Power for a Big Cereal Plant

Electrical energy for the Quaker Oats plant is supplied through four two-phase, 2300-volt feeder circuits connected to the main bus through 1000-amp. oil switches with inverse-time-limit-relays. The service is carried through underground conduits by 850,000-circ.mil double-conductor, concentric cables, lead-covered and varnish-cambric insulated. At the Quaker Oats substation the circuits feed through oil switches to a 2300-volt bus, protection at this end being given by dynamometer-type reverse-power relays with tripping reactors. From the bus, transformation to three-phase, 240-volt current is effected through two banks of T-connected 3000-kva. transformers operating in parallel. From each bank of transformers low-tension buses pass to opposite ends of the customer's switchboard and then back of the board parallel with each other. Each bus contains four pieces of copper 10 in. (25 cm.) wide by ¼-in. (6.35 mm.) thick. In these buses are 22,500 lb. of copper. The substation is reported to be the largest low-voltage alternating-current installation in the country, and a similar claim is made for the two circuit breakers on the switchboard. They are rated at 240 volts, 12,000 amp., are hand-operated and provided with shunt trips and laminated studs.

J. M. Drabelle is electrical and mechanical engineer for the Iowa company.

Getting the Maximum Out of Equipment

The Power Producer and the User Must Co-operate in Order to Improve Power Factor, Otherwise Adequate Power to Meet Essential Needs May Not Be Available in the Approaching Winter—Remedy Readily Applicable

BY WILL BROWN
Electric Machinery Company

CENTRAL-STATION systems have met the power demands of war industries admirably since the war began, but a point has now been reached where most of the larger systems are already overloaded, and something has to be done immediately if further demands for power are to be fulfilled. This is particularly true at this time, because it is now difficult, if not almost impossible, to obtain new generating apparatus and distributing equipment, and also because the fall lighting load is beginning to overlap the power load, leaving no margin of capacity for growth of load. Furthermore, every one has been warned that fuel will be scarce this winter, so power production is further limited. That there has been a shortage of electric power for some time is a fact well known to the industry. The two-hundred-million-dollar emergency power bill is a belated effort by Congress to remedy the situation.

Since power is the basic necessity of all war industries, it behooves every one interested in its production and use to consider how it is going to be secured in adequate quantities this winter. Of course, the usual methods of economizing here and curtailing unnecessary waste there can still be followed; but something more must be done, and that is to consider how poor power factor is limiting power and how it can be improved. The reduction of power factor has become particularly serious since the war, probably because of the fact that much alternating-current equipment has been installed and not operated at the best loads.

How a Whole Community May Be Affected

As an example of how a community and its power company has been affected by the handicaps mentioned, the Public Service Electric Company of New Jersey is quoted as follows: "At one time last winter this great company was forced to shut off 50 per cent of power to consumers—due to fuel shortage."

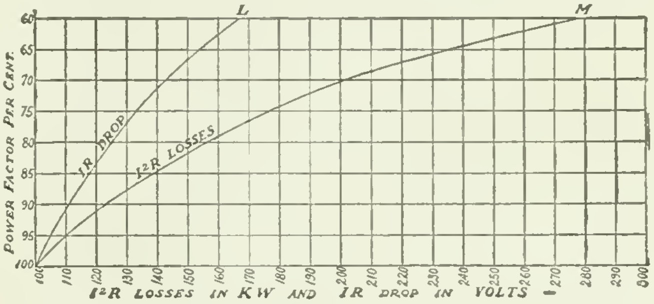
President McCarter of this company said: "In addition to coal difficulties, the company was materially handicapped by the failure to secure apparatus and supplies as contracted."

As to the handicap from low power factor, the company's general power representative writes as follows under date of August 30, 1918: "We now have a shortage of capacity both in generation and transmission, and in order to meet the demands of war industries, we are asking our customers to comply with our contract requirements of 80 per cent power factor. We have been making tests of our larger customers' operating conditions with an improvement in power factor in mind."

What is true of this company, which serves New Jersey's enormous war industries, is true of companies throughout Pennsylvania, Ohio, New York, Illinois, Indiana and other manufacturing states.

Power factor is a subject confronting not only the power producers but also the users, first, because if the user doesn't help to improve power factor he cannot get the power, and, second, because improving power factor is going to make it possible for him to get more work out of the equipment he has already installed. This is something that many industrial plant engineers have not stopped to consider, and still it is vital to maximum production. The details of the benefits to the producer and user will be discussed later, but what has been said should be sufficient to point out that coöperation between industrial plants and power producers is vitally essential now before any more time passes.

Plans cannot be definitely outlined for such coöperation since the conditions differ so in different localities, but it might be suggested that representatives of central-station companies (possibly the power sales engineers whose services as "contract getters" are not so essential now as they were before the big industrial boom) could confer with electrical representatives of the industries they serve to discuss plans of power-factor improvement. Having more engineering information back of them, the central-station engineers might point out to the industrial-plant engineers how power factor is going to benefit the user and how they go to work to locate the causes of poor power factor and improve it. Consulting engineers might be invited into such conferences and left to give the advice necessary to correct conditions where the industrial plant is not well equipped with electrical engineering talent. At any rate, there is an opportunity for coöperation, and not much time or money will have to be expended in getting results, as the remedy can be applied at once. Time is the essence of the problem—there is no time to install additional apparatus even if it could be obtained.



HOW POWER FACTOR AFFECTS I^2R LOSS AND POTENTIAL DROP IN CONDUCTORS

It is a curious fact that many men view low power factor as an abstract evil that is causing the "other fellow" lots of trouble. They readily admit the importance of high power factor, but cannot seem to realize that they themselves are helping to make matters worse—that right in their own plant power is being wasted and money is being lost. Hundreds of central-station officials write that the greatest obstacle to power-factor improvement is indifference. At Niagara Falls indifference on the part of a large user is responsible for a large lawsuit, involving more than a hundred thousand dollars—all for wattless current. Indifference is keeping many induction motors running at poor power factor when it would be just as easy to run them at good power factor.

It is not uncommon to find that managers in charge of power sales of large central stations are entirely unfamiliar with power-factor conditions on their own company's lines. For instance, in one case a manager, when asked whether his company was having trouble with power factor, replied that it was not and that it was being maintained well above 90 per cent with practically no corrective apparatus on the line. As a matter of fact the company was operating over 25,000 kva. of condensers on a system which was delivering an average of 45,000 kw. of power.

What would happen to a machinery salesman who made a practice of selling heavy machinery installed at a point in the country without figuring any cost for freight or delivery charges? And yet electric power companies have been allowing and are still allowing their salesmen to sell a commodity (electric power) without paying proper attention to one of the greatest sources of expense in power delivery, namely, lagging power factor of the consumer's load.

The power consumer who buys his power from a central station must also mend his ways. In the past large central stations which had excess power to sell were not over-particular about anything but load factor. The times are different now. Electric power is going to be sold and used under restrictions as to power factor. Central stations are by no means anxious to impose penalties, but they may be forced to do so if those who cause poor power factor do not correct conditions. This does not mean that the average cost of power is going to be increased; on the contrary, it is very likely that this will tend to decrease certain power rates. The power user who operates his plant so that his power factor is kept relatively high will actually be receiving a bonus in the way of reduced rates.

However, rates based on power factor are only a means to an end, and if the customers once realize how big an economy they can secure by a little attention to motor operation they will never again turn to old haphazard methods, and when added to this is the very present possibility that power in some cases cannot be secured at all unless power factor is improved, surely the power customers will get busy and improve their loads.

There is one thing encouraging about the situation; nine times out of ten when the discovery is made of what is really causing poor power factor it is possible to make considerable improvements without any additional apparatus. There is always a better way of using equipment now installed, and the advantage is that the remedy can be applied at once.

Picture of Waste from Low Power Factor

To visualize the losses brought about by low power factor, imagine a great hill of junked electrical apparatus—alternators, transformers, oil switches, thousands of miles of copper wire, lying tangled all over "no man's land." That's about what it means when we say in cold engineer's English that low power factor cuts down the capacity of generating, transmission and distributing apparatus. Alongside of this first hill is a second hill, small it is true, but very formidable. Here are piles of steam engines, gas engines, waterwheels and steam turbines that are giving no service at all. This is the condition that exists when we say that part of the capacity of prime movers is wasted because of low power factor. In addition to this there is another waste that cannot be shown as a piled-up hill of wreckage, but it exists nevertheless. It is the lowered efficiency at which all prime movers are forced to operate when they are working at part load.

Turn now to a water-power plant. Over the giant spillway thousands of tons of water is pouring, all wasted because the wheels can be operated only at part gate, this in turn being due to the reduced rating of the generators caused by poor power factor. The water can't be stored, the generators can't carry any more current, and so all this water power is going to waste just when it is needed most. Every kilowatt of I^2R loss means burning a certain amount of coal. The I^2R losses at 70 per cent power factor are more than twice as large as the I^2R losses at unity power factor (same power delivered in both cases). Then try to imagine the accidents and shut-downs happening every day due to overheating of conductors and consequent break-down of insulation. Low power factor is indirectly responsible for much of this contributory damage. Overloaded apparatus means work for the troubleman. It is difficult to think of a simile that will typify poor voltage regulation.

Every motor on such a system is working under the handicap of poor voltage regulation, and sometimes it doesn't work at all. Furthermore, poor power factor is usually an indication that alternating-current apparatus is working considerably below rating. This means that maximum use is not being obtained from equipment. The income of the power company is cut down just at the time when the customer is willing to pay almost any reasonable price in order to get increased power. The contributory damage which low power factor causes in this way cannot be computed. We know that it is serious because every productive hour counts in a munition plant or shipyard to-day as never before. Imagine the carloads of material—iron, copper, steel, etc.—and the skilled labor as well—which could be released for other war work if by some magic the power factor of the peak load on all electrical systems could be raised to 100 per cent!

Evil effects of low, lagging power factor are too well known to need much discussion. But it is one thing to understand statements in a general sort of a way and quite a different thing to be brought rudely up against the facts themselves.

Typical Examples

Here are typical examples of things that are now happening, using the words of the central-station managers who reported the cases:

Case 1.—"Our transmission lines were designed for certain loads, at 80 per cent power factor. After the load was connected we found the power factor to be around 60 or 65 per cent, sometimes as low as 50 per cent. When the demand for power kept increasing and the power factor still remained low it was the cause of very poor regulation, which necessitated reinforcing of the line. Had we had something in our contracts penalizing for low power factor, no doubt consumers would have kept it high and we would not have had to reinforce the line."

Case 2.—"We designed a line, 22 miles (35 km.) in length, 22,000 volts, for a certain kilowatt load, at 80 per cent power factor. After the load was connected, including a very large hoist, we found the power factor during the hoisting period would drop as low as 50 per cent. This doubled the kva. in the line and made regulation so poor that the hoist could not be operated. We had nothing in our contract protecting us on this installation, and as long as the consumer keeps his kilowatt demand in accordance with the contract we must serve it, which means we must practically double our line capacity in order to take care of the wattless currents."

Case 3.—"In calculating our generator capacity we did so on basis of 80 per cent power factor. We took on a lot of load recently, assuming it to be 80 per cent power factor, and made the necessary power station increase to take care of it. The power factor on the new load does not exceed 60 per cent, and our generator capacity is greatly reduced on account of the wattless currents."

Case 4.—"At our power house we have a day load (steam) of approximately 12,000 kw., which could be carried with good results on one turbine, but owing to low power factor on the system it is necessary to operate another turbine, which, of course, increases coal consumption materially." (R. B. McDonald, general manager of the People's Power Company, Moline, Ill.)

Case 5.—"At a certain power station we had three motors, totaling 400 hp., giving service to the towns, and one large power customer with a connected load of 300 hp. in induction motors. This customer's load factor is 30 per cent and the power factor is 60 per cent. At our request customer installed a synchronous condenser, receiving 10 per cent discount on his net bill. This resulted in raising the power factor to 85 per cent and enabled us to carry day load on two units, whereas it was previously necessary for us to run all three units to handle this load." (D. R. Truax, Central Illinois Public Service Company.)

Case 6.—Hodenpyl, Hardy & Company of New York state that on some of their large contracts, particularly in Ohio, they have allowed a better rate for energy consumed at specified high power factor. This has had the effect of inducing customers to install corrective apparatus, and in a number of cases where contracts approximated 10,000 kw. or more customers immediately installed synchronous condensers at their own expense.

The isolated plant which generates power for its own use is equally interested in providing for high power factor. This should be considered when apparatus is installed and also when planning methods of operating machines and motors. Of what use is it to install a pump of high efficiency if the leaks in the pipes are allowed to waste the water?

At Wappingers Falls, New York, there is a typical case of low power factor in an isolated plant. Waterwheel-driven alternators are supplying power for chemical works and a textile mill. Owing to partly loaded induction motors driving individual machines, the power factor frequently falls to 60 per cent lagging or even less. This makes conditions bad both as to voltage regulation and line losses. As a temporary expedient one of the waterwheel generators is allowed to run lightly loaded (approximately 25 per cent of its normal rating in kw.) and sufficiently overexcited to deliver its full rated kva. at a leading power factor. Under these conditions the over-all power factor at the generating plant is brought up to 90 per cent or better. Of course this does not relieve the losses in the feeders, but it does help materially in the operation of other alternators. The feeder lines are only a few hundred feet long; nevertheless the line losses are considerable as the voltage is low and the current large.

Any worth-while discussion of this subject of low power factor must cover a wide range of practical experience. For months past the writer has been obtaining information at first hand from central-station managers, power engineers and others, and the series of articles of which this one is the beginning is intended as an impartial résumé of that investigation. It will take up the matter of looking for causes of trouble, the testing of machines and motors; it will explain the main methods now employed for correcting power factor; it will describe the synchronous motor and its limitations and advantages; it will give the points of difference between such motors used for operation at unity power factor and for operation at low leading power factor—auto-synchronous motors, use of idle alternators as condensers, and static condensers; it will explain methods for determining condenser capacity required and how to estimate the kw. output and kva. input, etc., of synchronous motors for various duties. The proper location for condenser apparatus will also be discussed, and charts given showing the various proportion of I^2R losses saved by installing condensers at different points on the circuit.

In addition, the practice of central stations in regard to restrictions on loads of low power factor will be outlined. This will include a brief history of the situation from the central-station standpoint; the present emergency; regulatory measures now enforced by central stations, quoting prominent central-station managers; power contract clauses, etc.; also examples of power-factor penalties imposed on maximum-demand rate and on the energy rate for total kilowatt-hours consumed.

The subject of accurate power-factor metering, upon which the power-factor improvement depends, will be outlined, showing various methods which have been employed up to the present, including the voltmeter, ammeter, wattmeter method, reactive component meters, periodic tests with portable power-factor meters, graphic power-factor meters installed at customers' switchboards and the method employing two single-phase watt-hour meters for use on a balanced three-phase system. Advantages and disadvantages of the above will be given from actual experience, and conclusions as to what seems to be the most successful method of metering power factor for billing purposes will be presented.

BONUSES are an evil and must be stopped. I am acting upon that question. Concerning wages, the government is at present investigating the cost of living and wage conditions throughout the country. This will include, of course, conditions in the mining fields. I shall do all in my power to see that the commission investigating that subject is put in full possession of the facts concerning mine workers and be governed by its findings. But the proposal to consider an advance of mine wages by itself raises a wholly different question. Speaking in your behalf and at your request, I promised the President of the United States last October that no further increases in wages would be asked for during the period of the war. I cannot and will not break that promise. —*H. A. Garfield, United States Fuel Administrator, to the United Mine Workers.*

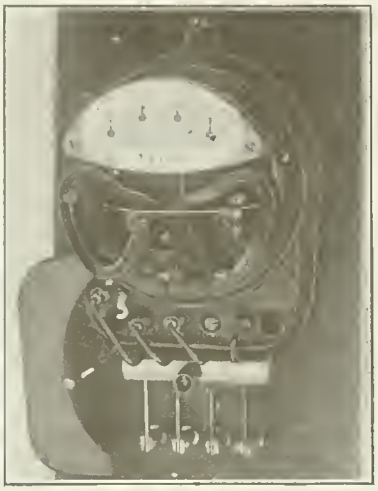
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

SAVING TIME IN METER TESTING

Convenient Switch for This Purpose Is Employed by Bridgeport (Conn.) Company

In the meter department of the United Illuminating Company, Bridgeport, Conn., a convenient switch, illustrated herewith, is used to make rapid connections in testing. Formerly it was necessary to attach the test contacts by hand at a relatively slow rate, but in the present arrangement it is only necessary to throw the switch upward, bringing tubular contacts fastened to stiff copper leads into contact with the meter terminals.



TUBULAR CONTACTS ATTACHED TO SWITCH-BLADE EXTENSIONS MAKE CONTACT WITH METER TERMINALS

AN EFFICIENT METHOD OF RECTIFYING LINE TROUBLE

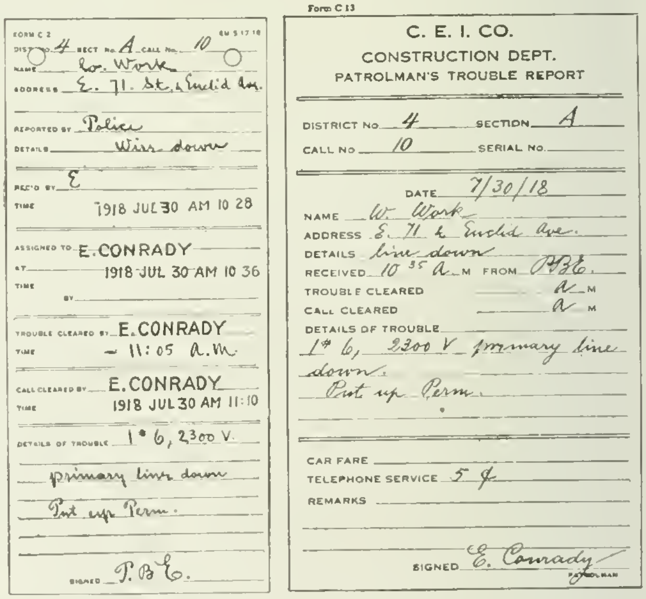
Trouble Department Has Complete Control of All Difficulties Arising on Lines and in Consumers' Premises—Trouble Men Arrive Quickly

Where large war industries are dependent upon central-station service it is imperative that their lines should be in working condition all of the time. When anything goes wrong on the lines of the Cleveland (Ohio) Electric Illuminating Company, which has considerable war business, there is always an assurance that it will be speedily rectified. This assurance is due to the efficient trouble department, which receives the calls and dispatches patrolmen to the scene of trouble as soon as possible.

When a fault is reported it is recorded on the slip reproduced on this page. The name and address are noted, together with the name of person calling and visible details or results of the accident. The time received is stamped on the card by means of an electric clock, and the person who receives the call initials the report. From a map of Cleveland the operator notes the district and section of the call.

Patrolmen are instructed to call the office whenever they finish a job, and therefore it is not long before a man is available in this district who can be sent to the scene of the accident. He will be told where the trouble is and its nature. The card is stamped with the name of the man to whom the call is assigned and the time. After the work is completed the patrolman goes to the nearest telephone and reports "all clear." He gives the time the line was clear, stating the details of the trouble and whether the repairing is temporary or permanent. The card is again stamped with the time and is filed after being signed by the head of the trouble department. The patrolmen are also required to keep a report which corroborates the cards kept in the office. This report, which is also shown herewith, contains lines for noting money spent for car fare, telephoning, etc.

In the trouble department's office the work of the operator is facilitated by means of a large blackboard which denotes the feeders and cables of the system. The feeders are designated with letters and numbers and are represented by a square on the board. They can be tagged so that the operator will know their condition. Thus F6, B6 and A11 are marked as dead, grounded, etc. When lines are interconnected it can be noted on the board by connecting the nails in the squares with strings.



FORM C 2 6M 5 17 18

DIST. NO. 4 SECT. NO. A CALL NO. 10

NAME Co. Work

ADDRESS E. 71. St. & Euclid Av.

REPORTED BY Police

DETAILS Wire down

REC'D BY E

TIME 1918 JUL 30 AM 10 28

ASSIGNED TO E. CONRADY

AT 1918 JUL 30 AM 10 36

TIME

BY

TROUBLE CLEARED BY E. CONRADY

TIME – 11:05 a.m.

CALL CLEARED BY E. CONRADY

TIME 1918 JUL 30 AM 11:10

DETAILS OF TROUBLE 1 ● 6, 2300 V.

primary line down

Put up Perm.

SIGNED P. B. E.

Form C 13

C. E. I. CO.

CONSTRUCTION DEPT.

PATROLMAN'S TROUBLE REPORT

DISTRICT No. 4 SECTION A

CALL No. 10 SERIAL No.

DATE 7/30/18

NAME W. Work

ADDRESS E. 71 & Euclid Ave.

DETAILS line down

RECEIVED 10 35 a. M FROM P.B.E.

TROUBLE CLEARED a. M

CALL CLEARED a. M

DETAILS OF TROUBLE

1# 6, 2300 V primary line down.

Put up Perm.

CAR FARE

TELEPHONE SERVICE 5 ¢

REMARKS

SIGNED E. Conrady PATROLMAN

FIG. 1—TYPICAL CARD RECORD MADE IN RECTIFYING TROUBLE

In the event of a severe electric storm there may be a great number of trouble calls, and if these had to be taken care of by one operator the really necessary repair work would be hampered by minor calls for replacing fuses, etc. To take care of this situation there are six booths in an adjoining room each equipped with a board and a desk telephone. Other employees of the company are called upon in case of an emergency to man these booths and record calls. Trouble requiring immediate rectification is recorded on red cards, whereas ordinary calls are marked on white, blue or yellow cards. In this way the urgent calls can be easily identified. The difference in color of the remainder of the calls is made to designate house calls, industrial plants, etc.

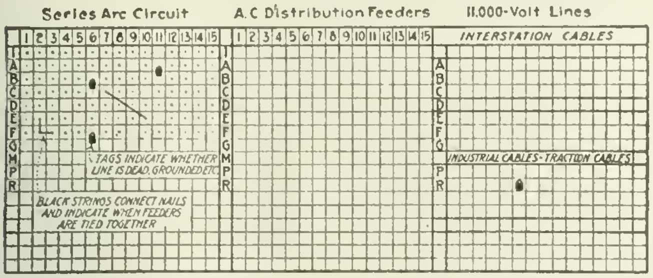


FIG. 2—BOARD MARKED OFF IN THIS MANNER USED TO RECORD CONDITIONS ON CIRCUITS

MECHANICAL INSTRUMENTS NEEDED IN A POWER HOUSE

It Is Becoming Established Central-Station Practice to Use More Instruments in the Boiler Room than Are Used in the Turbine Room

Following is a list of instruments and measuring equipment considered essential to the most economical operation of the steam end of a modern power station, as outlined recently before Ohio station operating men by C. E. Lewis of Toledo:

For Coal.—Track scales; choice of spiral spout meter, automatic scales at each point, weighing larry, weightometer. Coal calorimeter.

For Furnaces.—Draft gages at chimney, at outlet of economizers, at uptakes of boiler and over fire; choice of U-tube type, oil-filled differential type, indicating bellows type, recording types. Pressure gages on wind box (if forced draft), U-tube type, recording type. Recording flue-gas thermometer. Recording stoker speed meter.

For Boilers.—Steam-flow meter on each boiler; choice of Pitot-tube type, Venturi type, orifice type, combination recording steam flow, air flow, flue-gas temperature and indicating draft meter. Recording superheat thermometer. Recording blow-down meters.

For Economizers.—Four recording thermometers for gas entering, gas leaving, water entering and water leaving.

For Feed-Water Heaters.—Water meter on make-up line, on condensate line and on line leaving heater. Two recording thermometers for water entering heater. One recording thermometer for water leaving heater. Level recorder.

For Feed Pumps.—Indicating gage on suction and on discharge. Bi-record pressure gage.

For Turbines.—Indicating gages at throttle, at different stages, on bearing oil. Recording pressure gage. Superheat thermometer. Mercury vacuum gage. Barometer. Indicating thermometers. Hydrometer for air washer.

For Condensers.—Indicating or recording thermometers, or both, at exhaust steam from turbines, discharge water, injection water, air suction, condensate, condensate leaving reheater.

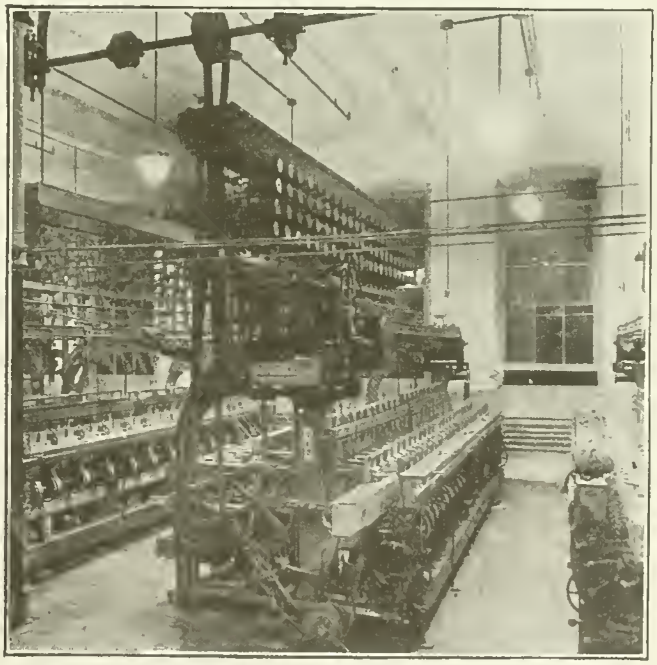
LIGHTING A LOOM ROOM FOR OVERTIME OPERATION

Semi-indirect Illumination Gave Sufficient Light Without Casting Shadows, While the Cost of Its Installation Was Less

BY F. C. TAYLOR

Being confronted with the now common problem of overtime operation, the Vogt Manufacturing Company recently had to rearrange its looms and improve the illumination. In one part of the factory a direct-lighting system had been tried out. This consisted of three 60-watt lamps with extensive reflectors hung about 4 ft. (1.2 m.) above the bar of the loom and equally spaced along it. The rear of the loom was illuminated by a 60-watt lamp. This direct system was found to cause shadows and did not give satisfaction.

In the new loom room the looms are illuminated by 200-watt type C lamps in Druid No. 3031 11-in. (28-cm.) semi-indirect glass fixtures. The ceiling and walls were covered with two coats of Rice's "mill white." To provide for portable lights a drop was hung over each loom within easy reach of the operator so that he could plug in an extension cord equipped with a trouble lamp. However, when the semi-indirect system was installed it was found that the intensity of light and the lack of shadows made a trouble lamp superfluous.



SEMI-INDIRECT LIGHTING MAKES PORTABLE LAMPS UNNECESSARY

It is interesting to note that this semi-indirect system of illumination cost less to install than any other system and gave better results.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

HARRISBURG HAS ADOPTED CONTINUOUS METER READING

Besides Lessening Considerably the Work of Bookkeeping, It Opens the Way for Better Sales of Electrical Appliances

The Harrisburg (Pa.) Light & Power Company has just adopted the continuous meter-reading system which will apply to all electrical consumers and is already in operation. A large amount of work was curtailed in the change-over from the old ledger system, but from now on it will make the work of the cashier and bookkeepers much easier. Another very important result of the change will be that it will produce a far better distribution of the crowd in the company's sales office and bring opportunity for more careful selling methods.

Under the old system, discount day brought a large run on the electric light office and produced so great a crowd that it was practically impossible to bring any selling influence to bear. From now on, however, there will be a limited number of discount takers in the office every day, and it will be possible to discuss the matter of appliances with them. This, it is felt, is certain to produce a large amount of business which otherwise would not be developed.

ELECTRIC RANGE SALES IN NORTHWEST CURTAILED

Idea, However, Is Not Abandoned, and Several Ingenious Plans Have Been Developed to Keep Interest Alive

A questionnaire was sent out a few months ago by the electric range committee of the Northwest Electric Light and Power Association to those central stations in the Northwest that had been engaged in range service. At the recent convention of the association the committee presented its report based on this questionnaire.

The replies received showed that with a few exceptions all of the companies answering have curtailed, if not entirely stopped, range sales work. Among the reasons given were shortage of power, increased cost of line construction and increased cost and difficulty of securing ranges, but the underlying reason in each reply was the necessity of curtailing expenses in general to meet war conditions. Other contributing causes were given as the cost and scarcity of transformers, the difficulty of retaining competent range salesmen at reasonable salaries, the high cost of ranges, the necessity of financing from earnings all ordinary additions to properties, and the feeling that money spent for new business should be devoted to securing the load which would give the greatest return on the money invested.

The replies indicated that, although little effort is being made to push range sales actively, none of the companies that reported has entirely ceased selling ranges. All have stopped making expensive line extensions, and in some instances no line construction other than the hanging of transformers and running of service blocks is done.

The committee stated that it felt that too much time, effort and money had been expended in promotion and sales work to warrant the entire abandonment of range sales. Several companies, it was pointed out, which have practically ceased all effort toward range sales have realized the necessity of maintaining interest in electric cooking, and a number of ingenious plans have been followed to keep this interest alive until conditions again warrant active range campaigns.

One of the companies reported that owing to war conditions the electric cooking idea had taken on the aspect of a general educational campaign intended to prepare the people in the city persistently for an electric range campaign which will be arranged when conditions become normal again. This company inaugurated a recipe service to 2000 prospective customers. This recipe service is not carried on to sell ranges now; it is just preparing for the future, on the theory that the inherent value of advertising is cumulative and must go on persistently. After twenty recipes had been mailed return post cards were sent asking if those to whom they were sent wished the recipe service continued, and 500 requests for continuance were received. These 500 have developed from possibilities into real "prospects." Each recipe sent out carried a few remarks on how electric cooking will improve the particular dish. No range salesmen are employed. Many prospective customers have been sufficiently interested to call at the cooking bureau, and ranges are sold where no extensions of lines are necessary. Where extensions of lines are necessary the inquirer is told that war conditions prevent expenditures of this character, but the interest in electric cooking is not allowed to wane.

FIXTURES FORMERLY RENTED ARE NOW SOLD OUTRIGHT

Conditions Have Increased Maintenance Cost Until There Is No Longer Any Rental Profit

A few years ago the commercial department of the New Orleans (La.) Railway & Light Company instituted a practice of installing high candlepower "mazda" fixtures on a rental basis, the object being to discontinue arc-lamp service. In all about 1500 of these lighting fixtures, or "pendants," as they were called, were put out, and up to within a few months ago the monthly rental produced a very satisfactory revenue over the operating expense. The influence of the war, however, has upset these conditions and increased the cost of maintenance until it practically balances the revenue. It has been decided therefore to discontinue the rental of "mazda" fixtures, but to continue the furnishing of them on a straight sale basis.

Present customers will be called upon to purchase the fixtures now in use on a rental basis, and this turnover will bring in a considerable amount of money and a large margin of profit. Some of the fixtures have been in service for several years, though they are now in perfect condition, and the price on the present basis of cost is well in advance of the original cost of the fixtures. It is believed that there will be very little difficulty in taking care of this change-over, for the fixtures are giving entire satisfaction, and it will be far more expensive for the customer to give them up and purchase something else.

STEP METER RATE BEING DISCOURAGED IN NEW YORK

Block System Providing the Same Revenue Is Found to Be More Equitable and Not to Embody Inconsistencies

A movement is on foot in New York State to abolish step meter rates. At the June meeting of the executive committee of the Empire State Gas and Electric Association the following resolution was adopted:

"Resolved, that it is the consensus of opinion of the executive committee that the method of charge for gas and electric service known as the step meter rate should be discontinued by companies wherever possible."

As part of its activity in this direction there is shown in a recent issue of the company's *Bulletin* a graphic representation of a step meter rate actually in use by one of the companies in the state. The Public Service Commission of the state ordinarily requires that rates of this character be governed by a so-called "more or less" clause, which provides that a discount or reduction in rates shall not be applied in such a manner that an increase in consumption will result in a reduction in the net bills. This particular rate, however, had never been filed with the commission, and no such clause was in effect.

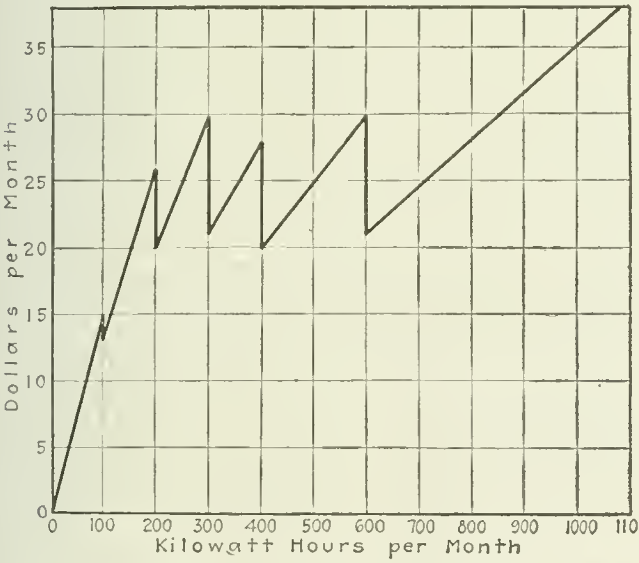


FIG. 1—HOW A STEP METER RATE WORKED OUT

A study of the curve will show that the net bill will be $25 per month whenever a consumer uses 191, 250, 357, 500 or 713 kw.-hr. For a consumption of 200 kw.-hr., however, the bill would go up to $26; for 300 kw.-hr. or 600 kw.-hr. to $30, and back to $28 for a consumption of 400 kw.-hr. Even if the "more or less" clause had been in effect, the result would have been nearly as bad, for the bill would have remained at $20 for all consumption from 153 kw.-hr. to 401 kw.-hr. It is admitted, of course, that this particular rate is an extreme case, but the same general situation results to a greater or less extent in the operation of all step rates.

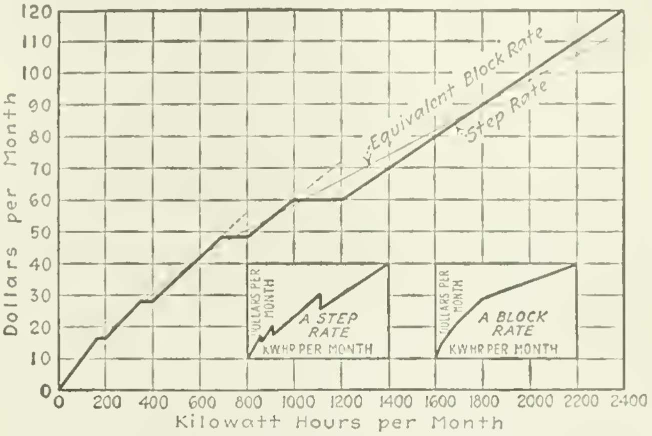


FIG. 2—COMPARISON OF BLOCK AND STEP RATES

A comparison of a step rate and a block rate computed to return the same revenue was developed as shown. The heavy line represents a step rate with a "more or less" clause in effect, and the light line running through it shows a block rate that can be substituted for it. The step rate is as follows: On a total consumption of from 100 kw.-hr. to 200 kw.-hr. per month, 10 cents per kilowatt-hour; from 201 kw.-hr. to 400 kw.-hr. per month, 8 cents per kilowatt-hour; from 401 kw.-hr. to 800 kw.-hr. per month, 7 cents per kilowatt-hour; from 801 kw.-hr. to 1200 kw.-hr. per month, 6 cents per kilowatt-hour; more than 1200 kw.-hr. per month, 5 cents per kilowatt-hour.

The same revenue will result from the following block rate: For the first 100 kw.-hr. per month, 10 cents per kilowatt-hour; for the next 100 kw.-hr. per month, 8 cents per kilowatt-hour; for the next 400 kw.-hr. per month, 6 cents per kilowatt-hour; for all over 600 kw.-hr. per month, 4 cents per kilowatt-hour.

In computing the substitute block rate, a curve is sketched which cuts off the sharp points and angles of the step rate. From this curve it would seem that for the first 100 kw.-hr. no change is necessary in a block of 100 kw.-hr., so that 10 cents was decided upon. It would next seem that the curve gave a cost for 200 kw.-hr. of $18. The first block of 100 kw.-hr., however, would cost $10, leaving $8 for 100 kw.-hr., or 8 cents per kilowatt-hour, and so on, for the remaining blocks. The computation, therefore, for the full rate schedule is not a difficult task and may quickly be accomplished by a company wishing to make the change.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Design of Large Dynamos.—M. VIDMAR.—This article investigates the changes in the dimensions of dynamos required to obtain increased capacity. On the assumption that in a series of machines the electromagnetic loading remains unchanged a number of laws are deduced for the dependence of the dimensions on the output. It is not possible to design machines for increased outputs by simple changes of linear dimensions, as would appear to be the case if the output coefficient were really a constant. As a matter of fact this coefficient decreases with increase of output if the speed remains the same. If designed according to the methods outlined, the losses will increase with the three-quarters power of the output, the ohmic drop will decrease with the fourth root of the output, and the percentage magnetizing current will decrease with the fourth root of the power. It is interesting to note that the heat-radiating capacity improves with increase in the size of the machine, as the parts in which the heat is generated are concentrated around the air gap where it can be carried off by the vigorous air draft, which improves as the machines become larger. It appears that the design of very large units will be determined mainly by heating considerations.—*Science Abstracts, Section B*, Aug. 31, 1918. (Abstracted from *Elektrot. u. Maschin.*, 36, March 31, 1918.)

Regulation of Alternating-Current Commutator Machines by Direct Current.—M. OSNOS.—Under the term "regulation" the author understands control of the speed of motors and of the voltage and frequency of generators and any other methods of regulation designed for adjusting the commutation and power factor of commutator machines. The methods described are all based on the regulation of the permeability of the machines themselves, or of apparatus external to the machines, by superposing direct current on the alternating currents flowing. The principle of the methods may be understood from one of the cases referred to, consisting of a four-pole commutator machine in which the windings of the four poles are connected to form the four arms of a bridge fed across one diagonal by alternating current passing through the armature, and across the other diagonal by direct current through a regulating resistance. The connections are such that the alternating current produces a four-pole field while the direct current produces a two-pole field that has no inducing effect on the four-pole armature. The superposed direct-current field alters the saturation of the machine so that the alternating-current field is weakened. If the machine has a number of poles not divisible by four, some of the field windings may be connected as described above and the remaining ones inserted outside the bridge. In the case of polyphase machines various devices are shown by which the direct-current field may be superposed on the alternating-current field in a non-inducing manner. The method must be modified for application to shunt machines, as variation of the permeability would not alter the flux but would merely change the value of the magnetizing current. In such cases reactive coils may be connected in series with the field windings, these coils being regulated by direct current. After describing a number of methods for connecting such reactive coils into circuit, details are given of their design.—*Science Abstracts, Section B*, Aug. 31, 1918. (*Elekt. Zeits.*, May 23, May 30 and June 6, 1918.)

Lamps and Lighting

Atomic Heats of Tungsten and of Carbon at Incandescent Temperatures.—A. G. WORTHING.—The atomic heat of tungsten under constant pressure has been measured by two methods for the region 1200 deg. K. to 2500 deg. K. The atomic heat of carbon has been measured by one method for the region 1200 deg. K. to 2100 deg. K. The results on tungsten when corrected to give atomic heats under constant volume lead to values considerably greater than those ordinarily expected in accordance with many theories. The carbon values agree well with this expected limit. Indications of an apparent lag between resistance and temperature or some other functions have been found which the writer is unable to explain. —*Physical Review*, September, 1918.

Generation, Transmission and Distribution

Power Development in Foreign Countries.—In Great Britain proposals have been set forth for vast central-station fuel power plants at strategic points for the supply of power for all industries, so as to secure the most efficient use of coal. The extraction of all by-products is being urged not merely on account of their value, which is enormous, but also because a cheap fuel will thereby become available to reduce the cost of power. A board of scientific societies acting under the auspices of the imperial government and recruited from the highest ranks of technical men in Great Britain is studying the resources of the empire. France, until the war an importer of one-third of its coal, was faced by the loss to the enemy of a considerable proportion of its own mines and the rising price and difficulties of transportation for imported fuel. Promptly, and in spite of many difficulties, it has proceeded with hydroelectric developments and by the end of this year will have 1,000,000 hp. developed, an increase of 450,000 hp. since 1910, two-thirds of which has been secured since war broke out. Lacking in coal, Italy is an excellent field for water-power development, and through the Allgemeine Elektricitäts Gesellschaft the Germans secured a hold on Italian industry such that by 1910 515,000 hp. was developed. Since the outbreak of war the Italian government has not merely broken the Teutonic hold but has proceeded with an active water-power policy. The power situation in neutral European countries is also outlined in this article.—*Monetary Times of Canada*, (Toronto), Sept. 20, 1918.

Mechanical Design and Specification of the Turbo-Alternator Rotor.—S. F. BARCLAY.—In this article the conditions underlying the mechanical design of the high-speed alternator rotor are reviewed and suggestions are made concerning the specifications for the guidance of the purchaser's technical adviser. The subject is dealt with by means of curves and diagrams and is not mathematical.—*Journal of (British) Institution of Electrical Engineers*, July, 1918.

Coal Economy in Mine Boiler Firing.—The question of scientific control of flue gases receives scant attention in the majority of plants. The comparatively few large mining installations have complete organizations for control and research and engineers who attend to such details; the small mining proposition cannot give the matter the attention it would deserve if operations were being conducted on a large scale; but among the number of medium-sized plants there are many installations where economical firing is little understood and scientific control believed to be an outside consideration. In this paper are given the underlying principles of fuel combustion and the description of a carbon-dioxide recorder apparatus. It should lead to a better realization of the feasibility of closer fuel control.—*Engineering and Mining Journal*, Sept. 21, 1918.

Saving Coal in Boiler Plants.—HENRY KREISINGER.—This paper is written for the fireman, the engineer and the owner of the small or medium-size plant, which as a rule is hand-fired. The principal losses that occur and their remedies are outlined. Stack losses and losses from incomplete combustion are particularly discussed. The significance of flue-gas analysis is pointed out and the importance of flue-gas temperatures shown.—*Technical Paper No. 205*, Bureau of Mines.

Traction

The Nuremberg-Furth Electric Railway.—P. SCHOLTES.—A previous article by the author dealt with the design and equipment of this line (*Abs.* 1140, 1905). The present article deals with the results which have followed from the adoption of the third-rail system at a later stage owing to electrolytic troubles and disturbance of telephone circuits. Diagrams and records are given which show that at the present moment these difficulties have disappeared. The author considers that it is desirable to return the current to the station mainly by insulated conductors and that the rails should only be regarded as equalizing circuits. In this way the heaping-up of the current in uninsulated rails is avoided.—*Science Abstracts, Section B*, Aug. 31, 1918. (Abstracted from *Elekt, Zeits.*, *39*, April 25, 1918.)

Installations, Systems and Appliances

New Plant of Pennsylvania Salt Manufacturing Company.—The company has a modern alternating-current plant with rotary conversion to direct current for electrolytic work. In the boiler room there is an operating board carrying a most complete complement of instruments and control for boiler-room auxiliaries and dampers. A modern system of cooling for the electrical machinery is used in the turbine room. By means of a series of eductor-type jet condensers the auxiliaries are operated under varying vacuum to maintain the heat balance.—*Power*, Sept. 17, 1918.

Selection of Bridge Motors for Traveling Cranes.—One of the papers which attracted considerable favorable comment at the recent Baltimore convention of the Association of Iron and Steel Electrical Engineers was entitled "Bridge Motors for Overhead Traveling Cranes," by R. H. McLain of the General Electric Company. Data were collected on the characteristics of twelve typical cranes, giving loads, rolling friction, speed and acceleration required for the particular service. Then, by the use of curves, the proper motor could be selected. The paper called forth an animated discussion in which many doubted the usefulness of such calculations as were introduced by Mr. McLain on the ground that the variation in friction is too great under operating conditions. Others felt that the method proposed in the paper was a step in the right direction and that more data of the kind presented should be gathered to make it possible to draw conclusions regarding operating conditions to be expected in various classes of work. Many had a good word to say for automatic control. It was also suggested that dynamic braking might be feasible for crane motors, particularly in the shipyards, where the travel is considerable and the wind may make accurate stopping difficult. In conclusion, Mr. McLain said that data of the kind he had presented would make possible the analysis of crane troubles, so that if the friction became excessive because of faulty alignment of the crane this could be remedied instead of putting in a larger motor as is commonly done.

Gas Firing for Boilers.—A comparison between gas and coal firing for steam raising deals particularly with efficiencies possible by improved gas-firing methods.—London *Electrical Times*, Aug. 1, 1918.

Electrophysics and Magnetism

Effects of Dielectrics on the Sparking Voltage.—E. R. WOLCOTT.—The results of this investigation might be summarized as follows: (1) The sparking voltage between a point and plate when the point is positive is about half of that when the point is negative; (2) a dielectric of discontinuous surface placed over the plate lowers the sparking voltage when the point is negative to a value comparable to that when the point is positive; (3) the discontinuity of surface may be an edge or hole, or the body may be fibrous or porous; (4) no lowering of the sparking voltage results when means are provided for conducting away the charge, as when the deposit is sufficiently moist or is in a humid atmosphere; (5) no lowering of the sparking voltage results when means are provided for preventing the accumulation of a heavy charge as by covering the dielectric with a grounded screen; (6) an intense brush glow appears upon the dielectric when just under sparking voltage. The decrease in resistance of the gaseous medium between the electrodes thus produced is probably the cause of the lowering of the sparking voltage.—*Physical Review*, October, 1918.

On the Effect of a Transverse Magnetic Field on the Discharge Through a Geissler Tube.—JAMES E. IVES.—The quantitative effects on the current in the Geissler tube of a transverse magnetic field are studied in this investigation. Many curves between current and magnetic field are presented showing these relations.—*Physical Review*, October, 1918.

Some Peculiar Thermoelectric Effects.—PAUL D. FOOTE and T. R. HARRISON.—It is pointed out that thermoelectric emfs. may be developed by touching a hot wire to a cold wire of the same material, by crossing two wires and heating one of the wires near the junction, and by drawing rapidly a hot wire over a cold wire, by joining two wires of different diameters and heating either wire near the junction. Effects of this character are discussed in this paper.—*Journal of Washington Academy of Sciences*, Oct. 4, 1918.

Magnetic Properties of Zinc Blende and Some Other Minerals.—F. STUTZER, W. GROSS and K. BORNEMANN.—Researches started in 1914 for the purpose of investigating the possibility of magnetic separation and the state of combination of the iron in minerals. Two equal primary coils were so mounted at right angles to one another that there was no mutual induction. The primaries, on glass tubes, 30 mm. in diameter, were joined in series, the secondaries (wound over them) in opposition. On suddenly changing the primary current, the ballistic galvanometer in the secondary circuit gave no deflection. When a piece of iron wire or a magnetic mineral in the shape of powder contained in a thin-walled glass bottle was introduced into the one tube, a deflection was observed. This deflection was, however, very weak with zinc blende. The differential arrangement was therefore improved by inserting an interrupter (at 1200 r.p.m.) into the primary and by rectifying the resulting secondary alternating current with the aid of a commutator. The deflections were then proportional to the susceptibility.—*Science Abstracts, Section B*, Aug. 31, 1918. (*Metall. u. Erz.*, 15, 1, Jan. 8, 1918.)

Electrochemistry and Batteries

The Sign of Potentials.—OLIVER P. WATTS.—A historical retrospect is given concerning the usage of electrochemists in designating the signs of potentials, and a plea is made for continuing the present conventions. It is pointed out that if the present conceptions of electric current being a flow of (so-called) negative electrons be correct, negative electrons would flow only to material of relatively higher (more positive) potential and the present usage of designating potentials would fit the facts in this case, while the proposed inversion of signs would contradict the facts.—*Paper presented before Convention American Electrochemical Society*, Sept. 30, 1918.

Units, Measurements and Instruments

Theory of the Thermionic Amplifier.—H. J. VAN DER BIJL.—In this paper the theory of operation of the thermionic amplifier is dealt with. This device consists essentially of an evacuated vessel containing a hot cathode and a third electrode adjacent to the cathode. This auxiliary electrode may be in the form of a grid placed between the cathode and anode. It may also be in the form of a plate placed on the side of the cathode opposite to that of the anode, or in the form of a wire or a plurality of wires galvanically connected and placed in the plane of the cathode parallel to that of the anode. The theory given here applies to any of these structures, although in particular it will be explained with reference to the case in which the auxiliary electrode takes the form of a grid between cathode and anode. Equations and experimental verifications are given.—*Physical Review*, September, 1918.

Miscellaneous

How Much to Charge the Consumer.—C. E. GRUNSKY.—The apportioning of the burden among the consumers is a problem which occasions quite as much discussion as the determination of what interest the company is to receive on its investment. Favoring the large consumer, ready-to-serve charges and other fundamental considerations are here discussed from the standpoint of their logical justification as well as their present feasibility.—*Journal of Electricity*, Sept. 1, 1918.

National Engineering Societies and the National Research Council.—GEORGE ELLERY HALE.—This article is a continuation of one by the author on May 28 in which he briefly described the war activities of the National Research Council. In the present paper the writer takes up more particularly the engineering activities connected with the war, giving the objects of the various agencies and committees through which the government is working, together with their personnel.—*Proceedings A. I. E. E.*, October, 1918.

Metallography of Tungsten.—ZAY JEFFRIES.—In this paper the metallography of wrought and ductile tungsten in the various stages of manufacture is considered more or less in detail. The general relationship between the properties of tungsten and other metals is also considered, and it is explained why fibrous tungsten is ductile at room temperature, even though past experience with other metals would indicate that it should be brittle. Finally, there is a brief comment regarding some new fundamental metallographic propositions relating to all metals.—London *Engineering*, Aug. 30, 1918.

Metallography and Heat Treatment of Metals Used in Aëroplane Construction.—F. GROTTS.—The fourth of a series of articles dealing with this subject. In this installment the uses of copper and its alloys in aëroplane construction are given particular attention. Among the topics discussed are requirements for sheets and tubes, details of the brazing process, methods of heating, fluxes and preparation of parts.—*Chemical and Metallurgical Engineering*, Sept. 15, 1918.

By-product Installations for Power Stations.—KLINGENBERG.—The author reviews first the trend of the market for by-products. A great increase in production will cause a fall in prices and, in particular, the price of ammonium sulphate is likely to decrease owing to competition from the numerous nitrogen plants erected during the war, including those working the Haber process. After a brief review of distillation processes (coking and gas-making), the author deals with the erection and operation of plants for gasifying the whole of the fuel and recovering by-products. He investigates in detail the relative economy of three types of power-station plant, namely, steam turbines with coal-fired boilers, steam turbines with gas-fired boilers and by-product plant and gas engines with by-product plant. These three cases are investigated with certain specified prices of coal and capital costs for plants.—*Science Abstracts, Section B*, Aug. 31, 1918. (Abstracted from *Zeits. Vereines Deutsch. Ing.*, 62, Jan. 5, 1918.)

Readers' Views and Comments

Use of Waste Solutions for Orsat Apparatus

To the Editor of Electrical World:

Sir: Referring to an article in the July 13 issue of the Electrical World on "Waste Solutions Utilized for Orsat Apparatus," I would venture to say that the 21 per cent KOH solution from Edison batteries might give rise to considerable error after this solution has become weakened and is saturated with particles of iron and nickel. The standard Edison solution also contains some lithium hydrate which would lead to error.

The use of this material is unwarranted except for the roughest of rough flue-gas analysis. I would like to hear something regarding a check-up of the error which would be introduced by this substitution.

H. E. Weightman.

Engineering Service Company, Chicago, Ill.

Wood Fuel in Argentine Central Stations

To the Editor of Electrical World:

Sir: Your article on the plant of the Central Argentine Railway in the issue of Oct. 12, 1918, was very interesting.

The writer recently returned from a trip to South America and saw this installation, which would be a credit to any country. He also collected considerable information on the burning of wood which may be of interest to your readers.

At one plant in Paraguay red Quebracho is used and costs $2.79 (United States currency) per ton delivered at the boilers. This wood is heavier than water and requires only 2.5 lb. to be equivalent to a pound of coal, while the woods we are used to in this country require 4 lb.

The following table was made up for the plant in question (prices are in United States currency):

	Wood	Coal	Oil
Equivalent weight, ratio	1	2.5 to 4	3.75 to 6
Equivalent value, ton	$2.93	$7.32 to $11.72	$11 to $17.58
Cost at that time, ton	2.93	23	31 to 50
Pre-war value	....	8	7.50

The government of Argentina has opened large oil fields in Rivadavia and since the war has largely increased the output. The government is charging the same price as is charged for imported oil, except to persons who contracted for their supply at the time when the oil fields were being opened for utilization.

One plant in Buenos Aires the writer visited was burning oil and wood. This was a plant of 5000 kw., and it was burning 30 tons of wood per day and all the oil it could get. It had burned as much as 200 tons of wood per day. The engineer had done considerable experimenting with different grades of wood, and the experiments which he conducted showed the result given in the following comparative tabulation:

Ratio, Wood to Coal	Kind of Wood
2.25 to 1	Red Quebracho without bark
2.25 to 1	Red Quebracho with bark
3.7-4.2 to 1	Mixed woods
2.7-3 to 1	White Quebracho

The plant was using a special firebox construction and had to watch superheaters as the long flames from the wood fires were liable to cause burning.

Another plant of 80,000 kw. was burning 1000 tons of wood and 500 tons of coal daily. It had extended the grates across the whole of the boilers, cut fire doors in the rear of the boiler and was throwing in wood from both ends. It was obtaining a ratio of 2.8 lb. of wood per pound of coal.

The coal used in all cases was either Cardiff coal from Wales or our best Pocahontas from the West Virginia coal mines.

Allentown, Pa. J. B. Crane.

Scientific Development in Italy Not Followed Abroad

To the Editor of Electrical World:

Sir: The difficulty to-day of keeping informed of all the new things being produced in the world is very great, even in a restricted technical field; therefore it may easily happen that a thing is presented by some one as perfectly new when it has been already presented to the public by another and already applied by many. Knowing this, I would not have disturbed you if the thing had not happened to me twice within a very short interval of time.

First: In the Electrical World of Jan. 19, 1918, E. G. Barrington of the Toronto Hydroelectric Commission describes a method of "Obtaining Power Factor by Use of Wattmeter" which is substantially the same method described by me, together with Ing. Guastalla, and published in 1912 in the *Atti dell' Associazione Elettrotecnica Italiana*, Vol. XVI, page 99. The system was patented by us, Italian Patent No. 119,889, Vol. 88, on Sept. 9, 1911, and has had a considerable number of applications.

Second: In the Electrical World of May 11, 1918, C. O. Gibbon describes a method for "Precise Measurement of Alternating Current" which is identical with that published by me as far back as 1908 in the *Atti dell' Associazione Elettrotecnica Italiana*, Vol. XII, page 291.

I shall be obliged to you if you will publish this letter to demonstrate that Italian scientific development is very badly followed abroad.

Milan, Italy. A. Barbagelata.

Concrete Breeching and Air Ducts in Power Plants

To the Editor of Electrical World:

Sir: Referring to the article in the Electrical World for Sept. 14, 1918, under the heading "Concrete May Replace Steel in Power-House Construction," I should like to offer these suggestions:

It is entirely feasible to make reinforced-concrete smoke breechings for power-house boilers, provided that certain essential features are employed; otherwise the work will prove to be a failure.

Concrete breechings, if properly reinforced and ribbed, need not be more than 3 in. (7.6 cm.) in thickness. The work will require expansion joints at suitable intervals, preferably not more than 40 ft. (12 m.) apart. These may be made of corrugated strips of sheet iron—"accordion fashion"—or may be constructed of suitable metal sliding plates.

The concrete on all sides must be exposed to free radiation, and the draft of the stack should draw in a small amount of air through its walls to keep them cool.

I have seen concrete flues constructed against brick walls or underneath the dirt floor which quickly went to pieces, owing to the concrete calcining from the heat of the waste gases. Where constructed so as to be ventilated on all sides, no failures have resulted from this method.

The concrete mixture should be made rather rich in cement, and the aggregates should preferably be of sandstone or other low calcium stone. It is preferable to use form work and cast the concrete around the reinforcement rather than to attempt to plaster up into position.

Reinforced-concrete air ducts for turbo-generators are quite successful and may be most easily constructed by means of expanded metal lath plastered on both sides with concrete mortar. They thus need not be more than 1½ in. (38 mm.) thick. Complicated curves and turns for air flues are much more easily formed in this manner than when the method followed is that of using steel-plate construction.

W. E. Moore.

President W. E. Moore & Company, Pittsburgh, Pa.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

MANUFACTURERS MUST USE SUBSTITUTES FOR BRASS

Makers of Electrical Supplies Hold Meetings in New York to Take Steps to Face the Serious Emergency

On the call of A. W. Berresford, a meeting of the manufacturers of supplies was held at the offices of the Associated Manufacturers of Electrical Supplies, New York, on Oct. 19. Representatives of about twenty-five manufacturers attended.

Mr. Berresford explained at length the situation in connection with the production of brass and also his conference with Everett Morss, chief of the brass section of the War Industries Board and a member of the Priorities Division. He stated that owing to the influenza and for other reasons brass production had been reduced to less than 50 per cent basis of production by the mills and that the situation was so extreme that Mr. Morss announced that unless the manufacturers took up at once the matter of the substitution of steel and other metals for brass in every possible case it would be absolutely necessary for him to issue definite instructions that orders could be filled only if accompanied by a permit stating the general purpose for which the supplies were wanted.

Mr. Berresford gave figures as submitted by Mr. Morss, showing the production and also the daily amounts or demands of the government for ordnance and other purposes, together with the increase in the munition demands and the seriousness of the situation by reason of the lessened production. He stated that Mr. Morss was very positive as to the necessity for drastic regulations and complete coöperation by the manufacturers in the matter of substitution and extreme substantial reduction in the amount of brass used.

An extended discussion was held, during which J. H. Trumbull stated that he had recently had an interview with Mr. Morss and that Mr. Berresford had in no way overstated the situation. He suggested that each manufacturer take up the problem and report at an early date what percentage of saving in brass could be effected in his product by the substitution of other metals.

Mr. Berresford suggested that each group should meet at once and discuss eliminations and substitutions and be prepared to make a report during the ensuing week. He said that this matter was more important than conservation and that if reports were prepared and ready for presentation to Mr. Morss he felt confident that he could get the matter before him without delay. He added that he would be in New York on Oct. 28 to take up decisions of groups to present to Mr. Morss.

In the absence of Mr. Dallam of the wiring devices group Mr. Barton suggested calling the groups together with the factory men and issued a call to the wiring devices group, embracing about seventy-five manufacturers, to attend a meeting at the offices of the association on Oct. 23.

Other groups took similar action, and on further discussion the following were decided upon as subjects to be considered and upon which definite statements should be made:

Average monthly consumption past six months.

Percentage reduction possible; time necessary to effect.

Character of substitute and amount required: copper, steel, zinc, etc.

Wherever possible indicate uses which may be specified for prohibition.

Mr. Trumbull suggested, in order to facilitate the work, that reports should be made on a tonnage basis, including average per month, stock in hand and complete list of eliminations of brass by substitution of other metals.

In accordance with the call, manufacturers of wiring devices met at the office of the Associated Manufacturers of Electrical Supplies on Oct. 23 and agreed that the reduction in the consumption of brass should be accomplished by substitutions as indicated in the accompanying schedule.

J. C. Dallam, chairman of the wiring devices group, has asked manufacturers to go over this carefully and have their reports made out to reach the office of the Associated Manufacturers of Electrical Supplies not later than 9 a.m. on Oct. 28.

SCHEDULE FOR THE SUBSTITUTION OF OTHER METALS FOR BRASS

A—SOCKETS AND RECEPTACLES:

1. Screw shells—copper.
2. Reinforcing rings and terminals—copper (unless subjected to rubbing contact).
3. Screws for binding and clamping—steel (protected where the device is intended for installation in damp places).

B—ATTACHMENT PLUGS AND RECEPTACLES:

4. Screw shells—copper.
5. Swivel plugs—copper for interior parts.
6. Receptacles—copper for interior parts except spring contacts.
7. Flush plates, without doors, up to and including three-gang—steel, properly protected.

C—SNAP SWITCHES:

8. Screws for binding and clamping—steel (protected where the device is intended for installation in damp places).
9. Shunts—copper.
10. Flush plates, up to and including three-gang—steel, properly protected.
11. Binding posts—copper (where mechanical difficulties do not prevent and where there is no rubbing contact).

D—KNIFE SWITCHES:

Combination Switches:

12. Screw shells—copper.
13. Shunts—copper.

14. Terminals—copper.
15. Screws, binding and clamping—steel (protected where the device is intended for installation in damp places).
16. Washers, spring hinges—steel.

All Other Types:

17. Except for the current carrying nuts on 30-amp. and 60-amp. back-connected devices, no brass shall be used other than castings.

E—Fuses and Cut-outs:

Fuses—Plug Type:

18. Caps—zinc, copper or steel.
19. Screw shell—copper.

Fuses—Non-Renewable—Ferrule Contact:

20. All current-carrying parts except ferrules and fusible elements—copper.
21. Non-current-carrying parts—steel (properly protected where necessary).

Fuses—Non-Renewable—Knife-Blade Contact:

22. All current-carrying parts except fusible elements—copper.
23. Non-current-carrying parts—steel (properly protected where necessary).

Fuses—Renewable—Ferrule Contact:

24. All current-carrying parts except ferrules and fusible elements—copper.
25. Non-current-carrying parts—steel (properly protected where necessary).

Fuses—Renewable—Knife-Blade Contact:

26. All current-carrying parts except fusible elements—copper.
27. Non-current-carrying parts—steel or brass castings.

Cut-out Bases:

28. Screw shells—copper.
29. Shunts—copper.
30. Terminals—copper.
31. Lugs—copper (not to be made from tubing) or brass castings.
32. Screws, binding and clamping—steel.

Back-Connected Terminals:

33. Except for the current-carrying nuts on 30-amp. and 60-amp. sizes, no brass other than castings shall be used.

PRODUCTION CURTAILED IN VARIOUS INDUSTRIES

Products in the Electrical Manufacturing Industry Affected by New Order of the War Industries Board

In announcing the necessity of curtailment of production in products of various industries the War Industries Board on Oct. 17 appealed to manufacturers to urge all workers who can be spared to go into the war industries and to coöperate with the United States Employment Service in so directing them.

Among the products affected by the new order are: Electric fans curtailed to 40 per cent of 1917 production; electric vacuum cleaners, for six months from Oct. 1, curtailed to 75 per cent of six months of 1917 production; builders' hardware, for six months from Oct. 1, curtailed to 40 per cent of tonnage used in 1917 production.

MUNITIONS PATENT BOARD IS FORMED AT WASHINGTON

Secretary of War and Secretary of the Navy Create Agency to Consider Patent Questions Affecting Their Departments

The War Department authorizes the following:

For the purpose of coördinating the policies of the War Department and the Navy Department in patent matters the Secretary of War and the Secretary of the Navy have established the Munitions Patent Board. The membership consists of Thomas Ewing, who has been jointly selected by the Secretary of War and the Secretary of the Navy; Max Thelen, representative of the War Department, and Pickens Neagle, representing the Navy Department.

SUCCESSFUL "GET-TOGETHER" DINNER OF ELECTRICAL MEN IN LOS ANGELES, CAL.

SERIOUS EFFECT FROM THE SPANISH INFLUENZA

Epidemic Has Made It Difficult for Central Stations to Maintain Service of the Usual Standard—Conditions in Various Cities

The disastrous epidemic of Spanish influenza, fortunately now abating, has made it difficult for the already depleted forces of central-station companies to maintain service at the usual standard. Reports to the Electrical World from different sections of the country show a wide variation in the amount of sickness among employees and the consequent additional labor borne by those remaining on duty. In some places the number of employees affected was slight, while in others it was large.

In New York City the effect of the epidemic was less than in many of the smaller cities, and it was felt more in the outside forces than in the office organization. In the up-state cities of New York, however, the epidemic brought serious sickness to large numbers of the employees of companies, touching both executives and workers in the outside and inside organizations. Operating forces in companies in central New York were therefore greatly reduced. In one city it was stated that one-half of the outside organization was away on account of the sickness.

Effect in New England Central Stations

In New England the loss of life in central-station circles from influenza and its complications has been small, although the epidemic has been widespread and is still to be reckoned with in many communities. The operation of generating plants has been maintained in some cases with from one-quarter to one-third of the staff absent, and much devoted service has been rendered in these and other departments in order that the most important work might be kept going. So far as can be learned, not a single government plant, munitions establishment, power or lighting customer in New England has called in vain for the usual service as a result of the epidemic. The number of employees out in various companies at the time of influenza peak has differed widely, runing from 5 to 20 per cent of the total payroll in representative instances.

The Boston Edison company reports 610 cases to Oct. 19 among 2000 employees, the maximum number out at once being 216. On Tuesday last there were but sixty-nine out, none of whom was understood to be dangerously ill. Six employees lost their lives.

Out of the two largest Stone & Webster central stations in New England, one life was lost at Lowell, Mass., and none at Brockton, Mass. At Lowell the generating station was operated for about two weeks by two-thirds of the normal staff, and at Manchester, N. H., it became necessary to operate the plants on two twelve-hour daily shifts in place of the usual eight-hour shifts. Eight out of thirty-two generating-station employees at Brockton were out at the climax. On the Manchester system five employees, including railway department men, out of a total of about 260 persons on the payroll, died. At the maximum period about 20 per cent of the employees were on the sick list. At Cambridge, Mass., the maximum number out was twelve, out of 125 employees, with no lives lost.

The Worcester (Mass.) Electric Light Company, with 225 employees, lost one. About 5 per cent was the maximum number out, the generating plant being particularly hard hit. No employees in the electrical departments of the properties operated by C. H. Tenney & Company, Boston, lost their lives, and about 10 per cent represents the maximum number out. At Providence, R. I., about 5 per cent of the 450 employees of the Narragansett company were out at the maximum time, but all recovered. On the Cumberland County Light & Power Company's system, Portland, Me., all employees recovered after illness, the railway branch of this service being hardest hit. The epidemic was slower in reaching Connecticut, and while it has been prevalent there, the mortality in electrical circles appears to have been very low to date.

It is too early to secure accurate estimates of the loss of business due to the epidemic in New England. An analysis by the Electrical World of the energy consumption of ninety-three motion-picture houses in the Boston district which were closed for about two weeks indicates that not far from 150,000 kw.-hr. was not taken as the result of the ban on entertainments in these establishments. Saloons, churches, lecture halls, bowling alleys and other places included in the closure might easily bring this total to 250,000 kw.-hr. unsold in the fortnight ended Monday morning. In one day the load at Malden, Mass., fell off 800 kw. owing to factory closing, but this condition lasted only a few days. Probably 25,000 kw.-hr. was unsold because of the closing of motion-picture houses. At Worcester the loss of business appears to be not over 5 per cent for the past fortnight, and in Providence about 3 per cent. At the latter city the load dropped about 15 per cent last week compared with normal conditions. In general, factories have been kept running, though often with depleted personnel.

The worst appears to be over, and it looks as though by the first of next week northern New England would return to open conditions, as Boston did on Monday. Elsewhere in the Northeast such curtailments as remain are likely to be of comparatively short duration. Executives and employees have responded finely to the call of the emergency upon their personal reserve powers, and once more the industry has cause for pride in the maintenance of high-grade continuous service in the face of severe handicaps, which easily may have been accompanied by the production of half a million kilowatt-hours less per week in the New England States as the direct result of the epidemic.

Pacific Coast Conditions

The Pacific Gas & Electric Company, San Francisco, reports that so far as it is concerned there have been only a few cases of Spanish influenza, 5 per cent or less of the employees being affected. Thus far there has been only slight inconvenience in the operation of the electric system. The Sierra & San Francisco Power Company reports that approximately 15 per cent of the operating staff is affected, which leaves the organization pretty well crippled. Much difficulty is experienced in the reading of meters, getting district office work out and in operation of plants generally. The Great Western Power Company reports a very small percentage out as yet. It has had no trouble in operating.

A report from a representative of the Electrical World in Portland, Ore., says that doubtless October earnings of all central stations will show more or less falling off on account of the epidemic. The ban on all public meetings and special sales has reduced lighting income $600 to $700 daily in Portland. Street-car travel has dropped 16 per cent. Soldiers are forbidden to use street cars. The number of central-station absentees on account of sickness is negligible. Seattle reports practically no effect on operation of property there, except decrease of street-car travel. Preventive measures, not actual sickness, cause such losses as are noted.

Chicago Not Seriously Hampered

Influenza has not seriously hampered the organization of the Commonwealth Edison Company. Some of the employees have been very ill, and there have been days when the absentees reported in some departments were 100 per cent above the usual figure; but in comparison with other concerns in Chicago the central-station employees have not suffered in large numbers. The most difficult situation was created by the shortage of nurses. Individuals were unable to secure them. Realizing this fact and wishing to be of real assistance to its employees, the company secured the services of several nurses in addition to those on its regular staff. These girls went from house to house of the employees reporting influenza and rendered such expert aid as was possible. Their work helped many families get properly started in taking care of the sufferers. Accurate information on the exact percentage of absentees cannot be obtained until the monthly reports of department heads are made.

MUNICIPAL ELECTRICIANS IN MEETING AT ATLANTA

International Association of Municipal Electricians, at Its Twenty-third Annual Convention, Tenders Services to the Government

The twenty-third annual, or "win the war," convention of the International Association of Municipal Electricians, held at the Piedmont Hotel, Atlanta, Ga., on Sept. 24 to 27, developed many interesting papers and discussions.

The character of the papers read and the discussions that followed hinged to a considerable extent on conditions caused by the war or growing out of it. Fire prevention was one of the subjects that came in for a good deal of discussion, while the report of the municipal standardization committee, which was adopted, was regarded as a matter of great importance. Discussion of a paper on "A Code of Electrical Rules Covering Both Fire and Accident Prevention," by Dr. M. G. Lloyd of the Bureau of Standards, also constituted a prominent feature of the meeting. It was decided to hold the 1919 convention at Chicago, the date to be announced later.

A resolution adopted by the association tendered the services of its members to the federal government in whatever capacity they can be used to help win the war. In inviting conferences with government officials, the resolution recited the facilities for fire prevention and protection in the hands of the members in the various cities throughout the country, already well organized, that are available for federal organizations concerned in war activities. The resolution also declared that already in some municipalities the facilities of the electrical inspection departments have been placed at the disposal of federal authorities. The fact that federal representatives in some localities have apparently remained uninformed of facilities available prompted the adoption of the resolution, especially where attempts at ineffective duplication of facilities have been made or the utilization of such facilities has been neglected.

Recommendations of Executive Committee

Among the recommendations made in the annual report of the executive committee were the following: That a committee be formed to be known as the jurisprudence committee, that some plan be developed by which the exhibits may be made more interesting from an educational viewpoint, and that the association provide an exhibit consisting of samples of peculiar or chronic cases of electrical trouble experienced from time to time. Members should supply such samples, accompanied by a brief description of the cause, together with a remedy for it, and a place should be provided on the program for discussing the matter. The exhibit referred to would, of course, be in addition to the regular exhibits made every year by manufacturers and others.

The convention also went on record as being opposed to the use of unprotected knife switches and recommended enactment of the necessary legislation to compel the use of approved inclosed knife switches operated from outside of the box.

The report of the standardization committee on standards for municipal electrical departments aroused much interest and considerable discussion, especially as regards specifications for underground cable, which were adopted as standard by the convention for underground use in fire and police signal systems.

The attendance at the convention, while not so great as in former years, was better than had been expected owing to war conditions and was well distributed from all sections of the country, one delegate being present from Canada.

A paper that attracted much attention was that read by Washington Devereaux of Philadelphia, chief of the electrical department of the Philadelphia Fire Underwriters' Association, on "How the Municipal Electricians Can Help in Fire Prevention." In referring to the subject he said, "We need more education instead of legislation." He declared that grave responsibility rests on the city electricians and that fire prevention is the most vital question of the day, because on it will depend winning the war.

Dr. M. G. Lloyd of the Bureau of Standards, Washington, who described what was being accomplished in preparing a code of electrical rules covering both fire and accident prevention, said the federal government would render all aid in its power in effecting the installation of safety appliances, especially in plants engaged in war contracts. Safety standards would be insisted on in such plants. "It means new safety rules, and the owners of such plants will have to live up to them," he said.

ILLUMINATING ENGINEERING SOCIETY WORK IN THE WAR

Activities Range from Lighting and Signaling in Trench Warfare to Speeding Industries by Means of Good Lighting

The twelfth annual convention of the Illuminating Engineering Society, held Oct. 10 in New York City, brought out the fact that all members of the society are on the war service committee, and thus the entire technical knowledge and experience of the membership is made effectively available to the government. The program was decidedly of war color, dealing principally with illumination in the war zone and the speeding of production in our industries by good lighting. As expressing the unanimous opinion of the convention. the following telegram was dispatched to President Wilson:

"Resolved, That the Illuminating Engineering Society, in twelfth annual convention assembled this day in New York City, desires to extend to the President of the United States and all others in authority the assurance that in its organization and its membership it is in thorough accord with the fixed determination of the American people and their chosen representatives to prosecute the war with the utmost vigor and to a victorious conclusion."

Indicating some of the war problems undertaken by the society and summing up its activities during the past year, President G. H. Stickney said in part:

"In the trenches or on the sea light can be used to reveal the enemy and often to confuse him, and an advantage in these respects may turn the tide of battle. Further, light is an important means of signaling both by day and by night. In caring for and supplying an army effectiveness depends in a large degree upon light. If the movements near the front could be illuminated for the benefit of the traffic without revealing it to the enemy, there would be a remarkable gain. In transportation on land and sea, and in production at the workshop and mine, properly applied light is an essential factor."

GOOD LIGHTING ESSENTIAL IN WAR INDUSTRIES

In dealing further with illumination both for speeding output and for protection, Mr. Stickney said:

"In the past the government's interest in industrial lighting was principally concerned with the prevention of accident and conservation of eyesight. To-day it is imperative that each worker produce to the maximum and that many of them do so at times and in places where daylight is absent or insufficient. It is therefore nationally important that an effort be made to improve industrial lighting. The society and its members are leading in a movement for better industrial lighting. Our committee on lighting legislation has been doing much of the pioneer work. Let us accelerate it as much as possible.

"Protective lighting is still of unusual importance, and will be so long as there are among us murderous and desperate enemy sympathizers who are seeking secretly, under cover of darkness, to interfere with our manufacturing and other activities. A slight explosion at a vital part may temporarily stop a large industrial plant or transportation line. With our complex institutions protective lighting is likely to retain a certain importance, even after the war; now it is indispensable. The pamphlet on protective lighting prepared by our committee on war service and published by the War Department is one of our important contribution toward winning the war.

"In this connection we must remember that street lighting always has been in the past a protective measure, and while in recent years a small part of it has acquired certain ornamental and advertising features, street lighting as a whole is still protective lighting, and as such cannot be reduced or eliminated without accident and criminal hazard. By warning those in authority we may be instrumental in preventing disorder and even disaster."

Further, regarding fuel conservation, Mr. Stickney said: "At the request of the United States Fuel Administration, received through the National Committee on Gas and Electric Service, our committee on war service has been studying the possibilities of fuel conservation in connection with illumination. The elimination of extravagance and waste we could heartily subscribe to as tending to develop the art of lighting and put it on a more stable basis. We have looked upon the restriction of useful lighting, even for commercial or advertising purposes, as a destructive measure, containing possibilities of injury and injustice. However, when advised of the necessity, we have heartily coöperated, even to an extent which may pull down part of the structure of lighting practice of which we are so proud. But when we balance the lives of American soldiers against lighting comforts and refinements—as the Fuel Administration tells us we must—there is but one answer.

"We believe that no curtailment of useful industrial or protective lighting can be made without loss of production or danger to operatives. Reduction of useful commercial lighting will work some hardship and relatively small fuel saving. So that it seems apparent that the end sought is to utilize the psychological effect in securing economy in other fuel applications."

COMMITTEES REPORT PROGRESS

After listening to the president"s address reports of committees were taken up. F. E. Cady, chairman of the committee on progress, gave a summary of the work of the past year. It was stated that the use of carbon lamps in this country has increased in spite of the well-known superiority of more modern lamps. This was attributed to the policy of free renewal of carbon lamps only. Aside from the developments for use in connection with the war, one of the most important achievements of the year has been the successful application of the gas-filled lamp to motion-picture machines. A special camera is being made also for taking pictures at the rate of 500 per second.

In the absence of Dr. A. E. Kennelly, chairman of the committee on nomenclature and standards, the report was presented by Dr. C. H. Sharp. Regarding this report Dr. E. P. Hyde said that it showed far greater progress than had been made by any other country. As president of the United States national committee of the International Commission on Illumination, Dr. Hyde then made a statement for his committee, saying that preparations were under way for resuming this work, which was interrupted by the war. F. M. Hugo, Secretary of State of New York, then explained how the highways were being made "safe for democracy" through the coöperation of members of the I. E. S. He said that the number of automobile licenses in the state had risen from 173,000 to 465,000 within the last three years. The chief problems were to control the careless driver and to eliminate glaring headlights. Dr. Sharp, for the committee on automobile headlighting specifications, described photometric road tests and assured the membership that the roads would be well lighted and rid of glaring headlights.

Industrial Lighting Codes

In several states industrial lighting codes have been put into effect or are in preparation, namely, Pennsylvania, New Jersey, New York, Wisconsin and Ohio, according to L. B. Marks, chairman of the divisional lighting committee. Capt. Lloyd M. Scott explained that a liaison officer had been appointed by the general staff to keep it informed of war problems for which solutions were sought so that these might be turned over to the war committee of technical societies. The principal problems handled by the Illuminating Engineering Society had so far been connected with flares, floodlighting and improving searchlights. P. S. Millar then told of service performed by members of the society serving the Signal Corps of the Army and Navy Departments, the Bureau of Military Intelligence and the United States Fuel Administration. An appeal by T. C. Martin for support of the fourth Liberty loan ended the morning session.

Of the papers presented at the afternoon session those by W. A. Durgin, R. E. Simpson and the committee on war service will be abstracted or digested in future issues.

Included in the program was a blackboard talk on "Lighting of Cantonments" by Bassett Jones. Mr. Jones gave a résumé of observations made in traveling through navy camps in the East. He asked particularly that these be cured of the "drop-cord fever," indicating that there was a serious lack of general illumination in many places due to entire reliance on drop cords supporting cheap reflectors or "tin shades." He had even seen combinations of this sort in hospitals. In some places these conditions have been corrected.

Edmund Leigh, chief of plant protection, Bureau of Military Intelligence, gave an interesting talk, crediting the I. E. S. with great assistance in protecting important war industries from destructive agents. He said the essentials of plant protection consisted principally of good fences, good lighting and good watch service.

Patriotism Rife at War Supper

As master of ceremonies at the war supper D. McFarlan Moore interspersed patriotic songs with speeches by G. H. Stickney, retiring president; Dr. G. A. Hoadley, the new president; O. Monnett of the Fuel Administration and Lieutenant-Colonel Millikan, now of the National Research Council at Washington. Mr. Monnett made a very lucid and straightforward statement of the necessity for lighting curtailment and told of the enormous demands for fuel. Lieutenant-Colonel Millikan spoke on the subject "Research of America." He reminded the audience that the United States has so far had but a small part in the war and deprecated loose talk concerning our own achievements. In the matter of scientific development he said that our country is undoubtedly a second-class power and pointed to the honored position of the royal societies in England as an example for us. He forecasts the establishment of great research agencies in this country within the next two years, believing, as he does, that our position in the front rank of industrial nations after the war depends upon greatly stimulated research work.

ESSENTIAL INDUSTRIES FINANCE CORPORATION

Representatives of Westinghouse Electric & Manufacturing Company and General Electric Company Are on the Board of Directors

The newly formed Essential Industries Finance Corporation has completed organization in New York. Eugene V. R. Thayer, president Chase National Bank, was elected president. Gerhard M. Dahl, vice-president Chase National Bank, and Frederick Strauss of J. & W. Seligman & Company were elected vice-presidents. The directors include the officers and the following: E. B. Sweezy, First National Bank; Frederic W. Allen, Lee, Higginson & Company; Harold Stanley, Guaranty Trust Company; Thomas W. Lamont, J. P. Morgan & Company; Sidney Z. Mitchell, Electric Bond & Share Company; O. D. Young, General Electric Company; E. W. Clark, E. W. Clark & Company, Philadelphia; James N. Wallace, president Central Union Trust Company; John Hays Hammond, Randal Morgan, Guy E. Tripp, chairman Westinghouse Electric & Manufacturing Company, and Willard V. King, president Columbia Trust Company.

As stated in the Electrical World of Sept. 28, the corporation will aid in financing utilities and other essential industries. Its initial capital is $3,000,000, and that may be increased to $20,000,000.

An Echo of Gasolineless Sundays

Owners of electric and steam-driven automobiles were practically the sole occupants of Chicago's boulevards on the recent gasolineless Sundays. Public sentiment against Sunday driving was so strong that even some electric cars were stopped before the electric car dealers furnished their customers with signs like those shown in the photograph. Needless to state, the electric car business has improved wonderfully of late.

CHANGE IN DATE FOR THE CONFERENCE CLUB MEETING

Conditions Adverse to Gatherings at the Present Time Lead to Its Postponement to Nov. 21, 22 and 23

Owing to the difficulties encountered by all those attempting to hold meetings at this time, the executive committee of the Conference Club has decided to postpone the Pittsburgh meeting to Nov. 21, 22 and 23.

SUBSCRIPTION TO THE FOURTH LIBERTY LOAN

McGraw-Hill Company, Inc., Publisher of the "Electrical World," Subscribes for $1,035,000 for Itself, Officers and Employees

The McGraw-Hill Company, Inc., publisher of the Electrical World and the associated technical papers, subscribed, on behalf of the company, the officers and the employees, for $1,035,000 fourth Liberty loan bonds.

WAR SERVICE BULLETIN OF THE MANUFACTURERS

General War Service Committee of the Electrical Manufacturing Industry Issues Bulletin Giving Information to Manufacturers

No. 1 of a *News Bulletin* has been issued by the General War Service Committee of the Electrical Manufacturing Industry. It is issued for the information of every electrical manufacturer and contains data regarding rulings at Washington, etc. The committee calls attention to the fact that the information "may be of only temporary value because of rapidly changing conditions due to present circumstances."

WATER-POWER PLANTS AND LIGHTLESS NIGHT ORDER

Companies in New York State Are Asked by Fuel Administration to Observe Same Regulations as Coal-Consuming Systems

Two hundred lighting companies in New York State hitherto not included in "lightless night" orders, because they generated electricity from water power and not coal, were requested recently by the United States Fuel Administration to observe the same restrictions as the companies using coal. Claims of discrimination "by those communities served from steam plants which adjoined those served by water-power plants," as well as the effect of universal observance of this government order, were assigned by the Fuel Administration of New York State as reasons for asking the Empire State Gas and Electric Association to convey this request to the water-power plants of the state.

"We will convey to every one of the water-power plants in this state this official request," said C. H. B. Chapin, secretary of the Empire State association. "We have coöperated closely with every government rule to win the war thus far and shall continue to do so, in spite of the big burden that present conditions impose on every one of our members."

URGE THE CONSERVATION OF CONDENSER TUBES

Requirements of Navy and Emergency Fleet Corporation So Large that There Will Be at Best a Very Small Supply for Others

M. Greenberg of the electrical and power equipment section of the War Industries Board has addressed the following letter to George W. Elliott, secretary National Committee on Gas and Electric Service:

"1. As you are aware, the requirements of the navy and the emergency fleet for non-ferrous condenser tubes are so large that the indications are that there will be none, or at best a very small supply, of such tubes available for repairs on land condensers.

"2. May we not therefore suggest that you emphasize the seriousness of the situation to the members of your association and urge upon them the necessity of conserving their condenser tubes in every possible way?"

ABANDONS PLAN TO EXTEND THE DAYLIGHT-SAVING LAW

Senator Calder Withdraws His Measure Because of Opposition—Clocks to Be Turned Back One Hour on Oct. 27

Senator Calder has abandoned his bill to make the "daylight-saving" law operative throughout the year. It had been passed by the Senate, but not the House.

In accordance with the original law, clocks will be turned back again one hour on Oct. 27. The official change in time takes place at 2 a.m.

The Fuel Administration, in estimating the coal saving from operation of the law, says:

"It was shown that in one district the saving of coal was 17½ tons per 1000 population over the period of seven months. These figures were checked against records obtained from other places in widely separated districts having the same relative conditions, and from the mass of facts thus gathered the estimate of 1,250,000 tons of coal saved is determined."

The Daylight Saver

He has fooled himself
Since the first of April,
And he wants to continue
To fool himself
And others
Around the complete cycle
Of a year.
He offers us statistics
To show that
Many million tons of coal
Have been saved
And that many million more
Will be saved
If we are content
To arouse ourselves
During the darkling morning hours
Of the winter,
And to begin the day
Before the sun has risen.
But his mere claim proves nothing
And will be of no avail
Until he can show
Why artificial light in the morning
Is cheaper than in the evening.
—"E. F. E." in Boston *Transcript*.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Electric Club of Philadelphia.—On Oct. 17 the Electric Club of Philadelphia held a meeting to promote subscriptions to the fourth Liberty loan.

San Francisco Electrical Development League.—"Leadership in Russia" was the subject of an address by Prof. Alexander S. Kaun of the University of California given at the Oct. 9 meeting of the San Francisco Electrical Development League.

Northwest Electric Light and Power Association.—L. B. Faulkner of the Olympia Light & Power Company is unable to accept the presidency of the Northwest Electric Light and Power Association, to which he was recently elected. The place will be filled by another election in the near future.

N. E. L. A., New England Section-Massachusetts State Association of Contractors and Dealers.—Members of the New England Section of the N. E. L. A. and the Massachusetts State Association of Contractors and Dealers witnessed the United States War Department official "V. D." films called "Fit to Fight" at the Boston City Club on Oct. 24. President Emeritus Eliot of Harvard University occupied the chair, and Major A. N. Thomson and Dr. Russell B. Sprague were the chief speakers.

New York Jovian League.—One hundred and fifty members of the New York Jovian League, lunching at the Hotel McAlpin, raised $30,000 in support of the fourth Liberty loan in less than thirty minutes. Inspiring talks were given by Lieut. John Quinney of the Canadian Mounted Rifles, Theodore Beran, J. M. Wakeman, T. C. Martin and Congressman Caldwell of New York, who said that it would cost at least $100,000,000,000 to place an army of 5,000,000 men in France and keep it there until the Prussian menace is ended.

A. I. E. E., Toronto Section.—The Toronto Section of the American Institute of Electrical Engineers held an informal discussion on the subject of "The Grounded Neutral" at the Oct. 4 meeting. The discussion was participated in by a number of prominent engineers associated with the Hydro-Electric Power Commission, the Toronto Power Company and other organizations. The question of the amount of resistance, if any, in the grounded circuit was discussed in detail, as was also the effect of the various systems on telephone lines. The departure from the usual program of a formal address on some single subject proved to be a popular one.

Toledo Joint Company Section.—Employees of the Toledo Railways & Light Company and associated companies, representing gas, railway and electric lighting interests, opened the year's work with a minstrel show attended by more than 800 persons. This meeting not only served to attract employees to the section meetings for the coming winter but also to provide a social attraction designed to help keep men and women interested in and contented with their environment, thus reducing the labor turnover incident to war conditions. George E. Lafferty is secretary of the joint section.

Association of Electrical Contractors and Dealers of Oregon.—A meeting of the Oregon State Association of Electrical Contractors and Dealers was held in Portland on Sept. 20 and 21 at the Multnomah Hotel. Captain Conway, secretary of the British Columbia Association of Electrical Contractors and Dealers, gave a talk on the advantages of the association. Roy C. Kenny presided at the open meeting, at which B. W. Paul of Medford read a paper on "Proper Electrical Retail Merchandising," Charles H. Carey, local chairman of the War Industries Board, gave an outline of its activities, and George L. Oman, Northwest manager for the Pacific States Electric Company, and C. P. Scott, of the Scott Electric Company, read papers.

National Association of Stationary Engineers.—Considerable attention was given the subject of fuel conservation by the National Association of Stationary Engineers in convention at Cincinnati, Ohio, recently. Although observing the requests of the Federal Fuel Administration strictly, many factories really deprive themselves of material savings through imperfectly planned lighting systems and faulty arrangement of equipment, it was said. Henry Missistow, chief engineer of the Indiana Steel Company, Muncie, Ind., discussing this subject, said: "Unnecessary partitions are permitted to obstruct windows in many factories. Machines, workbenches and other contrivances which might be used to better advantage if rearranged are permitted to shut off light. By giving careful attention to shop plans and arrangements, by keeping windows in good repair and by keeping them clean much light, often wasted, may be saved. By placing artificial lights according to plans, instead of simply scattering them about the shop, they can be made much more useful, and many otherwise required might be eliminated without violation of the rules of safety" William Reynolds, Hoboken, N. J., speaking on "Efficiency in Officership," said that the officers of industries are more responsible than the workmen for the conservation of fuel. He urged that the heads of concerns inquire more closely into the manner in which foremen conduct their departments and discharge immediately those who are careless in the observation of the Fuel Administration's requests.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Increased Rates at Chester, Ill.—The Illinois Public Utilities Commission has authorized the Southern Illinois Light & Power Company to increase its rates temporarily in Chester, Ill. The commission in establishing rates found the value of the property to be $50,000, the operating revenue $20,000 and the operating expenses $15,325. The commission established depreciation at 4¼ per cent with an allowable return at 5½ per cent. The rates established for lighting range from 15 cents to 8 cents with a one-dollar minimum bill and for power from 7 cents to 3 cents with a one-dollar minimum bill.

Massachusetts Telephone Decision Affecting Hotels.—After Nov. 1 hotels are to be forbidden to resell telephone service at a profit, according to a decision of the Public Service Commission in the so-called Boston hotel rate case. The commission investigated the practice of charging 10 cents for pay-station calls in hotels instead of the standard local rate of 5 cents for the inner metropolitan district exchanges. The board concludes that hotels have no right under existing laws to retail telephone service at a profit and sets forth the opinion that the fundamental relationship between innkeepers and the public forbids the practice.

Extensions in War Time.—A decision of the Missouri Public Service Commission affecting rules and regulations governing extensions of electric service of the Empire District Electric Company says in part: "We believe the rule generally in force in pre-war times is the correct rule—that utilities should ultimately bear the cost of all extensions and that such cost should become part of the capital investment of such utility upon which the entire consuming public within the territory covered by the franchise and operations of such utility should pay rates for service sufficient to afford a reasonable return to such utility upon the capital actually invested therein. . . . It is more fair to distribute the burden among all consumers than to place it on the few who are so unfortunate as to require such service under present conditions. We know of no rule granting low rates or more favorable terms to consumers requiring extensions in times of abnormally low prices. No utility has been completely built with all its distribution plant at uniform prices. New consumers will be penalized by the requirement that they deposit a large portion of the cost of extensions, thus being placed in the position of being compulsory lenders of capital to the utility."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Commonwealth Edison Section, N. E. L. A., Ceases Activities.—For the duration of the war the activities of the Commonwealth Edison Section of the National Electric Light Association will be suspended. This decision was reached by the executive committee of the organization at a recent meeting. The present officers of the section, A. G. de Clercq, W. L. Sees, W. A. Fox and E. S. Butt, were appointed to serve another year on account of their familiarity with conditions surrounding the work of the section.

Popular Lecture on Protective Lighting.—The third of a series of popular lectures prepared under the auspices of the committee on popular lectures of the Illuminating Engineering Society is now ready for presentation. It is entitled "Protective Lighting" and treats of the use of light as a means of defense against damage to the industrial and military machinery of the country resulting from sabotage and acts of enemy agents in general. The treatment of the subject is popular throughout. The lecture is illustrated by thirty-four lantern slides and can be presented in an hour's time. It may be reserved for presentation upon application to the Illuminating Engineering Society, 29 West Thirty-ninth Street, New York.

Attendance at German Technical Schools.—According to the *Frankfürter Zeitung* of Aug. 27, in the eighth war semester—the summer of 1918—the eleven high technical schools of the empire had 2231 students on the rolls, as compared with 1721 in 1917 and about 12,000 at the outbreak of the war. The increase over 1917 is due chiefly to the return of students from the field, some of whom were furloughed to finish their studies, while others were invalided home. The school registers carry 10,145 names of students "on leave." Among the students in attendance were 183 women, most of whom are studying architecture or chemistry. The schools had, in addition, 916 men and 1246 women registered as "guests" (hospitants), so that the total number of persons in attendance was 4393, as against 13,000 to 14,000 in peace time. The school at Aix-la-Chapelle showed the greatest increase in the number of students, owing to a larger attendance of students from Luxembourg. Charlottenburg had 429 students in attendance, holding thus the first place, as it did in peace times. Then followed Munich, with 410 students; Dresden had 273; Aix-la-Chapelle, 253; Darmstadt, 174; Karlsruhe, 162; Hanover, 152; Danzig, 123; Stuttgart, 114; Brunswick, 75; Breslau, 66. Of the woman students Dresden had 32; Munich, 27; Darmstadt, 25; Charlottenburg, 24; Aix-la-Chapelle, 19; Karlsruhe, 14; Brunswick and Danzig, 12 each; Hanover, 6, and Breslau, 2.

More Than Three Thousand Commonwealth Edison Men Register.—Between the ages of eighteen and forty-six there are 3308 men who have registered among the employees of the Commonwealth Edison Company of Chicago. Of this number 712 are between eighteen and twenty-one years of age; 1226 are between twenty-one and thirty-one, and 1370 are between thirty-one and forty-six. The total registration includes all but 1250 of the company's employees. Of the 1250 employees 700 are women, the remainder are older men and boys under eighteen.

Serious Accident When Boys Crawl Through Fence 60 Ft. from Broken Wire.—One wire of a 13,200-volt, three-phase transmission line in Wisconsin broke not long ago and came in contact with a wire fence beneath the line. This fence was connected with another fence in the yard of a farmer. It had been raining shortly before the wire broke and three barefooted boys felt the current through their feet as they walked down the road. Two of them ran to the fence on the opposite side of the highway, and one boy in trying to crawl through the fence was instantly killed, while the other boy in trying to crawl under the lower wire was severely burned. The fence where the accident occurred had no connection with the fence which was in contact with the transmission line wire and was fully 60 ft. from it. The power plant is about three miles away. The boys were between the plant and the broken wire.

California Power Administrator Removes Lighting Restrictions.—H. G. Butler, Power Administrator of California, has sent out an announcement to power companies and municipalities in northern California removing all lighting restrictions, so far as the State Power Administration is concerned, beginning Oct. 14. The effect of this order will be that there will be five bright nights each week. Mr. Butler's order has been made possible by the rainfall in the mountains and the reservoir conditions, together with the great decrease in the use of water for irrigation. "It is barely possible," Mr. Butler stated, "that a condition might arise by which some restrictions may be necessary before the year is over, but I doubt very much if the order will be changed again. The operation of the order during the last three months has brought a wholesome result, and the timely rainfall has made me feel abundantly safe in the order just established." The federal order requiring two lightless nights a week—Mondays and Tuesdays—for the conservation of fuel is still in effect, however. Unless this order is changed these two nights will remain lightless.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Responsibility for Lineman's Gloves.—If an electric power company did not furnish gloves to its lineman, who was killed when he touched a highly charged wire, and the lineman used his own gloves, the power company is not responsible for their condition, the Supreme Court of North Carolina held in Clements versus Elizabeth City Electric Light & Power Company. (96 S.E. 652.)

Rate Discrimination.—Where rates charged by a telegraph company to some concerns are lower than the rate charged another concern, the lower rate constitutes discrimination only if the circumstances and conditions affecting the service rendered the latter are substantially similar to conditions affecting the service rendered the former, or if difference in rates is disproportionate to difference in conditions relating to the service, the Supreme Court of New York held (171 N. Y. S. 791).

Injury to Land.—In the absence of a requested modification, a charge that damages to land by the erection of a dam is the difference in value before and after the erection of the dam will not be deemed misleading because it failed to use the words "immediately before" according to the Supreme Court of South Carolina in Sullivan versus Sullivan Power Company (96 S. E. 405). A charge that the damages to land by the erection of the dam is the difference in value before and after the erection is not objectionable as allowing damages for loss of crops.

Remedy for Landlords for Damage by Backwater.—In condemnation proceedings by a power company which had constructed a dam that had been washed out and was constructing another dam of the same height, it was competent for a landowner to prove damage by backwater of the former dam to show what his compensation should be, there being no question of damage to crops or temporary damage, it was held by the Supreme Court of South Carolina in Lockhart Power Company versus Askew (96 S.E. 685). Where condemnation is provided for taking of land flooded by dam, that remedy is exclusive, and there can be but one assessment of compensation, which is conclusively presumed to include all damages to the owner of the land, past, present and future, by reason of the taking. In condemnation of land for a dam it was not error to show damage done by a former dam of the same height where the jury was instructed to exclude any element of damage arising out of past tort of trespass.

N. A. Perry, formerly manager of the Indianapolis Light & Heat Company, is now connected with the Air Craft Board at Washington, D. C.

W. D. RAY

William D. Ray, formerly vice-president and general manager of the Pennsylvania Utility Company, Easton, Pa., has been commissioned as a major in the Quartermaster Corps, Construction Division, War Department. Major Ray's work will be that of utility officer at one of the cantonments, where he will have charge of the lighting and other utility services. His experience in the electrical industry has extended over a number of years, beginning in 1887 as wireman and station attendant with the Cicero Water, Gas & Electric Light Company at Oak Park, Ill. In the following year he became electrician with the Chicago & Northern Pacific Railroad Company at Chicago, where he stayed for three years, when he became electric light inspector for the Chicago & Northwestern Railway. From there he went with the Standard Electric Company of Chicago in 1892 as assistant consulting electrician, and in 1893 he became connected with the electrical department of the Chicago World's Fair, remaining until the following year. At that time he became general manager and superintendent of the Everett (Wash.) Railway & Electric Company, resigning in 1897 to become sales engineer of the Lorain Steel Company's Chicago office in the sale of railway material. From 1898 to 1899 he was assistant electrical engineer of the Woods Motor Vehicle Company, from 1899 to 1900 general manager C. P. Magoon Air Brake Company, from 1900 to 1904 electrical engineer Detroit Construction Company, from 1904 to 1908 sales representative of the Westinghouse Traction Brake Company, from 1908 to 1910 contract agent electrical department of Sanitary District of Chicago, and from 1910 to 1915 vice-president and general manager for the Northern Indiana Electric Company. In 1915 he joined the gas and electric light utilities of Easton, Pa., as vice-president and general manager.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

Frank E. Watts, Eastern agent for a number of electrical manufacturers, past Jupiter of the Jovian Order and former Eastern manager for the Electrical World, is receiving the condolences of his many friends on the death on Monday of his wife from pneumonia following influenza.

M. L. Pomares has resigned from the department of water supply, gas and electricity of New York to become connected with the organization of William J. Shore, electrical contracting engineer of that city. Mr. Pomares, who will be assistant engineer to Mr. Shore, received his education in electrical engineering at Columbia University. He is a member of the executive committee of the National Association of Electrical Inspectors.

Obituary

Wallace B. Lindsay, head of the electrical engineerng department of Ingersoll, Rand & Company, died on Oct. 12, at his home in New York City, of pneumonia.

W. H. Fairclough, Sr., who was in the employ of the Commonwealth Edison Company of Chicago as general agent for thirty-three years, died at his home on Oct. 15 at the age of eighty-three years.

T. H. Bevan, who prior to enlisting in the Canadian Engineers in May, 1917, was superintendent of the meter department of the Central Power Company, Canton, Ohio, was recently killed in action on the western front in France.

Harry J. Pepper, general superintendent of the Urbana & Champaign Railway, Gas & Electric Company, Champaign, Ill., died on Oct. 17. For twenty-nine years he was associated with electrical interests in Champaign and Urbana, beginning with the Harris interests in 1889 and being retained by the McKinley interests when the Illinois Traction System, of which the local company was a part, was organized.

Leonard S. Cairns, general manager of the Eastern Pennsylvania Railways Company, which controls the Eastern Pennsylvania Light, Heat & Power Company, died of pneumonia on Oct. 10 at Pottsville, Pa. He was thirty-six years of age. Interment was at Minneapolis, Minn., his former home. For a number of years Mr. Cairns was general superintendent of the Twin City Rapid Transit Company of Minneapolis and St. Paul, Minn. In 1912 he resigned from the operating organization of that company to join the staff of the J. G. White Management Corporation, New York, and was assigned to the position of assistant general manager of the Manila (P. I.) Electric Railroad & Light Company. He was promoted by the management corporation in 1917 to the office of general manager of the Eastern Pennsylvania Railways Company, Pottsville.

Jonathan Camp, president and general manager of the Franklin Electric Manufacturing Company, manufacturer of the Franklin "Mazda" lamp, died at his home in Hartford, Conn., on Oct. 13, from pneumonia following an attack of Spanish influenza. Mr. Camp had been in the electrical industry for a good many years and his loss will be felt by the many friends he made. He was born in Norfolk, Va., on Jan. 10, 1874, and was educated at Williams College. He began his business career in the hardware field in Hartford, Conn., but later became interested in the electrical industry through the Perkins Electric Switch Company of Brdgeport, with which he was connected. A few years ago Mr. Camp and the late C. I. Hills purchased the lamp-manufacturing business of the Perkins company and formed the Franklin Electric Manufacturing Company, Mr. Hills acting as president and Mr. Camp as treasurer and general manager. After Mr. Hills' death Mr. Camp became president and held this office until his death. Mr. Camp was a member of the Hartford Club, the Hartford Golf Club, the Farmington Country Club and the Engineers' Club of New York.

MATHIAS KLEIN

Mathias Klein, founder of the well-known firm of tool manufacturers bearing his name, died on Sept. 28, at the age of ninety-two. In his decease the industry loses a pioneer in the development of tools for the lineman and electrical mechanic. Mr. Klein saw his idea grow from a humble beginning as a blacksmith shop in 1857 to one of the largest tool-manufacturing plants of its kind. Mr. Klein retired from business only three years ago, at which time he was succeeded by his sons.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

IRON CONDUIT STOCKS STEADILY GETTING SHORTER

Manufacturers Unable to Ship Except on Orders of Priority Rating A or Better—Few Jobbers Have Full Supply

Electric supply jobbers are beginning now to realize how serious the iron and steel situation really is. Particularly is this true when the supply of iron conduit is considered.

Producers of iron conduit, so far as can be learned, are not and have not for some time been shipping conduit to jobbers under their B-4 priority classification. All that a jobber can get is for orders of A rating or better. As to replacing stock utilized for shipments of A orders there appears to be a misunderstanding. Some manufacturers refuse to replace any stock, while other manufacturers are more liberal, taking the stand that stocks used for A rating shipments can be replaced provided it is pledged that they will be used to fill only those orders having an A or AA rating. Generally speaking, all of the manufacturers are living up to the pledges, but already there are unconfirmed rumors abroad that certain jobbers have been able to get conduit for stock.

Occasionally a jobber is found with a rather full supply of conduit, but this is very rare. In every industrial section it will be found that stocks of conduit are very low and becoming much shorter. Some houses already are out of material and within a very short time there will virtually be no available stock of conduit in the country.

Mills are working to capacity turning out pipe, but they are hardly able to meet the essential demand. A couple of weeks ago one producer was within ten days of shipping to jobbers for stock on their B-4 rating, but now this same concern cannot come within five weeks of making such shipments.

The production of pipe for oil lines is reducing the October output of standard pipe used for electrical purposes. The November output is expected to be still lower.

SUPPLY OF APPLIANCES HAS BECOME VERY SHORT

Already Some Manufacturers Are Beginning to Apportion Shipments to Their Customers on a Pro Rata Basis

Conditions in the electric appliance market have been fast approaching a critical stage for some weeks. Now the market is generally speaking quite bare. Here and there a few sizable stocks of flatirons, vacuum cleaners and washing machines can be found. The demand which accompanied the shortage of domestic help has grown to large proportions, and the manufacturers have not been able fully to meet it, let alone laying by a reserve stock to use for emergencies such as now exist.

In fact, orders placed as long ago as late last spring have not been filled, and now that the War Industries Board has pointed out the necessity for curtailment it is pretty certain that the trade will not receive all of the appliances ordered. In fact, some manufacturers are already allowing their customers only a prorated supply.

The principal shortages occur in 6-lb. flatirons, heaters, vacuum cleaners and washing machines. The supply of toasters, it is understood, is better than of these other articles. Flatirons have been short for some time. Four weeks ago it was impossible in the East to get a large immediate shipment of one of the more popular makes. About the same time one of the large producers had to call upon an Eastern jobber, who it so happened had anticipated conditions and stocked up heavily, to help him out of a serious predicament by releasing to him some of his stock.

The supply of heaters was very moderately fair at the end of the summer. At the first signs of cold weather these stocks were quckly cleaned out, and now heaters are very scarce. The landlords in the large cities have withheld heat much longer than normally, and with the influenza epidemic the demand for heaters was consequently greatly increased.

Vacuum-cleaner and washing-machine stocks are not so much shorter than they have been, nor will the curtailment orders of the War Industries Board make the situation any better.

PREPARATIONS MADE FOR COMING EXPORT TRADE

Combination of Small Electrical Companies Making Each a Separate Line Is Urged in England

Combinations for export trade are no new idea. German interests know how well this plan has succeeded, and English manufacturers have taken certain steps in this direction. Only recently it was proposed by the president of the British Institution of Electrical Engineers that the small firms, each making a different line of goods, should so unite.

Essentially the Webb bill was drawn up for this very purpose. Small manufacturers could not afford to develop foreign markets. They could not individually stand the sales expense nor the expense of collecting the account. On the other hand, a manufacturer of wire—say—another of lamps, one of motors, one of wiring supplies, etc., until a fairly complete line should be represented, could put a selling organization in the foreign field and by dividing the expenses make it possible for each to share in the export trade.

So far as is known, however, no such combination has developed in the electrical industry. Many small manufacturers, it is known, are anxious to sell abroad as soon as the war is over. They, of course, may do so through export houses, but in such cases business is taken as it comes and not developed for any particular domestic manufacturer.

With peace proposals being received from our enemies, it becomes apparent that this war is not going to drag on indefinitely, but that a victorious peace is not so far distant that the American manufacturer can longer postpone making definite preparations for stimulating export trade. Some things, of course, are being done, but for the most part they are being done very secretly for fear that American competitors will find them out. New electrical devices are being produced for the South American trade, but they are shown only in the greatest secrecy. However, there is apparently by no means so much interest in the development of foreign trade being taken in the United States as there in Europe. The signing of peace may find this country as unprepared for the world's trade as it was for the world's war.

EFFECT OF STILL FURTHER BUILDING CURTAILMENT

Latest War Board Ruling Should Lessen Demand on Stocks Already Low, but Will Prove Unfortunate to Contracting Interests

That no theaters, schools, hotels, hospitals or churches may be built in New York City during the war is the latest order from the War Industries Board affecting building. Furthermore, operations on buildings partly completed must cease at once unless they are so nearly completed that only the finishing material is needed. In such case they may continue if a permit is obtained. Pending further action of the War Industries Board, the manufacturers and distributers of and dealers in building materials may continue to furnish such materials to buildings substantially completed and to builders who have materials on the ground of operation.

Coming close after the recent non-war-building order of the War Industries Board, this ruling reduces building almost to the irreducible minimum. The electrical industry will be affected in some ways favorably and in others perhaps disastrously. It will mean another reduction of demand on jobbers' stocks for certain items that are already very low. This is particularly true in the case of conduit and wire.

Contractors and fixture dealers will probably feel this latest ruling most acutely. The former have for some time had but little to do, and now this little is lessened. The latter will not be so hard hit as if this action had occurred a year ago. The several housing projects and the business of fitting out new merchant ships have proved a great boon to this trade.

METAL MARKET SITUATION

Exports of Brass and Copper Decrease—Further Reduction in the Price of Tin

Business last week continued quiet, but there is evidence that, in spite of the heavy demand for war purposes at home and abroad, the output of copper will be sufficient to meet all essential requirements. There is every prospect that the output of both refined and crude copper this year will break all records. Nothing has happened to indicate that there will be any important change in the price of copper for shipment after Nov. 1.

Tin has been reduced in the London market again to £334 for standard prompt and future, and £334 10s. for Straits.

Some importers have received notice that the applications for permits which they had made and which they confidently expected to be granted promptly for a large quantity of tin for October and November shipments have been refused. This is chiefly for Straits tin for shipment from Singapore.

NEW YORK METAL MARKET PRICES

	Oct. 15	Oct 22
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26 00
Casting	Govt. price 26 00	Govt. price 26.00
Wire base	28.75	28 75
Lead, trust price	8.05	8 05
Antimony	13 62½	13.37½
Nickel, ingot	40.00	40 00
Sheet zinc, f.o.b. smelter	15.00	15.00
Spelter, spot	9 00	9.20
Tin, Chinese *	No quotations	No quotations
Aluminum, 98 to 99 per cent	Govt. price †33.10	Govt. price †33 10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	23 50 to 24.00	23.00 to 23.50
Brass, heavy	14 00 to 14.25	13.50 to 14.00
Brass, light	11 50 to 12.00	11 00 to 11 25
Lead, heavy	7 50 to 8.00	7.50 to 7.75
Zinc, old scrap	6.00 to 6.25	6.00 to 6.25

* No Straits offering. † In 50-ton lots or more; carload, 33 10 cents per lb. 0-ton to 14-ton lots, 33 20 cents per lb

THE WEEK IN TRADE

SHORTAGES in stocks, particularly in conduit, small wire and domestic appliances, seem to be prevalent everywhere. Demand, however, has apparently showed no let-up. Suppliers, of course, are not able to handle all of the business that comes to them—some of it is not essential, some essential but not sufficiently so, and in other cases there is no stock. The latter is especially true with flatirons and radiators. Prices continue to show almost no changes. This condition has been going on now for four or five weeks.

Influenza is exacting its toll from the industry throughout the country in lives and loss of time and of production. In the East the epidemic is pretty well checked.

NEW YORK

No slackening of business was noticeable last week, although the latter part of it was almost wholly given up by business men to putting the Liberty loan through.

On Oct. 17 the Priorities Division of the War Industries Board announced the curtailment of production of electric fans to 40 per cent of 1917 and of electric vacuum cleaners to 75 per cent of six months of the 1917 output.

The situation in domestic appliances is still abnormal. The local market is virtually bare of stocks, and already there are indications of a prorated supply in the future, the most optimistic report being that not more than 70 per cent of the orders on hand could be filled.

According to the latest reports the influenza epidemic seems to have reached its height in the East and is now decreasing.

On Oct. 19 the War Industries Board announced that all new construction in building must stop until after the war. No theater, school, hotel, hospital or church will be allowed to be built in New York during the war or until further notice from the board. Operations on buildings partly completed must cease at once, but those structures so near completion that only finishing material is needed may continue, provided a permit is obtained. In addition, operations on buildings substantially completed and with builders who have materials on the ground may continue.

INSULATORS.—The demand for high-tension insulators has been good, and manufacturers' supplies on hand are in fair volume. Shipments are prompt. Low-tension glass-insulator stocks, owing to the general shortage of glass, are fairly low, but shipments are still going forward on time. Prices have not changed in the last two months.

MOTORS.—Motors of all types, both large and small, are in great demand and stocks on hand are low. The Emerson Electric Manufacturing Company on Oct. 5 advanced prices slightly more than 10 per cent on all types of motors 2 hp. and smaller, including motor applications, such as blowers, lathes and exhausters. Motor-generator sets were not advanced.

RADIATORS.—The shortage of stocks with all manufacturers of heating appliances is very acute, and the market is bare of supplies on hand. Orders on hand are very large, and one of the largest manufacturers has been obliged to supply his customers pro rata. Prices to date have not changed.

WIRE AND CABLE.—The requirements of the government for rubber-covered wire have increased so rapidly in volume that the manufacturers are rushed to capacity. At present there is an acute shortage in the market of all sizes under No. 6. Double-braid solid and stranded wires in gages No. 8 and smaller, as soon as the small stocks on hand are exhausted, cannot be furnished except with a single-braid protection. The same situation applies to twin and duplex wires in solid and stranded form. One of the largest manufacturers will advance prices about 6 per cent this month.

VACUUM CLEANERS.—The popular demand for vacuum cleaners is still far ahead of the supplies on hand. One large manufacturer reports that he has 33⅓ per cent more orders on his books than he can fill and deliveries cannot be made until January. Prices have not changed.

CONDUIT.—The situation in this market remains the same. Steel mills are rolling pipe of all sizes to the limits of their capacity, but very little of it finds its way into the local market. Stocks on hand are spotty and getting shorter, and all shipments are confined to Class A and AA priority.

LAMPS.—Although the demand for lamps has been phenomenal, it is still increasing and makers are rushed to capacity to fill their orders. Supplies on hand are fair.

METERS.—One large manufacturer reports that foreign demand is brisk and increasing. Japan and China are large buyers. Prices in this line advanced about 10 per cent on Oct. 6.

TRANSFORMERS.—The demand still continues brisk with no accumulation of stocks on hand. Prices remain unchanged. One of the largest manufacturers has virtually discontinued making toy transformers, the reason given being that the demand had greatly decreased.

CHRISTMAS-TREE OUTFITS.—Manufacturers are reported to be loaded up with stocks. As yet no appreciable demand for them has developed.

CHICAGO

As far as activity in demand is concerned every week is a good week now. The situation has simmered down to one which is clearly understood as a struggle for material to supply the demand. The jobbers appear to be getting just about enough stock to get their customers by.

The big features of the week of course have been the Liberty loan and the talk about an early peace. Apparently the urgent necessity of closing up the Liberty loan successfully last week occupied the time of the entire trade. The talk of an early peace has had no effect on business as yet.

News of large industrial activities related to the war continues to come in. A commission of army officers has been sent to Chicago by the Secretary of War to investigate and report on a hospital project in Maywood, a suburb of Chicago. A contract involving $700,000 to $800,000 for the construction of 100 industrial houses for employees of the Corn Products Refining Company has been let to O. F. Giesecke & Company, Eastern contractors. The Wells Brothers Construction Company has the general contract for building 174 industrial homes in Hammond, Ind., at a cost of around $600,000 for employees of the Standard Steel Car Company. Rumors concerning the location in Chicago of additional aircraft work continue to be heard frequently.

The labor situation seems to be entering a new phase. The wage earners appear to be more quiet. Salaried employees, on the other hand, are showing evidence of a restless state which was not in evidence when the lower-priced labor was most active in its disturbances. The only class of men who seem to be in supply are men who were formerly devoting their entire effort to specialty sales. Curtailment of production along this line has driven them to market their services elsewhere.

Retailers report that the appliance trade in Chicago is all that could be expected. Jobbers report that there have at times been as many as 10 per cent of their employees away from work on account of the influenza epidemic. The peak of the epidemic appears to have passed, however.

ELECTRIC RADIATORS.—Jobbers report that there are no electric radiators to be had for immediate shipment out of their stock. They have on file back orders for several hundred radiators and are receiving radiators from the factories in lots of fifty at a time. This situation does not indicate any immediate opportunity for catching up. Relief is expected, however, owing to the fact that certain new lines of radiators were expected to come into the market on Oct. 15. The supplies have not yet been received from these manufacturers.

ELECTRIC RANGES.—Some electric range salesmen have been taken off the road temporarily.

SCHEDULE MATERIAL.—Jobbers' stocks are extremely heavy, having been built up to a war-tme basis. This is one line from which the jobbers would expect to suffer if an early peace were declared.

MOTORS.—The Emerson Electric Manufacturing Company of St. Louis has announced that on Oct. 5 prices advanced on all types of Emerson motors of sizes 2 hp. and smaller. No advance was made in the existing prices of motor-generator sets.

BOSTON

The volume of business is still somewhat below that of last month, though sufficient to keep everybody active. Many unfilled orders are still in jobbers' current files. Appliance sales show some falling off on account of government restrictions of output. A temporary lull in war business inquiries is on. Collections are a little slow, due probably to absorption in the Liberty loan campaign and to curtailment of electrical forces from the influenza epidemic. Business conditions are assuming a more normal aspect this week in this district, with the reopening of theaters, soda fountains, bowling alleys, schools and many other establishments temporarily closed. The feeling is widespread that fundamental conditions in the electrical trade are sound, with a promising outlook for business in the reconstruction era. Stocks are being maintained with considerable difficulty, and in some lines jobbers are about exhausted. Prices are about the same, with upward tendencies here and there.

RADIATORS.—Jobbers' stocks are practically "shot to pieces," with the market extraordinary. Retailers are not yet entirely sold out, but their stocks are running low. Innumerable householders are buying electric radiators in preference to starting furnace fires at the usual time.

LUNDIN FAULT LOCATERS.—Sales are good, and recent orders include sets for the Watertown Arsenal, Victory shipbuilding plant at Squantum and Hog Island shipyard. The demand is based upon service records, especially in connection with the cutting down of interruptions due to line and cable troubles and maintenance of production in munitions and other war plants. Inquiries are being received from foreign countries as well as domestic sources. At present immediate shipments can be made from stock. Recently a price advance of $25 was established on these sets, making the present price $400.

WIRE AND CABLE.—New England is still very short of No. 14 wire. Rubber-covered wire is quoted on a 34-cent base. There is some accumulation of local stocks of larger-sized wire at present. House-wiring work is very quiet.

STORAGE BATTERIES.—All types are running short, though here and there an exceptional stock can be found. Prices are steady. Government and transportation requirements dominate the field.

DRY CELLS.—Stocks continue low, with no immediate prospect of better conditions. No price changes are noted.

METALLIC FLEXIBLE CONDUIT.—The market is unsettled and some complaint is heard that manufacturers are not holding the jobbers' prices.

STARTING AND LIGHTING SETS.—Stocks of repair parts are running low. In some cases only about 20 per cent of the requirements are being shipped in at any one time. The curtailment of new pleasure-car building for next year will cut down this business materially.

MOTORS.—Stocks are increasing, certainly up to 50-hp. or 75-hp. rating.

LAMPS.—Better stocks are reported with steady prices and a stronger demand.

ATLANTA

Jobbers report a continued heavy demand for all classes of electrcal material and supplies, which they are endeavoring to take care of from available stocks. The call for equipment from shipyards and military camps dominates the market, however, and comparatively little material is finding its way to ordinary commercial channels. A large volume of business is beng transacted in schedule material mostly for government account.

The recent ruling of the War Industries Board curtailing the manufacture of heating devices will, no doubt, affect retail sales to some extent, but the shipment on electrical devices has been so poor of late that there will be little difficulty in absorbing the new edict. The scarcity of workmen is still pronounced. This holds true at shipyards and the picric-acid plant at Brunswick, Ga.

The protracted drought over the Southeast is becoming more serious every day, and the power companies have inaugurated further curtailment of electrical energy. In order that the curtailment of all illumination may be uniform, the local fuel administrator's rulings apply to all classes of illuminants, such as electricity, gas, oil, and candles. The Georgia Railroad Commission has received several new applications for rate increases, includng one from Rome, Ga.

The deficiency appropriation bill reported to the Lower House contains an item covering about $1,000,000 for extensions to the Federal Prison, Atlanta, Ga. Additional government construction is contemplated at Pensacola, Fla., for barracks; at Fort McPherson, Atlanta, for hospitals; at New Orleans, for office building, yard and docks, and at Charleston, S. C., for 400 dwellings to accommodate navy yard employees.

HEATERS.—There is a good market for all available stocks. The headlight type is very popular and shipments so far have been good.

AUTOMOBILE ACCESSORIES.—The demand exceeds any visible supply. This equipment is hard to get. Spot lights are going fast; 36-cp. miniature lamps are not obtainable.

RECTIFIERS.—Jobbers are getting rid of these as fast as they come in. Shipments are not so good

FLATIRONS.—Outlying districts report that stocks are low and it is almost impossible to replace them in certain lines. One manufacturer, however, seems to have no difficulty in supplying his customers.

SEATTLE—PORTLAND

Business in the two largest Northwest cities continues very active, with nothing especially big in the way of sales noted. The volume to shipyards and allied industrials engaged solely in essential war work showed a slight increase over the past two weeks. However, this did not cause comment as volume necessarily fluctuates more or less as orders for ships are placed and as construction of vessels on the ways progresses. Retailers report sales volumes a shade heavier on domestic appliance lines.

The approach of winter is speeding up the sale of socket devices, heaters, reading lamps, shades, etc. Washing machines as usual are leading in sales. Movement in washing machines, however, has been retarded on account of short stocks and slow deliveries. The demand for house-wiring devices is unprecedented in the history of the Northwest. Lamp supplies in smaller sizes are in fair shape, but the shortage in the larger sizes, particularly in the Seattle district, has never been overcome. Demand for larger sizes comes from shipyards and industrial plants, and they have resorted to substitution when demands could not be met. The shortage in rubber-covered wire, motors and conduit is acute, but no worse than heretofore reported.

Portland territory reports about the normal run of orders for the past week. There were no marked fluctuations in movement of merchandise in any particular line. Electric welding is gaining very rapidly in popularity, and within the last few weeks several welding outfits have been ordered and installed. The popularity of electric welding over gas welding is due partly to scarcity of oxygen and acetylene gases and also to the superiority of the electric process for many kinds of work.

The Dominion government has awarded British Columbia shipyards contracts for ten steel ships valued at approximately $20,000,000. J. Coughlan & Son, Vancouver, will build four; the Wallace Shipyards, Vancouver, four, and the Victoria Machinery Company, Victoria, two. Orders for 100,000,000 ft. of lumber for military car material for the United States government to be distributed immediately among fir manufacturers of Oregon and Washington have been received. Seven thousand men are needed at once in Seattle's war industries, and 14,000 will be required before Dec. 1.

SAN FRANCISCO

The feature of the past week has been the number of power projects either projected or in course of construction that have been actively called to the trade's attention. These comprise several tying-in systems that will bring power from Oregon to San Francisco Bay, besides the building of certain dams and the raising of others on the systems of the Pacific Gas & Electric Company, the Great Western and the Sierra & San Francisco Power Companies. The lightless nights order for California has been curtailed from five to two. Gold dredgers are again operating after sixty days' restrictions.

The Vallejo Electric Power Company will extensively enlarge its plant to take care of the industries around Mare Island. Besides the increased industrial housing, unconditional work is being performed on the concrete shipbuilding plant in Oakland. On the other hand, it is reported that the Liberty Shipbuilding Company operations in the same locality have been discontinued and that the Parr-McCormack company's activities will extend to the repair of ships instead of building them.

Contractors' business is reported light. Orders are in small quantities on account of the patriotic pledges signed by the contractors, but a great increase in the sale of devices is noticed.

SCHEDULE MATERIAL.—Coast jobbers are now refusng to sell standard items such as push switches, ½-in. cap sockets and No. 14 rubber-covered wire in smaller than carton or coil lots.

RADIATORS.—With several makes in the market and the government recommending such devices for saving coal, a good season is assured. All companies are away behind on their orders. A local producer is requiring at least two months for completion of jobbers' stock orders, and the Eastern factories are having similar trouble.

MOTORS.—Unexpected early rains have killed most of the projects requiring motors from 100 hp. to 250 hp. for irrigation. Several sales of 250-hp. motors to the shipbuilding yards are reported for their fire pumps. The deliveries of smaller motors are a little better, but as essential permits are required a great deal of business is going to motor-repair plants.

HEATING DEVICES.—The flatiron market is quiet because of big stock orders placed by dealers prior to the recent advance. Few ranges are being sold. Prior to the recent influenza quarantine orders some big spare unit orders were placed by government yards and plants that expected to be subjected to quarantine regulations.

SWITCHES.—The number of externally operated steel-clad switches sold in the Pacific Coast district is estimated to have tripled during the past two years. This is mainly due to state rules, although the state rules require in addition to external operation the factor of a no-voltage-release to insure safety in operating machinery. State inspection has not yet been rigid. New switchboards for industrial factories present a very novel appearance owing to the new style of switches.

PORCELAIN MATERIAL.—Three hundred and fifty industrial cottages at Bay Point will be wired throughout with knobs and tubes.

FARM-LIGHTING PLANTS.—These are being actively solicited, and salesmen report awakened interest.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61 00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106 00
No. 6 solid	145 00
No. 10 stranded	95 00
No. 8 stranded	115 00
No. 6 stranded	160 00
No. 4 stranded	205 00
No. 2 stranded	266 00
No. 1 stranded	315 00

Twin-Conductor

No. 14 solid	104 00
No. 12 solid	135 00
No. 10 solid	185.00
No. 8 stranded	235 00
No. 6 stranded	370 00
No. 4 stranded	575 00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	6%-10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	6%-10%

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	6%-10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	6%-10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20% to $73 20
Coil to 1000 ft	List

	No. 12 Solid
Less than coil	+20% to $85.20
Coil to 1000 ft	List

Twin-Conductor

	No. 14 Solid
Less than coil	$115 00
Coil to 1000 ft	100.00

	No. 12 Solid
Less than coil	+20% to $162 00
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0.22 to $0 30 each.
Standard packages from 100 to 250

DISCOUNT—NEW YORK

Less than 1/5 std pkg	+20%
1/5 to std. pkg	List
Std. pkg	15%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to 12%
1/5 to std. pkg	+5% to 20%
Std. pkg	18% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 45—$0 46	$0 45—$0 47
2 to 50	40	40—41
50 to barrel	.35—36	36—37
Barrel lots	32—329	33—329

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40 to $0 45	$0 40 to $0 45
12 to 50	.35 to 39	35 to 39
50 to barrel	.319 to .362	329 to 382
Barrel lots	.289 to .332	.299 to .342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13 00
1	50	21 00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45 00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75 00	$63.75—69 75
3/8-in. double strip	75 00—82 50	72.00—75 00
1/2-in. single strip	100.00	85 00—93.00
1/2-in. double strip	100 00—110.00	96 00—100 00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75 00	$63.75 to $64 25
3/8-in. double strip	78 25 to $90 00	71.25 to 75 00
1/2-in. single strip	100.00	75 00 to 85 00
1/2-in. double strip	105.00 to 120 00	93.00 to 100.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0 05½	1	$0 25
1/4	06	1¼	33
3/8	09	1½	40
1/2	12	1¾	47
5/8	15	2	55
3/4	18	2½	65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$25 00–51 70	$24 00–35.20	$23.00–30 25
1/4-in.—	30 00–56 40	28 00–38.40	26 00–33.00

NET PER 1000 FT—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$44 00–60 00	$30 00–33 00	$26 50–29 15
1/4-in.—	48 00–65.00	33 50–37 50	29 00–31.80

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
1/4	$0 08½
3/8	08½
1/2	08½
3/4	11½
1	17
1¼	23
1½	27½
2	37½
2½	58½
3	76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
1/4	$0.05	$0.19
3/8	06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1.10
2½	.40	1 80
3	.60	4 80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	7% to 7.1%	9% to 9 1%
2500 to 5000 lb.	10% to 10.1%	12% to 12 1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 to 1/2 In.	3/4 to 3 In.
Less than 2500 lb.	+3.5% to 5.5%	+1.5% to 3.5%
2500 to 5000 lb.	+2.5% to +5%	+5% to 1 5%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$6 00 to $7.00
Discount	20% to 30%

CHICAGO

List price	$6.00 to $7 00
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp	100	$0 25
35-amp. to 60-amp	100	.35
65-amp. to 100-amp	50	.90
110-amp. to 200-amp	25	2 00
225-amp. to 400-amp	25	3 60
450-amp. to 600-amp	10	5 50
600-Volt		
3-amp. to 30-amp	100	$0.40
35-amp. to 60-amp	100	60
65-amp. to 100-amp	50	1 50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5 50
450-amp. to 600-amp	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std pkg	30%
1/5 to std pkg	41% to 45%

DISCOUNT—CHICAGO

Less than 1/5 std pkg	30% to 31%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6.00 to $9 30
1/5 to std. pkg.	5.25 to 7 00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std pkg	$8 00
1/5 to std. pkg	7 00

Standard packages, 500. List, each, $0.07

LAMPS, MAZDA OR TUNGSTEN

110 *to* 125 *Volts*

Regular, Clear:	Std Pkg.	List, Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	70
100-watt—C	24	1 10
200-watt—C	24	2 20
300-watt—C	24	3.25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25	50	.60
25-watt—G 25	50	60
40-watt—G 25	50	60
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4⅜-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30 47—$40 77
Coil to 1000 ft	27 42— 30 22

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$38 00
Coil to 1000 ft	28 00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24 00

CHICAGO

Net per 100	$21 75 to $30 00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30 00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S	30 00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20 00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%	20%
$10.00 to $50.00 list	36%	31%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20%	10%
$10.00 to $50.00 list	30%	20%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	5%
1/5 to std. pkg	15%
Std. pkg	25%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$21 00 to $34 00
1/5 to std. pkg	17 85 to 28 90

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$16.80–24 15
1/5 to std. pkg	15 80–21 00

Standard package, 2200. List per 1000, $20.00–21 00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500 5½ N C.—Solid Nail-it	Std. Pkg. 4000 N C.
Less than 1/5 std. pkg	$16 00 to $22 00	$32 00
1/5 to std. pkg	13.60 to 18 70	27 20

CHICAGO

Per 1000 Net.	Std Pkg. 3500. 5½ N C.—Solid Nail-it	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg	$11.70–$24 00	$33 85–$36 80
1/5 to std. pkg	10.15– 20 00	26 60 32 00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0 33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List
1/5 std. pkg	10%

SWITCHES, KNIFE

250-*Volt, Front Connections, No Fuse*

High Grade:	
30-amp. S. P. S. T	$0 80
60-amp. S. P. S. T	1 20
100-amp. S. P. S. T	2.25
200-amp. S. P. S. T	3 48
300-amp. S. P. S. T	5 34
30-amp. D. P. S. T	1 20
60-amp. D. P. S. T	1 78
100-amp. D. P. S. T	3 38
200-amp. D. P. S. T	5 20
300-amp. D. P. S. T	8 00
30-amp. 3 P. S. T	1 80
60-amp. 3 P. S. T	2 68
100-amp. 3 P. S. T	5 08
200-amp. 3 P. S. T	7 80
300-amp. 3 P. S. T	12 00
Low Grade:	
30-amp. S. P. S. T	$0.42
60-amp. S. P. S. T	74
100-amp. S. P. S. T	1 50
200-amp. S. P. S. T	2 70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T	1 22
100-amp. D. P. S. T	2 50
200-amp. D. P. S. T	4 50
30-amp. 3 P. S. T	1 02
60-amp. 3 P. S. T	1 84
100-amp. 3 P. S. T	3 76
200-amp. 3 P. S. T	6 76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15% to +10%
$10 to $25 list	2% to 5%
$25 to $50 list	5% to 10%
	Low Grade
Less than $10 list	+5% to list
$10 to $25 list	8% to 15%
$15 to $50 list	15% to 20%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 15%
$10 to $25 list	List to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15% to 16%

SWITCHES, SNAP AND FLUSH

5-*Amp. and* 10-*Amp.,* 125-*Volt Snap Switches*

	Std. Pkg.	List
5-amp single-pole	250	$0 28
5-amp. single-pole, ind.	250	32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	54
5-amp. three-point	100	54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P	100	66

10-*Amp.,* 250-*Volt Push-Button Switches*

	Std Pkg.	List
10-amp single-pole	100	$0 45
10-amp. three-way	50	.70
10-amp. double-pole	50	70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to 10%
1/5 to std. pkg	+5% to 16⅔%
Std. pkg.	18% to 25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0 34
No. 160	60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 30%	Net to 30%
$2.00 to $10 00 list.	10% to 35%	5% to 40%
$10.00 to $50.00 list.	20% to 37%	10% to 52%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2 00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 50%

TOASTERS, UPRIGHT

NEW YORK

List price	$6 00 to 6 50
Discount	20% to 30%

CHICAGO

List price	$6 00 to $6 50
Discount	20% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.51–$0 66
No. 18, full spools	.49– .56

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0 65 to $0 72
No 18, full spools	.55 to .605

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$20.00 $25 00	$15 00–$17 00	$15 00
12	23.58– 27 09	21 62– 29 09	$17 68– 23 22
10	30 20– 37 80	27 45– 32 40	23 47– 32 40
8	42 74– 53 34	38 85– 45 72	33.21– 45 72
6	61 50– 84 42	55 35– 72 36	52 58– 55 48

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$25 00	$18 00	$15.50
12	$29 46– 31 44	$29 46– 31 44	$25 54– 31 44
10	41 10– 43 84	41 10– 43.84	34 62– 38 36
8	57 00– 61 76	57 90– 61 76	50 18– 54 04
6	85 31– 97 68	85 31– 85 47	72 21– 85 47

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 *to* 3 *Inc.*

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$39 75 to $44.00
25 to 50 lb	39 75 to 42.00
50 to 100 lb	38 75 to 40 00

CHICAGO

	Per 100 Lb. Net
Less than 25 lb	$41 00 to $41 76
25 to 50 lb	39 75 to 40 76
50 to 100 lb	38 75 to 39 76

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Stove with Exchangeable Heating Unit

Ease and quickness in repairing are facilitated by the readily exchangeable heating unit featured in the No. 103 stove recently brought out by the Redtop Electric Company. 8 West Nineteenth Street, New York City. It is pointed out by the manufacturer that where stoves are used on farms and homes distant from electric repair shops the exchangeable heating unit makes it possible for the user himself to do the repairing.

EXCHANGEABLE HEATING ELEMENT FACILITATES REPAIRS

The stove is of polished nickel plate, has a steel top and two handles, is wound for voltages ranging from 32 to 240, either alternating or direct, and requires 600 watts.

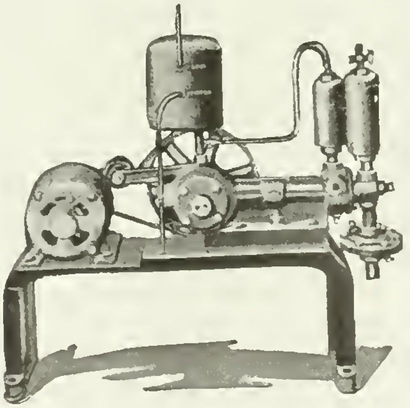
Ozone Water Purifier

For use in homes, offices, drug stores, restaurants, hospitals and the like, the Ozone Company of America, Milwaukee, Wis., has designed a convenient size of ozone water purifier. The manufacturer says that in the ozonizing process employed ozone is produced by means of an electric current and mixed thoroughly with the water as drawn from the faucet. It is also held that the extra oxygen atoms of the ozone combine with organic matter of the germs in the water and burn them up, the carbon dioxide formed by this chemical action passing out into the air and leaving a trace of the same effect produced in carbonated beverages. This adds to the palatability of the ozonized water. It is claimed that all tastes and odors are removed by this process, while mineral elements essential to health remain, since they do not oxidize.

Water supplies are frequently chlorinated, and it is claimed that this ozone water purifier will eliminate the odor and taste of chlorine from the water in the same way as it eliminates other objectionable odors and tastes. It also is stated that each of the water purifiers has a producing capacity of over 2000 gal. a day; therefore any user is entirely independent of the condition of the water at the municipal plant in his city. This company also is in position to furnish industrial and municipal installations ranging from 100 gal. up.

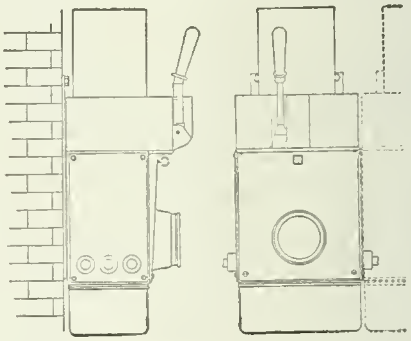
Electric Suction Pumps

Suitable for individual water supply systems and for a large variety of special purposes, Paul suction pumps, manufactured by the Fort Wayne (Ind.) Engineering & Manufacturing Company, are said to be exceptionally strong, are easily accessible and are convenient to handle. This pump was designed especially to supersede the water motor-driven pump, and it is claimed that it does away with all the troubles connected therewith and practically eliminates care and repair. Noiseless in action, small in size, simple, strong and self-contained, it fills the requirements for residence service in an ideal manner, according to the makers. The pump is driven by a special belt from an electric motor of ⅓ hp. mounted on the bed plate. The belt is tightened by a spring-loaded idler with oilless bushing. The pump is of the plunger type, fully brass-fitted, bolted to the frame so that it overhangs the bed, and giving free access to all pipe connections. On the bed plate between the pump and the motor is an automatic electric controller connected to the pump by a small copper tube and wired to the motor, starting the pump automatically when the pressure has dropped to the lowest point and stopping the pump when the pressure has reached the highest point for which the controller is set, thus keeping a constant supply of water under pressure.


AUTOMATICALLY KEEPS WATER PRESSURE CONSTANT

"Safety First" Wall-Type Switching Unit

The wall-type switching unit shown herewith is intended for the control of alternating-current circuits up to 300 amp. and 2500 volts. The unit consists of an industrial-type oil circuit breaker with a space above which serves as a housing for disconnecting switch, current and potential transformers and also provides a location for either voltmeter or ammeter, or both when desirable.


NEAT AND COMPACT SWITCHING APPARATUS

Following safety-first principles, the disconnecting switch is interlocked, mechanically, with the oil circuit breaker so that the switch cannot be opened when the breaker is closed, nor can the breaker be closed while the disconnecting switch is open. A key projecting through the front of the panel is used to operate the switch. This key can be removed when the switch is open and carried by the operator with the assurance that no one can close the switch while he is working on lines or apparatus on the circuit controlled by this unit. The interior of the switch compartment is also inaccessible while the switch is closed, and the oil tank cannot be removed while the disconnecting switch or oil circuit breaker is alive.

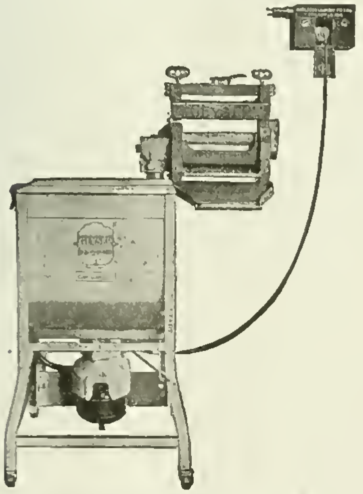
These switching units are made for use with the control of circuits feeding banks of transformers, motors in steel mills and pumping plants where it is desirable to mount the motor-control appliances on walls or pillars. They are designed for single or group mounting and have a large bus compartment just above the disconnecting switch and inside the cast-iron housing. This switching unit is made by the General Electric Company, Schenectady, N. Y.

Luminous Attachment for Pull-Chain Lamp Sockets

An adaptation of the self-luminous substance used on the hands and figures of their watches is being marketed by Robert H. Ingersoll & Brother, 315 Fourth Avenue, New York City, for attachment to the pull chains of lamp sockets. The lamp is thus readily found in a dark room. The "Ingersoll Lite," as the device is called, consists of a small unbreakable glass filled with the luminous substance. A brass cap completes the attachment, which can easily be placed on the chain without the use of tools.

Laundry Fittings

The Appleton Electric Company of Chicago has designed a laundry fitting for use in apartment houses which is so arranged that each tenant will have available a branch circuit from his meter for the purpose of using electric washing machines and ironers. The outlet on this circuit is kept locked while not in use to prevent theft of electricity. This fitting is made in single, two-gang and three-gang styles and is provided with one, two or three locked hinged doors, so that each tenant holds a key to his particular outlet. Where there are more than three tenants in a building, as many gang boxes as necessary are installed. The manner of installing a three-gang fitting and connecting it to a washer is shown in the accompanying illustration.



AFFORDS INDIVIDUAL OUTLET ON WASH DAY

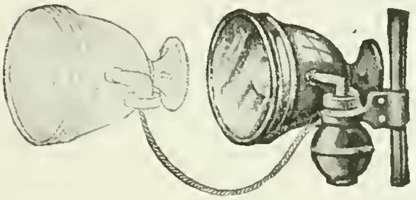
The gang-fittings are furnished with partitions forming separate compartments. The back of each compartment is drilled and tapped for the supporting screws of the receptacle for receiving the attachment plugs of a washer or iron.

Reflectors for Showcases

Designed for glass or wood-frame showcases, special reflectors are being made by C. W. Cole & Company, Los Angeles, Cal. These reflectors, which are made to the measurements of showcases, consist of three parts, the reflector itself, a triangular channel for the upper corner of the showcase and a clip that passes through the channel and reflector and through the felt and cement separating the top and front plates of glass in the showcase. This clip serves to hold the triangular channel in its place in the reflector, and the channel in turn holds the reflector in proper position without the use of other visible support. The reflector, which is designed for use with 10-watt Mazda sign lamps, is made of one piece of heavy metal finished to match the case. The inside is finished in a flat-white sprayed celluloid.

Spot Light Useful for Night Repair Work

An automobile spot light has been placed on the market which combines an automatic extension feature whereby the lamp may be removed from its windshield brackets without altering or making any electrical connections and carried to a considerable distance from the car if desirable. Such a combination is made by the Anderson Electric Specialty Company, 118 South Clinton Street, Chicago. An adjustable cord reel is placed in the ball casing just back of the lamp. To use the lamp for portable purposes the knurled nut is unscrewed and the lamp withdrawn to the desired length. The cord reel operates like an ordinary curtain roller.



SPOT LIGHT MAY BE CARRIED TO A CONSIDERABLE DISTANCE FROM THE CAR

Although this spot light is designed more particularly for automobile repair work, it should evidently be very useful in connection with night repair work on electric lines and outdoor substations, giving the lineman a powerful and dependable source of illumination.

Charging Panels for Damp Locations

Where the battery-charging outfit is exposed to leaks in the roof or other sources of moisture it is important to protect the switchboard apparatus. This the Automatic Electrical Devices Company, Cincinnati, Ohio, accomplishes by roofing the panel as shown in the illustration. This particular panel is also designed for the minimum space requirement.

In addition to the usual equipment of switches and circuit breakers it is equipped with a chargemeter and automatic underload switch which disconnects the batteries in case of failure of line voltage and recloses the circuit upon the restoration of the supply voltage. It is stated by the manufacturer that the charging operation is extremely simple, requiring only the setting of the chargemeter for the desired length of charge and closing the switch.

COMPACT CHARGING PANEL PROTECTED FROM MOISTURE

The company makes a wide range of panels for charging Edison as well as lead batteries.

Portable Galvanometers with Rugged Suspension

The suspension type of portable galvanometer has been used for work requiring a high sensitivity, but care has been necessary because the instruments had to be accurately leveled, and if not handled carefully the suspensions would break.

The Model A portable galvanometers manufactured by Herman H. Sticht & Company, Park Row Building, New York City, have a new type of moving system which is said to be extremely rugged.

The single suspension has been replaced by top and bottom metallic suspensions, both being under tension. With this construction the instrument does not require leveling. Because of the special construction of the frame in which the moving system is mounted the maker says it is practically impossible to break the suspension. Means are provided for setting the pointer at the zero position, and the instrument is equipped with a device for damping the moving system during shipment which automatically operates when the cover is closed.

The instrument is mounted in a walnut case, 9 in. by 8 in. by 6 in. (23 cm. by 20 cm. by 15 cm.), with removable hinged cover. The scale is provided with mirror reflector and can be furnished with graduations of 100 or 150 divisions.

Trade Notes

QUARTERMASTER'S LIST OF BIDDERS.—A list of bidders on all articles purchased by the Quartermaster's Corps is being prepared. All manufacturers and business concerns that make application for a place on the list will be included, whether they have been doing or bidding for work for the department or not. Such applications should be made to the Purchase Records Branch, Supply Control Division, office of Quartermaster-General of the Army, Washington. D. C.

NEW QUARTERS OF ST. PAUL ELECTRIC COMPANY.—The St. Paul Electric Company, electric supply jobber of St. Paul, Minn., is sending to its customers a "Good-Will Book" in a spirit, says B. B. Downs, president of the company, of "appreciation and satisfaction—appreciation of the business you have intrusted to us and satisfaction in having supplied your needs for goods promptly." The occasion for this book is the opening, after nineteen years of business, of the concern's new home, a large and imposing five-story building. The book is devoted to its facilities for giving services in these new quarters.

HURLEY EMPLOYEES HOLD REGULAR DANCES.—In Hurley Hall, Chicago, which the Hurley Machine Company has provided for its employees, dances and card parties are held every two weeks. On a recent occasion the hall was beautifully decorated by the boys and girls of the company. Over 400 employees, including men and women from both the office and shop, were in attendance. The dance program included fifteen numbers. Honorary members of the "Hurley Thors" are N. C. Hurley, J. H. Sullivan, H. Dubia, R. J. Kellogg, A. J. Fisher and F. A. Allair. The reception committee comprises Chairman M. Gareis, May Zima, H. L. Osborne and W. Sheehan and the floor committee Chairman C. J. Ulrich, Francis Vodraska, George Geske and A. Johnson.

PITTSFIELD GENERAL ELECTRIC EMPLOYEES FIGHT INFLUENZA.—Vigorous coöperation in the campaign against the influenza epidemic was rendered by the Pittsfield (Mass.) Works of the General Electric Company last week. C. C. Chesney, general manager of the company, was recently made chairman of a citizens' advisory committee, of which Sidney W. Ashe of the company was also a member, in assisting the local board of health, the federal authorities and others in attacking the scourge. As the result of a conference, the city was sectionalized and the headquarters of one section was established at the Pittsfield plant of the company, with day and night telephone service. Two hundred employees of the works volunteered to act as nurses, and sixteen of these were promptly inducted into service.

PROVISION OF NEW WAR DEPARTMENT PURCHASE CONTRACTS.—The new standardized form of contract to be used by all purchasing agencies of the United States War Department contains the following provisions: Claims, doubts or disputes as to non-performance of contract which cannot be settled by agreement will be placed before the Secretary of War or his representatives for adjustment. Government retains right to terminate any contract in the public interest, and provision is made for equitable adjustment of expense incurred by contractor. In cases specified by law wages shall be computed on basic eight-hour day. Minors under fourteen shall not be employed, and minors between fourteen and sixteen not over eight hours per day or more than six days per week, or before 6 a. m. or after 7 p. m. Convict labor is prohibited, except by executive order. Contractor may appeal to Secretary of War for settlement of labor disputes that threaten to delay work and is obligated to comply with Secretary's adjustment. In case an increase of wages is ordered, contractor will be compensated, and if wages are reduced, price to government will be lowered. Government retains right of inspection of all cost elements in "cost-plus" contracts; proposed expenditure for labor and material must be approved in advance, and all such contracts are subject to review by the superior board of contract review. Fixed-price contracts will be used whenever possible. Contractor is obliged to provide protection for his plant against espionage, fire, explosion, acts of war and alien enemies. Contractor shall, when required, report alien status of any or all of his employees. Government retains right to prevent employment of suspected persons.

JAPANESE FOREIGN LAMP TRADE.—A party of Chinese business men and journalists recently visited, by special invitation, the electrical exhibition in Uyeno Park, Tokyo, Japan, where domestic electric appliances, lamps, electrochemical plant, wireless telegraph and telephone apparatus, etc., were exhibited. The opportunity afforded by the stoppage of German, British and American supplies of electrical machinery to China is being turned to good account by Japanese manufacturers. The latest figures available show that the exports of electric lamps and apparatus from Japan are already valued at nearly $4,000,000 per annum. In this connection, however, it must be kept in mind that American lamp manufacturers have seen the advantage of having lamp works in Japan manned with Japanese labor. It is quite probable, therefore, that a very considerable portion of this incandescent lamp trade of the East will return a profit to American manufacturers.

WESTERN ELECTRIC WAR ACTIVITY.—In explaining how the Western Electric Company had come to its war activity of between 90 and 100 per cent, H. A. Halligan, vice-president of the company, in a recent issue of the *Western Electric News* summarized the situation as follows: "1. The engineering department's time is now divided between the problems incident to the transmission of speech, broadly speaking—this for the benefit of the telephone industry, now under government control, and these problems as applied particularly to warfare. 2. The manufacturing departments are working 100 per cent on telephone and telegraph apparatus and cable for either the government itself or its controlled operating telephone and telegraph companies. 3. The distributing department warehouses and disburses the foregoing equipment exclusively to these two classes of customers, and in so far as the business of jobbing electrical supplies is concerned, it is required to limit such sales to industrial plants actually engaged in war work, to contractors installing electrical material in such establishments, or to public service corporations, coal mines, street railways or others enjoying a preferred classification as essential to the conduct of the war. Even among the few exceptions to the foregoing, we are selling equipment like sewing machines, heat regulators, washing machines, farm power and light plants and similar devices which because of their labor and fuel saving character are looked upon by the government as in the field of necessary manufacture, and up to now the raw material has been made available by government order."

ALLIS-CHALMERS WAR WORK.—Like other manufacturers in the industry, the Allis-Chalmers Manufacturing Company is largely engaged in war work, with the government its biggest customer. At the present time, however, this work is almost entirely made up of its normal products. What strictly war goods are going through the plant are very small. Only one item of the following table shows any strictly war goods, and that, the "Miscellaneous," has only a small portion of shells, etc. Thus the production of this plant, while going to help win the war, is nevertheless essentially of a peace nature. The official classification, showing eight months' "sales invoiced" and "orders booked," is reported as follows:

	Sales Invoiced Eight Months	Orders Booked Eight Months
Gas and oil engines..	$522,244	$1,056,799
Steam engines..... .	2,448,009	5,049,879
Forging..........	1,441,951	339,761
Electrical...........	7,608,518	7,746,404
Air brake..........	182,340	310,136
Hydraulic turbines .	1,049,429	398,051
Centrifugal pumps..	743,329	703,278
Flour-mill.........	755,368	1,069,972
Saw-mill..........	458,174	821,408
Steam turbines......	1,848,761	1,676,143
Pumping engines....	591,274	661,823
Mining machinery...	1,480,511	2,110,818
Crushing and cement	1,865,513	1,421,992
Farm tractors.......	351,381	342,232
Miscellaneous.....	607,693	2,017,908
Total	$21,954,498	$25,723,608

In excess of $5,000,000 worth of orders, it is reported, were booked in August, which represents the maximum the management could see its way clear to accept under labor conditions and conditions governing the raw material market. It does not, by any means, represent the orders which might have been obtained if plant capacity were not limited. In August the output was invoiced at $3,000,000, which is $1,200,000 more than in January and $200,000 more than in July. It is the highest month's production so far attained. Unfilled orders totaled $30,856,361 on Aug. 31.

THE ANGOLA (IND.) ELECTRIC MANUFACTURING COMPANY, it is reported, has taken over the Sevison Electric Company of Elkhart, Ind., and also the Sevison Electric Repair Company. The new company manufactures the Sevison high-tension magneto, an all-metal switch which is used with the magneto, besides three designs of magneto coupling.

THE KOPPEL INDUSTRIAL CAR & EQUIPMENT COMPANY has been organized as a subsidiary of the Pressed Steel Car Company to take over the business of the Orenstein-Arthur Koppel Company, builders of electric industrial trucks and other equipment, Koppel, Pa. The plant was recently sold to the Pressed Steel Car Company by the Alien Property Custodian.

EDUCATING DISTRIBUTERS OF FARM-LIGHTING SETS.—Manufacturers of farm-lighting sets have for some time now been making strenuous efforts toward obtaining wider distribution. Various schemes have been tried, but one difficulty has been to get distributers who not only are salesmen, but who know the product they are handling. In order apparently to overcome such objection, there has recently been printed by the Lalley Electro-Lighting Corporation, Detroit, a comprehensive discourse in two sales manuals on how to sell farm-lighting sets. It has been the policy of this company to market its products exclusively to established distributers who are operating with the manufacturer under a contract by the terms of which the distributer is granted the sale of the company's products in a fixed territory. The two sales manuals which have just been put out are for the purpose of giving to all of the salesmen of the lighting sets information in simple and concrete form which should be the basis for the dealer's development of the agency into a real merchandising business which will be permanent and increasingly profitable. In addition, the information given in the manuals was designed to form the basis of a salesman's training in the field. The information appears to be very complete.

PLANS FOR AFTER-WAR TRADE.—The time is now ripe for more centralized, concerted work on a program of economic reconstruction after the war, says a report made public by the Bureau of Foreign and Domestic Commerce, Department of Commerce. It is the first of a series of reports to be issued on this subject and is devoted to the plans under consideration by other countries, especially as they bear on future foreign-trade developments. "The outstanding fact under observation," states the report, "is the recognition in every land and by all statesmen of the problem called 'economic reconstruction.' But of more immediate importance is the fact that England, France, Italy, Germany and Austria are making preparations to resume their peaceful economic life, with improved facilities for foreign trade, with a national supervision of the use of natural resources for the benefit of their own citizens, and with assistance from the state." Attention is called to the achievement of our own government in preparing for after-war conditions, such as the building and organization of a huge merchant navy backed by large and efficient shipyards and docks, the Webb-Pomerene export trade act authorizing exporters to combine for export trade, and the leeway in foreign-trade banking now possessed by the Federal Reserve Board and banking system. All told there has been a very considerable amount of effective work done looking toward the future, but much remains undone, and the bureau is issuing this analysis of European tendencies as a guide, although calling attention to the fact that each country has its own peculiar problem that it must work out for itself. "In England," says Mr. Cutler, chief of the bureau, in his introduction, "judging from present comments on the work of the committee on commercial and industrial policy after the war, any present attempt to lay down complete and binding policies regarding the future is now recognized as a waste of effort. What is more important is the assembling of facts, taking the basic step to improve our education, research and promotive organizations and contributing to clear thinking as to the questions involved. Sooner or later we must have a definite program in which work and plans for the future based on known conditions affecting our future may be coördinated. I personally feel that the time is now ripe for some more centralized, concerted work to that end." The report is entitled "Economic Reconstruction," Miscellaneous Series No. 73, and is on sale at 10 cents a copy by the Superintendent of Documents, Government Printing Office, Washington, D. C., and by all the district and coöperative offices of the Bureau of Foreign and Domestic Commerce.

THE AMERICAN NITROGEN PRODUCTS COMPANY has opened Eastern offices in the Woolworth Building, New York City.

C. D. MORTON has left his position as sales engineer for the Page Steel & Wire Company to become a captain in the General Engineer Depot, United States Army.

C. F. HENDERSON, Call Building, San Francisco, has been appointed representative of the Electric Controller & Manufacturing Company for the northern half of the State of California.

E. E. STRONG is leaving the employ of the New York State Railways, Rochester Lines, of which he was superintendent of transportation, to go into the electrical machinery and apparatus business with the Henry J. Shiefer Company, 312 E. & B. Building, Rochester, N. Y.

PAUL DRUMMOND, who was formerly connected with the Pittsburgh office of the Cutler-Hammer Company, has been appointed second lieutenant in the Twenty-ninth Engineers by General Pershing. Mr. Drummond has been in France for some time as a private.

R. F. IRVIN has been appointed as assistant to L. D. Calhoun, the advertising manager of the Square D Company of Detroit, manufacturer of Square D switches. The appointment became effective Oct. 3. Mr. Irvin was formerly branch advertising manager of the B. F. Goodrich Rubber Company, in charge of advertising for the Philadelphia territory.

H. M. NEWKIRK has been appointed mechanical engineer of the Hygrade Lamp Company, Salem, Mass., succeeding L. H. Pike, who recently became factory manager. Mr. Newkirk has been in the employ of the Hygrade company for three years. His first work was as head of the wire-drawing department, after which he was made a development engineer. His latest work has been the charge of shrinkage on mounts.

CHARLES E. GOODNOW, formerly assistant sales manager of the electrical and special wire department of the American Steel & Wire Company and more recently identified with building construction work in Washington and Brooklyn for the army and navy, is now with the Page Steel & Wire Company, 30 Church Street, New York. Mr. Goodnow's efforts will be devoted to sales and service on "Armco" iron welding rods and "Copperweld" electrical wire.

THE NATIONAL X-RAY REFLECTOR COMPANY, Chicago, has announced the following changes: O. F. Benjamin, sales engineer, is now in charge of the lighting department of Brown-White, Inc., resident engineers for X-ray products in the Philadelphia territory. J. E. Lauderdale of the engineering department is now service manager, taking the place of W. F. Martin, resigned. I. M. Kirlin, formerly resident engineer in Minneapolis, is now in the engineering department of the Chicago office.

THE LINEMEN PROTECTOR COMPANY, Detroit, has made an offer to lighting companies that have not purchased its full-line safety devices to furnish two Marshall's linesmen shields, listed at $45 each, and three Marshall's cross-arm shields, listed at $15 each, a total of $135 worth, for either a hundred-dollar Liberty bond or twenty five-dollar thrift stamps. This offer, which expires Nov. 1, is being made to help win the war in addition to allowing all lighting companies an opportunity to give a practical test to the company's full equipment of linemen protective devices.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, is on its way for the most prosperous year in its history. Recent reports are to the effect that manufacturing profits for the first six months of the current year were approximately $2,000,000, which compares with $2,220,613 for the whole of 1917 and $1,318,796 for the whole of 1916, the last-named year having been the best year the company had had up to that time. The figures are compiled before federal taxes have been provided for, for which $450,000 was set aside last year. Although the company is engaged largely on government contracts, it is on lines of production which the company has been accustomed to handle and which have not required plant extension or new equipment that will have to be scrapped after the war is over, as is the case with many companies. The plant enlargement accomplished a couple of years ago was to take care of the increase in the company's regular business, and there is reason to expect that this business will continue to be of large volume when peace comes.

W. C. ANDERSON has retired from the presidency of the Electric Car Company, Detroit, Mich., after more than thirty years of active service as president of that company and its predecessor, the Anderson Carriage Company. Mr. Anderson is succeeded as president by M. S. Towsen, who has been general manager of the company's plant in Cleveland. The other officers are: Vice-president and general manager, G. O. Fairgrieve; treasurer, W. M. Locke; secretary, W. P. McFarlane. The company's plants in Detroit and Cleveland have been enlarged and it is reported that provision has been made for increased production of Detroit electric passenger cars.

THE UNDERFEED STOKER COMPANY OF AMERICA, Chicago, is opening a number of new offices owing to its rapidly expanding business. A new district office has just been opened in Cleveland, at 604 Sweetland Building, in charge of H. F. Post, formerly connected with the home office. S. A. Williamson, until recently a member of the Cincinnati staff, has been chosen to take charge of a new office that is being established at Minneapolis. The address will be announced later. G. W. Bonnell, who formerly represented the company in the St. Louis territory, will shortly take charge of a new office being established at St. Louis. The address of this office has not yet been definitely decided upon.

THE EDISON ELECTRIC APPLIANCE COMPANY, INC., Chicago, as a result of the seriousness of the heater cord situation, because of the manufacturers of heater cord having had to utilize their machinery to a large extent for war purposes, has addressed to its customers a letter stating its position as follows: "At the present time we are experiencing great difficulty in getting cord in sufficient quantities to supply the demand. We suggest that you put forth every effort to conserve heater cord wherever possible. This could be accomplished by suggesting to your customers who want to purchase new cords for their appliances to have their old cord repaired if possible, and if the customer is buying two appliances where the cords and plugs are interchangable, suggest to them that they use one cord and plug for both appliances, and you can use the extra cord and plug for repair purposes. Therefore it has been necessary for us to limit our distribution of cords complete to six to any one customer. We can, however, supply plugs to which you can attach proper length of cord from your stock."

THE LEWIS-ROTH CORPORATION is now installed in its new building at Thirteenth and Wood Streets, Philadelphia. This company, which has had a rapid growth, was organized as the Lewis-Roth Company on July 1, 1910. The force, then consisting of the two partners, L. R. Lewis and R. T. Roth, and a stenographer, rapidly increased, and in October of that year the company had to move to larger quarters. In 1914 and 1915 it secured substantial contracts for installations for plants largely engaged in war work, including the Remington Arms Company, Baldwin Locomotive Works, Eddystone Ammunition Works and others. In May, 1916, the company opened a factory on the second floor at 824 Cherry Street, Philadelphia, to manufacture high-tension apparatus and switchboards. Business increased so rapidly that it was soon necessary to take additional space on the first floor and basement, and later the fourth floor of the same building was engaged. In June, 1918, the company was reorganized as the Lewis & Roth Corporation under the same management. The growth of the business is illustrated by the following figures showing the annual sales: 1912, $92,865.43; 1913, $118,716.99; 1914, $133 249.56; 1915, $203.774.97; 1916, $603,077.06; 1917, $675.243 62, and for four months of 1918, $345.908.09. Additional orders and contracts in hand at that date amounted to $890,899.47.

Trade Publications

SOLDERING IRONS AND SAFETY RACKS.—Two leaflets, publications 403 and 404, have been put out by the Cutler-Hammer Manufacturing Company, Milwaukee and New York. The first enumerates advantages of the company's automatic safety racks, which keep soldering irons at safe temperatures between periods of use, while the second points out the war-work requirements met by the Cutler-Hammer soldering iron.

SHADE HOLDERS.—Harvey Hubbell, Inc., Bridgeport, Conn., is distributing a two-color leaflet giving description and prices of the Hubbell shade holders.

PORTABLE GALVANOMETER.—Herman H. Sticht & Company, Park Row Building, New York City, are sending out a mailing card containing information regarding their Model A portable galvanometer which has rugged construction.

LINEMEN'S STRAPS AND BELTS.—Descriptions and illustrations of linemen's straps and belts, coupling rods, sewer or conduit screw rods, a cable reel jack and a shoving or trench jack are given in a recent circular of T. J. Cope, 1620 Chancellor Street, Philadelphia.

ELECTRIC STOVES.—A line of electric stoves, including one with an exchangeable heating element, is illustrated and described in a leaflet from the Redtop Electric Company, Inc., 8 West Nineteenth Street, New York City. A sterilizing and a combination cooking utensil are also included.

LAMP GUARDS AND SHADES.—With the title of "The United States Army and the Holdfast Army—An Interesting Comparison," W. N. Matthews and Brother of St Louis, Mo., are distributing a circular giving interesting facts regarding the United States Army and the Matthews "Holdfast" lamp guards and shades.

VALVE CONTROL.—"Facts" is the title of the new eight-page booklet issued by the Cutler-Hammer Manufacturing Company of Milwaukee and New York. The Dean valve control and its applications to large valves are described and illustrated with special emphasis on the prevention of bursting water mains through the strategic placing of these valve controls.

PHOTOGRAPHIC AND MOTION-PICTURE ARC LAMP.—Describing comprehensive changes in their arc lamps for motion-picture and photographic use, Allison & Hadaway, Inc., 42 West Thirty-ninth Street, New York City, have prepared a booklet on their "Panchroma" twin-arc lamp which is self-contained, light in weight and has a folding stand

FUEL AND ASH CONTROLLING GATES.—To give descriptions, dimensions and illustrations of its standard gates for controlling the flow of granular materials from bunkers, the Beaumont Manufacturing Company, 315 Arch Street, Philadelphia has published its catalog 37, which also illustrates the design of ash pits under boilers and the correct gates to use for this purpose.

New Incorporations

THE ROCK RIVER VALLEY LIGHT & POWER COMPANY of Hillsdale, Ill., has been incorporated with a capital stock of $20,000 by Clarence D. Butzer, Frank L. Wake and Fred Frels.

THE ADRIANCE BATE STEAM FUEL ECONOMY CORPORATION of Brooklyn, N. Y., has been incorporated by J. T. Berney, F. N. Moses and A. Calleson, 80 Richards Street, Brooklyn, N. Y.

THE ORLAND WATER & LIGHT COMPANY of Springfield, Tenn., has been incorporated with a capital stock of $10,000 by J. W. Drake, W. W. Gilbert, V. E. Crocker, R. L. Porter and H. G. Gilbert.

THE ELECTRIC IRONS, LTD., of Orillia, Ont., has been chartered with a capital stock of $75,000 to manufacture machinery, boilers, electrical equipment, etc. The incorporators are James B. and William H. Tudhope, Robert L. Whitman and others.

THE ELECTRIC TRANSPORT COMPANY of New York, N. Y., has been incorporated by R. Sugden, J. C. Norris and W. A. Anderson, 165 Broadway, New York City. The company is capitalized at $100,000 and proposes to construct and operate underground carriers.

THE ESSENTIAL INDUSTRIES CORPORATION of New York, N. Y., has been incorporated with a capital stock of $3,000,000. The purpose of the company primarily is to finance public utilities, but its activities need not necessarily be confined to this field. Eugene V. R. Thayer, president of the Chase National Bank, is president of the corporation, and Gerhard M. Dahl and Frederick Strauss are vice-presidents.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

NEW MARKET, N. H.—The New Market Electric Company is contemplating raising its dam on the Lamprey River at New Market to a height of 18 ft. above the level of the present dam, increasing the storage capacity of the pond from 45 acres to 550 acres. This will give a dam 30 ft. above the river bed. A new power house will be erected about a quarter of a mile to the east, which will give a fall of 50 ft. and develop 4000 hp. It is proposed to use the excess power over local needs in connection with the plant of the Rockingham Light & Power Company.

BOSTON, MASS.—Plans have been prepared by the New York, New Haven & Hartford Railroad Company for the erection of a two-story signal tower, 20 ft. by 24 ft., on First Street, in the South Boston district.

DANA, MASS.—At a special town meeting held recently the town of Dana voted to appropriate $15,000 for the installation of a municipal lighting system. Electricity to operate the proposed system will be obtained from the Gardner (Mass.) Electric Light Company. A transmission line will be erected to Petersham, where it will connect with the Gardner company's line.

SHELTON, CONN.—Bids, it is reported, are being received by S. Blumenthal Company of Shelton for an addition, 90 ft. by 125 ft., one story, to its power plant. The cost is estimated at about $35,000. G Aus, 101 Park Avenue, New York, N. Y., is engineer.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 28, under Specification 3515, for electrical wiring, lighting and fixtures in nurses' quarters at the naval hospital.

BROOKLYN, N. Y.—Plans have been prepared by Tobias Goldstone, 50 Graham Avenue, for the erection of an addition, 50 ft. by 50 ft., to the shop of the Electric Welding Company, 744 Graham Avenue, Brooklyn.

BUFFALO, N. Y.—Plans have been filed by the Worthington Pump & Machinery Corporation for alterations and improvements in its transformer station at Clinton and Roberts Streets at the Snow Holly Works, to cost about $5,000. Contract has been awarded to Henry Harder, 287 Northampton Street, Buffalo.

NEW YORK, N. Y.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is considering the construction and equipment of a new electric shop, to cost about $700,000. Specification 3551.

NEW YORK, N. Y.—Plans have been prepared by W. Whitehill, architect, 39 Union Square, for the erection of a new screen-well house at the power plant of the United Electric Illuminating Company on 203d Street.

NEW YORK, N. Y.—Bids will be received by Scott & Prescott, architects, 1 Madison Avenue, New York, N. Y., until Nov. 2 for construction of base hospital on Tremont Avenue, between Andrews and Montgomery Streets, for the New York Catholic Fund, 334 Fifth Avenue. The cost is estimated at $250,000, and the building will consist of five three-story units.

WADDINGTON, N. Y.—The New York & Ontario Power Company has petitioned the International Joint Commission for permission to reconstruct its dam at Waddington on the St Lawrence River. The company's project involves two structures on Canadian territory. Its present works are situated on Little River between Ogden Island and on the south shore and south of the international boundary line. The new plans provide for the construction of an embankment from the east end of Ogden Island to Canada Island, crossing the boundary line.

CAMDEN, N. J.—Contract has been awarded by the New York Shipbuilding Corporation to Armstrong & Latta, 119 South Broad Street, Philadelphia, Pa., for the erection of an addition to the pumping station at its plant, to be located at Broadway and Fairview Avenue, to cost about $35,000.

CAPE MAY, N. J.—Plans have been prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for a forge and blacksmith shop, coppersmith works and electrical shop at Cape May.

NEWARK, N. J.—Plans are being prepared by the Allweather Train Controller Company, Sumner Avenue and Crane Street, for the installation of a new fire-alarm system in its plant.

NEW BRUNSWICK, N. J.—The erection of a new pumping station at the municipal waterworks is under consideration by the City Council. The building will be located on the Raritan River near Landing Bridge. The cost is estimated at about $150,000.

NEWPORT, N. J.—Plans have been prepared for the erection of a packing house and storage plant for the Staden-Cosier Company, to cost about $150,000.

TRENTON, N. J.—The City Commission is considering opening negotiations with the Trenton & Mercer County Traction Company for the construction of a new branch railway to begin at its West State Street line and to extend through the Sullivan Way tunnel direct to the New Jersey State Hospital for the Insane.

CHAMBERSBURG, PA.—Plans are being prepared by the Chamberland Valley Railroad Company of Chambersburg for the construction of an engine house to cost about $30,000.

ESSINGTON, PA.—The construction of a hydroplane station and plant at Essington to cost about $400,000, is under consideration by the Ordnance Department. General R. C. Marshall, Jr., construction division, is in charge.

PHILADELPHIA, PA.—A boiler plant, to cost about $50,000, will soon be erected by the Barrett Manufacturing Company, Bermuda and Margaret Streets, Philadelphia.

PHILADELPHIA, PA.—Plans have been prepared by Baugh & Sons, 30 South Delaware Avenue, for the erection of a new boiler plant, 35 ft. by 45 ft., at Morris Street and Delaware Avenue, to cost about $20,000.

PHILADELPHIA, PA.—Contracts have been awarded by the Philadelphia & Reading Railway Company to Charles C. Pace, Merion, for the construction of a one-story and a two-story signal tower and battery building on Erie Avenue, to cost $14,000 and $4,000 respectively; also the erection of two similar buildings at Luzerne Street, to cost $14,500 and $3,500 respectively.

PITTSBURGH, PA.—Work has begun on the construction of the large electric generating plant of the West Penn Power Company to be erected at Springdale, about 15 miles from Pittsburgh, at a cost of about $5,000,000. Contracts, it is understood, have been placed with the Westinghouse Electric & Manufacturing Company for two turbine generators.

PLATSFORD (not a post office), PA.—The construction division of the War Department is planning to erect a gas plant near Platsford, to cost about $2,000,000.

READING, PA.—Plans have been prepared by Muhlenberg Brothers, 513 Penn Street, Reading, for the construction of a power plant for the Carpenter Steel Company at River Road and Exeter Street.

RUTHERFORD, PA.—Contract has been awarded by the Philadelphia & Reading Railway Company to A. L. Carhart, Philadelphia, for the construction of a new engine house and shop at Rutherford, to cost about $100,000.

FAIRFIELD, MD.—Contract has been awarded by the Union Shipbuilding Company to the Hughes Foulkrod Company, Commonwealth Building, Philadelphia, Pa., for an addition to its plant, to cost about $150,000. The company is also having plans prepared for a 700-ft. pier.

INDIAN HEAD, MD.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 28 for coal storage basin (Specification 3208) at Indian Head, to cost about $125,000.

MONKTON, MD.—Work has begun on the construction of the new plant of the Monkton Roller Mills, which will include a hydroelectric power plant, to cost about $30,000, and electrical machinery, $21,000. The cost of the flour mills and machinery is estimated at about $80,000. Otis E. McCoy of Mount Washington, Md., is president of the company.

CHARLESTON, W. VA.—Bids will be received at Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 28, under Specification 3436, for electric traveling crane for F. & F. shop, to cost about $50,000.

MOUNT HOPE, W. VA.—The erection of machine shops and a warehouse, to cost from $75,000 to $100,000 in Mount Hope is under consideration by the New River Company.

ALEXANDRIA, VA.—The City Council is considering an ordinance to grant to a company, yet to be named, a franchise to erect poles and string wires and cables on certain streets of the city.

CAMP STUART, VA.—Extensions and improvements are contemplated by the construction division of the War Department to the base hospital at Camp Stuart, consisting of construction of additional officers' quarters, laboratories, storehouses and alterations to administration building, receiving ward, nurses' infirmary and nurses' quarters. The cost is estimated at $448,200.

RICHMOND, VA.—The Air Reduction Company, 120 Broadway, New York, N. Y., it is reported, has purchased a site in Fulton, on which it proposes to erect a plant, 400 ft. by 100 ft., to manufacture oxygen, nitrogen, acetylene gas and probably storage batteries and other gases.

WALDROP, VA.—The Waldrop Telephone Company, recently incorporated with a capital stock, it is reported, will erect and operate a telephone system (20 miles) in Louisa and Orange Counties.

WASHINGTON, D. C.—The War Department is planning to erect three new power plants on the Ohio River, to be located at Dam No. 24, at Millwood, W. Va.; Dam No. 21, near Morgan, W. Va., and Dam No. 25, near York, W. Va.

WASHINGTON, D. C.—The Washington, Baltimore & Annapolis Electric Railroad Company has awarded contract for block signaling system to be installed over its double-track line between Naval Academy Junction and District Line, near Washington, to the Union Switch & Signal Company. The new installation will protect 36 miles of track and 37 switches.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Annapolis, Schedule 6523½—two electric motors. Brooklyn, Schedule 6527½—motor-driven surfacers. Boston, Mass., Schedule 6537½—switches and levers. Eastern navy yards, Schedule 6545½—signaling keys, condensers and 500 searchlights. Submarine base, Conn., Schedule 6562½—motor-generator sets, transformers and voltmeters. Puget Sound, Schedule 6569½—one boiler-feed pump. New London, Conn., Schedule 6571½—1200 flashlights. Mare Island, Schedule 6573½—underwriters' lighting cable and switchboard wire. South Charleston, Schedule 6589½—charging machines. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Plans are being prepared by the Bureau of Yards and Docks, Navy Department, for work at the various navy yards for which bids will be called for at some future time. Mare Island, Cal., Specification 3240—electric traveling crane for structural shop; Specification 3561—electrical storehouse (bids to be opened at the yard). Newport, R. I., Specification 3250—widening and lighting slips. Hampton Roads, Specification 3300—coal-handling machinery. Montauk, L. I., Specification 3338—underground wiring. Bellevue, D. C., Specification 3372—electric crane. Norfolk, Specification 3377—electric light and power system and steel storage building; Specification 3380—cranes for galvanizing plant; Specification 3546—two radio buildings. Philadelphia, Pa., Specification 3345—machinery and electric shop; Specification 3420—wood-block floors, structural shop, smithery, machine and electric shop. Pensacola, Fla., Specification 3389—power plant improvements. Rockaway, L. I., Specification 3415—electric power service (bids opened at the yard). New York, Specification 3438—electric traveling crane in structural shop; Specification 3551—light machine and electric shop; Specification 3565—fire and water alarm systems, building 3. Great Lakes, Ill., Specification 3458—power house; Specification 3475—three drill halls and two power houses. Boston, Mass., Specification 3477—electric traveling crane for extension to machine shop and foundry building No. 2. Portsmouth, N. H., Specification 3502—two cranes for machine-shop extension. Miami, Fla., Specification 3507—extension to motor test stand. Applications for proposal blanks should designate the schedule desired by number.

North Central States

DETROIT, MICH.—Plans have been prepared for an addition to the plant of the Aluminum Castings Company, Campau Avenue, to cost about $150,000.

DETROIT, MICH.—Plans are being prepared for the erection of an addition to the plant of the Detroit Copper & Brass Rolling Mills, Clark Avenue, to cost about $350,000.

DETROIT, MICH.—The Hudson Motor Company is planning an addition to its plant, 60 ft. by 460 ft., to cost about $60,000. The building, it is understood, will be used for making shells.

LANSING, MICH.—An agreement has been reached between the city of Lansing, the creditors of the Michigan Power Company and Judge Arthur J. Tuttle whereby the city of Lansing will take over the property of the Michigan Power Company and combine it with the municipal electric service.

MANISTIQUE, MICH.—The Manistique Pulp & Paper Company is contemplating extensions and improvements to its plant, involving an expenditure of more than $500,000. The work will be done by day labor under the supervision of H. J. Storer, consulting engineer.

MASSILLON, OHIO.—Work will soon begin on the construction of the addition to the power house of the Massillon Electric & Gas Company on South Erie Street, to cost between $35,000 and $40,000. The extension will be used to take care of the energy received from the transmission line from Canton, which the plant is at present unable to use. The plant which the company was to have built at Bolivar will be erected at some future time.

YOUNGSTOWN, OHIO.—Plans have been prepared by C. D. Cooley & Company, architects, Century Building, Pittsburgh, Pa., for the construction of a bakery for the Youngstown Bread Company.

CONCORD, KY.—Contract has been awarded by the Chesapeake & Ohio Railroad Company to Roberts & Shaefer Company, 332 Michigan Avenue, Chicago, Ill., to build an electric locomotive coaling plant of 500 tons capacity.

MANNINGTON, KY.—The Memphis Coal Mining Company is planning to build a power house and two electrically equipped coal tipples, also to install a number of large motors.

FORT WAYNE, IND.—Preparations are being made for the installation of a 725-hp. boiler in the municipal electric light plant. Contract for the work, it is understood, has been awardéd.

FORT WAYNE, IND.—Contract has been awarded to the Crowell-Lundorff-Little Company of Cleveland, Ohio, for the erection of new buildings for the Pennsylvania Railroad Company in Fort Wayne, to cost about $280,000.

INDIANAPOLIS, IND.—Work will soon begin on the erection of new buildings at Fort Benjamin Harrison, to cost about $2,500,000. An administration building is included in the plans.

PETERSBURG, IND.—The Pike Coal Company, of Petersburg, it is reported, is planning to rebuild its coal tipple and replace machinery recently destroyed by fire.

GREAT LAKES, ILL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 28, under Specification 3550, for construction of two storehouses and power house, to cost about $250,000.

APPLETON, WIS.—The Langstadt-Meyer Company of Appleton has leased the building formerly occupied by the Appleton Motor Car Company and will install new equipment for production of direct-connected electric generating units for shops and farm purposes. The company manufactures electrical appliances, farm lighting systems, etc.

PESHTIGO, WIS.—Contract, it is reported, has been awarded by the Oconto Service Company for the construction of dam to the Jorgensen Construction Company of Denmark, to cost about $25,000.

SHEBOYGAN FALLS, WIS.—Contract has been awarded by the Falls Motor Corporation to the Immel Construction Company of Fond du Lac for the construction of an addition, 120 ft. by 272 ft., one story, at its plant. The company manufactures gasoline engines.

LITTLE FALLS, MINN.—The Little Falls Water Power Company has awarded contract to Siems, Helmers & Schaffner of St. Paul for the construction of a concrete spillway for dam, to cost about $80,000.

ROCHESTER, MINN.—Plans are being considered by the State Board of Control for the construction of a new power plant at Rochester, Minn.

ST. JOSEPH, MO.—Contract for electrical work in the new store building of the Townsend & Uberrheim Clothing Company has been awarded to the American Electrical Company of St. Joseph.

ST LOUIS, MO.—The Polar Wave Ice & Fuel Company is contemplating the erection of an ice-manufacturing plant at 4735 Eastern Avenue, to cost about $200,000. H. G. Clymer, Wainwright Building, St. Louis, is architect.

YORKTOWN, IOWA.—At an election held recently the proposal to grant a franchise for the installation of an electric lighting system was carried.

FREMONT, NEB.—At the request of the National Fuel Administration arrangements have been made whereby the generating plant of the Fremont Gas, Electric Light & Power Company will close down during the war and electricity to operate its system will be purchased from the municipal electric plant.

Southern States

CHARLESTON, S. C.—Contract has been awarded by the Charleston Consolidated Railway & Lighting Company for improvements to its plant to the J. A. P. Crisfield Contracting Company, Graves Lane, Philadelphia, Pa. The proposed work will cost about $750,000 and will include doubling the capacity of the Charlotte Street electric generating station as well as transmission system, etc.

GLENN SPRINGS, S. C.—A charter recently granted the Glenn Springs Corporation gives the company the right to further develop Glenn Springs mineral water property, to construct and operate railways and electric light plants, hotels, etc. The company is capitalized at $100,000. The incorporators are Julian Calhoun and L. W. Perrin, both of Spartanburg.

JACKSONVILLE, FLA.—The Armour Fertilizer Works would like to receive catalogs and prices on direct-current motor and generator supplies, engines, blowers, engine and boiler room supplies, pumps, etc. B. Winford Bahl of Jacksonville is chief engineer.

GREENVILLE, MISS.—Bids will be received by the Black Bayou Drainage District until Dec. 10 for furnishing and installing two drainage pumps with combined capacity of 80,000 gal. per minute against low heads; also supplementary machinery and appurtenances. The Morgan Engineering Company, Goodwyn Institute Building, Memphis, Tenn., has charge of the engineering work.

FAYETTEVILLE, ARK.—The City Council is considering the installation of an electrically driven pump at the White River pumping station.

NEW ORLEANS, LA.—The Crescent Stock Yard & Slaughter House Company is planning to rebuild two cooling plants, machine shop and shipping shed, recently destroyed by fire, causing a loss of about $200,000.

OKMULGEE, OKLA.—Contract has been awarded by the city of Okmulgee for construction of waterworks and sewer systems as follows: For general construction of power house, dam, intake, basins, reservoir, etc., to Tibbetts & Pleasant, Tulsa, at $135,200; pumping machinery, steam-power plant, engine and generator and erection of machinery in power plant to the E. J. Merkle Machinery Company, Kansas City, Mo., at $68,200. The equipment will include two boiler-feed pumps, two 150-hp. water-tube boilers, heaters, one 100-kva. engine-driven generating unit with switchboard. The transmission lines will also be rebuilt. Burns & McDonnell, Interstate Building, Kansas City, Mo., are engineers.

Pacific and Mountain States

HOQUIAM, WASH.—The City Commissioners are considering replacing the gas lamps at each street corner with electric lamps. About thirty-four electric lamps will be installed.

SEATTLE, WASH.—Permit has been granted to the Skinner & Eddy Shipbuilding Corporation for the construction of a power house at 1201 Railroad Avenue, South, to cost about $20,000.

SEATTLE, WASH.—An ordinance is before the City Council authorizing an issue of $1,750,000 for extensions and permanent improvements to the municipal lighting installation. It is proposed to take up the light department warrants, issued to pay for permanent improvements, build the Spokane and Ballard Street substations, pay for the proposed connection of the municipal and the Puget Sound Traction, Light & Power Company's power plants, and to provide a fund to cover extensions for the next three years.

TACOMA, WASH.—The development of a storage basin for the municipal hydroelectric plant at La Grande is under consideration by the City Council. The site of the proposed impounding basin was selected by H. F. Gronen, commissioner of light, and is said to be the only one available of sufficient capacity in the Nisqually watershed. The cost is estimated at $500,000. This additional water will enable the city to double the output of the municipal electric plant. Additional loads in sight for the municipal plant, which it will not be able to handle with its present capacity during the low-water period next year, include that of lighting Camp Lewis, American Lake Cantonment, near Tacoma, which will be taken over No. 1.

FLORENCE, ORE.—Plans are being prepared by the Florence Mill, Power & Light Company, recently incorporated, for a sawmill. The company is capitalized at $30,000.

PORTLAND, ORE.—The Pacific Power & Light Company is installing additional equipment at its reserve power plant in Astoria, consisting of a 700-hp. steam engine directly connected to a 750-kva. generator, increasing the output of the plant to 1600 kva. Orders have been placed by the Hammond Lumber Company of Astoria for equipment for a steam-driven electric generating plant, consisting of Erie City boilers of 1800 hp., a 1500-kw. turbo-generator, a Beyer barometric condenser, a 3000-hp. Cochrane feed-water heater and auxiliaries. The output of the plant will be sold to the Pacific Power & Light Company, and will be distributed by it to shipyards and other industries in this vicinity.

SACRAMENTO, CAL.—All bids submitted for equipment for an electrically driven pumping unit at the city waterworks station have been rejected by the City Council.

SAN FRANCISCO, CAL.—A plan to increase the supply of electrical energy available in this district by 100,000 kw. by an expansion of its present hydroelectric system, and which it is estimated will cost $15,000,000, has been recommended, it is reported, to the War Industries Board by Major George F. Sever, who is investigating power conditions in the West. The project includes, it is said, the completion of the Drum development of the Pacific Gas & Electric Company on the Feather River, the heightening of the dam of the Great Western Power Company at Great Meadows and the construction of an additional power house on the system of the San Francisco-Sierra Power Company on the Stanislaus River at a point where it makes a drop of 1200 ft., and an expansion of the Sheep Rocks project on the Pitt River.

PETERSBURG, COL.—The power house of the National Alfalfa Products Company of Petersburg, between Petersburg and Littleton, was recently destroyed by fire.

Canada

TORONTO, ONT.—The date for receiving tenders for the four 52,500-hp. turbines for the Chippewa-Queenston power development of the Ontario Hydro-Electric Power Commission has been extended to Nov. 1.

MONTREAL, QUE.—Capitalists, represented by M. J. O'Brien of Renfrew, Ont., and Quinlan & Robertson, contractors, are negotiating with the city authorities regarding the establishment of a hydraulic power plant to develop about 40,000 hp. from the Rivière des Prairies, a short distance from this city. The cost of the proposed plant is estimated at about $12,000,000.

ROSTHERN, SASK.—The Water Commissioners are planning to install additional electrical equipment at the power house for lighting purposes.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Nov. 6 for furnishing, under Circular No. 1234, copper wire and cable, electrical supplies and fixtures, conduit, laboratory instruments, etc. For further information address the above office.

Record of Electrical Patents

Notes on United States Patents

1,278,964. Recording Device for Speedometers and Other Purposes; Charles F. MacGill, Cambridge, Mass. App. filed July 26, 1917. Graphic record of speed variations for a motor car; may be made to cover any interval of time.

1,278,966. Circuit Interrupter; Joseph N. Mahoney and Howard G. MacDonald, Wilkinsburg, Pa. App. filed Nov. 28, 1913. Has single, compact operating mechanism which may be installed in front of any two adjacent poles, and also combined accelerating and retarding device insuring rapidly opening circuit breaker free from jars and shocks.

1,278,967. Circuit Interrupter; Joseph N. Mahoney, Wilkinsburg, and Walter M. Austin, Swissvale, Penn. App. filed Aug. 7, 1914. Decreases current in winding of closing, holding and tripping electromagnet of circuit interrupter after contact members of same are engaged.

1,278,982. Control System for Electric Arc Welding Mechanism; Harry D. Morton, Detroit, Mich. App. filed Feb. 21, 1917. Equilibrium is automatically maintained within any desired limit to control rate at which welding strip is fed to arc.

1,278,983. Automatic Arc-Welding Machine; Harry D. Morton, Detroit, Mich. App. filed March 2, 1917. For automatically feeding welding strip or wire into and away from arc of automatic metallic electrode arc-welding machine.

1,278,984. Method of and Means for Electric Arc Welding; Harry D. Morton, Detroit, Mich. App. filed March 2, 1917. Increase and decrease of resistance in welding circuit is not directly dependent on current in welding circuit.

1,278,985. Portable Electric Arc-Welding Apparatus; Harry D. Morton, Detroit, Mich. App. filed March 2, 1917. Automatically welds parts of large structures such as buildings, ships, railroad cars and boilers.

1,278,993. Electrical Coil and Method of Winding Same; Edward F. Parks, Providence, R. I. App. filed March 15, 1917. Scoring or creasing paper or other material provides raised shoulders or fin-like ridges to prevent displacement of wire.

1,278,997. Supporting Bracket for Electrical Instruments; Oscar H. Pieper and Alphonse F. Pieper, Rochester, N. Y. App. filed Oct. 15, 1915. Supply of current to instrument is automatically cut off when instrument is supported on bracket and not in use.

1,279,005. Cooking Apparatus; William F. Roos, Mamaroneck, N. Y. App. filed Jan. 2, 1918. Apparatus may be reversed for supplying either top or bottom heat, and any radiation or waste of heat during parboiling or sweating operation is prevented.

1,279,009. Polyphase Generator with Tuned Spark Gap; Lucien Rouze, Paris, France. App. filed Jan. 8, 1915. Increases number of discharges per second height of sound while maintaining lower frequencies.

1,279,012. Centrifugal Switch; Harold M. Schiebe, Wilkinsburg, Pa. App. filed June 5, 1913. Has reference to starting means for fan motors of the single-phase induction type.

1,279,020. Fuse Device; Edmund O. Schweitzer, Chicago, Ill. App. filed April 21, 1913. Externally controlled fusible cut-out has a casing of insulating material provided with annular terminals and supplementary terminals passing through extremities of casing.

1,279,074. Battery Separator; Frank T. Baird, Blue Island, Ill. App. filed Nov. 19, 1917. Formed by sawing tripoli in its native state into slabs or sheets.

1,279,095. Safety Appliance; Edgar T. Eaves, Rawlins, Wyo. App. filed Feb. 16, 1916. Automatically operates block signal or semaphore to danger position upon breakage of switch points to side-track train from main line.

1,279,111. Dilator; John G. Homan, Steubenville, Ohio. App. filed Sept. 24, 1917. Excites the nerves and stimulates capillary blood vessels.

1,279,113. Electromagnetic Air-Brake Valve; Edward R. Humphrey, Victoria, B. C., Canada. App. filed Feb. 6, 1918. Air for service and emergency application and release controlled by use of only two magnets.

1,279,120. Electrotherapeutical Chair; John H. Kellogg, Battle Creek, Mich. App. filed Dec. 5, 1916. Some electrodes for supporting various portions of body are adjustable relatively to the others.

1,279,146. Electric Furnace; Samuel Peacock, Philadelphia, Pa. App. filed March 1, 1918. Adapted for laboratory and other uses.

1,279,168. Electromagnetic Switch Mechanism; Guy B. Smith, New York, N. Y. App. filed Jan. 26, 1915. Pair of switches effect the operation singularly and selectively by means of single operating magnet.

1,279,178. Telautographic System; George S. Tiffany, Summit, N. J. App. filed May 2, 1916. Movements of receiving pen effected by local source of energy, only work performed by main-line currents being that of controlling these circuit connections.

1,279,179. Candle Socket; Arthur J. Tizley, Brooklyn, N. Y. App. filed Oct. 30, 1916. Few special parts in switch need be manufactured.

1,279,192. Electrode; Frank C. Wheeler, Appleton, Wis. App. filed July 21, 1916. Designed especially for use as an anode in the electrolysis of chloride solutions, although susceptible of use in many other relations.

1,279,204. Headlight; Overton Winston, Minneapolis, Minn. App. filed May 31, 1916. Improved arrangement of contact device in socket and on shank of two-filament electric light bulb.

1,279,244. Protector for the Timers of Automobile Engines; Monna R. Brugman, Windsor, Ohio. App. filed Oct. 2, 1917. To prevent short-circuiting by oil and muddy water splashing on timer and adjacent wires.

1,279,252. Resistance Element; John A. Capp, Schenectady, N. Y. App. filed April 18, 1916. Alloy of iron, nickel and manganese is used.

1,279,256. Conduit Connection; Albert Casper, Vallejo, Cal. App. filed April 17, 1917. Can be readily connected without use of locknuts and may also serve as a closure for knock-out openings.

1,279,279. Secondary Battery; Henry Csanyi, New York, N. Y. App. filed Feb. 27, 1917. Accidental spilling and consequent loss of battery solution is prevented and necessity of frequently refilling cell is obviated.

1,279,280. Secondary Battery Cell; Henry Csanyi, New York, N. Y. App. filed Feb. 27, 1917. To dispense with sulphuric acid or alkali ordinarily employed in battery cells instead of chloride.

1,279,283. Method of and Apparatus for Electrical Distribution; Alfred H. Darker, Blackheath, England. App. filed March 18, 1910. Complicated automatic regulating means in electric lighting systems of constant-current type and constant-voltage type eliminated.

1,279,305. Ignition Tester; John L. East, Jr., Claudell, Kan. App. filed June 19, 1917. Spark plugs can be tested in circuit with timer of motor vehicle before being placed in engine.

1,279,313. Electrical Heating Furnace; Herman V. Finnie, St. Catharines, Ontario, Canada. App. filed May 10, 1918. To treat shells or other tubular structures electrically so that they will be rapidly and uniformly heated.

1,279,321. Electrically Heated Soldering Iron; Benjamin F. Gardner, Chicago, Ill. App. filed Jan. 19, 1916. Accurate automatic regulation of the heat developed is obtained in resistor.

1,279,342. Telephone Disinfector; Louis S. Hershberger, Smithburg, Md. App. filed March 28, 1917. Elements of device are so arranged as not to interfere with operation of telephone to which it is attached.

1,279,344. Burglar-Alarm System; Simon B. Hesse, New York, N. Y. App. filed June 3, 1915. To avoid possibility of defeating system by tampering with circuit-controlling apparatus.

1,279,352. Impulse Transmitter; Alexander E. Keith, Hinsdale, Ill. App. filed Dec. 24, 1917. Use of inherently lubricant material reduces abrasion of various parts of mechanism.

1,279,360. Motor-Control System; Willem C. Korthals-Altes, Schenectady, N. Y. App. filed March 16, 1918. Pilot motor used for varying speed of main motor is promptly brought to rest by dynamic braking action.

1,279,363. Electrical Air Heater; Frank Kuhn and Jay A. Hand, Detroit, Mich. App. filed Feb. 21, 1918. May be placed under hood of automobile to prevent undesirably low temperatures and is protected from overheating.

1,279,364. Portable Cook Stove; Frank Kuhn, Detroit, Mich. App. filed April 6, 1918. Size assures ready portability, and yet full amount of heat necessary to use of ordinary cooking utensils is furnished.

1,279,378. Maximum-Demand Recorder; George D. Pogue, St. Louis, Mo. App. filed Nov. 20, 1917. Simply constructed and does not frequently require services of attendant.

1,279,380. Misfiring-Testing Device for Multiple-Cylinder Engines; Matt B. Thurber, Tecumseh, Neb. App. filed Oct. 21, 1914. Is applied to insulated electrodes of spark plugs in all cylinders except the one to be tested and is also connected with body of engine.

1,279,392. Electrical Distributing System; Vittorio Martinetto, Turin, Italy. App. filed Jan. 4, 1916. Provides total or partial working reserve which is instantly available should sudden failure in transmission of power from main source take place.

1,279,393. Signaling Apparatus; Jesse L. Mayberry, New York, N. Y. App. filed Nov. 30, 1915. Enables driver of automobile to show when he intends to turn to right or left or to stop.

1,279,404. Tire-Wrapping Machine; Howard I. Morris, San Diego, Cal. App. filed Nov. 18, 1916. Peripheral segment of roll-carrying shuttle may be readily removed and replaced for changing tires.

1,279,405. Tire-Wrapping Machine; Howard I. Morris, San Diego, Cal. App. filed Dec. 1, 1916. Means for driving and stopping shuttle facilitate adjustment of tires and increase production.

1,279,415. Electric Lamp; John A. Orange, Schenectady, N. Y. App. filed Sept. 12, 1914. Combination arc and incandescent lamp containing gaseous atmosphere, electrodes being so proportioned that advantages of gaseous atmosphere at relatively considerable pressure in an incandesent lamp may be secured in lamps of very small rating.

1,279,423. X-Ray Target; Carl A. Pfanstiehl, Highland Park, Ill. App. filed Sept. 25, 1916. Disk of polished tungsten is connected with its electrode body of copper so that very rapid conduction of heat will occur between tungsten and electrode body.

1,279,426. Electrical Attachment Plug; Johann G. Peterson, Jersey City, N. J. App. filed Nov. 23, 1917. Means provided for interlocking contacts to prevent their accidental separation.

1,279,427. Electrical Attachment Plug; Johann G. Peterson, Jersey City, N. J. App. filed Jan. 24, 1918. To be used in conjunction with certain types of electrical appliances.

1,279,437. Electric Switch; Arthur E. Read, New York, N. Y. App. filed Sept. 12, 1917. Color of portion of push-button shank visible shows when circuit is open or closed.

1,279,472. Compression-Operated Ignition Device; Warren F. Stanton, Pawtucket, R. I. App. filed Nov. 9, 1916. Adapted for internal-combustion engines, pumps and other devices.

1,279,484. Telautographic System; George S. Tiffany, Summit, N. J. App. filed July 22, 1916. Overcomes difficulty in controlling motor-generator in alternating-current systems.

1,279,489. Telephone-Exchange System; Frederick E. Anderson, Newark, N. J. App. filed Jan. 8, 1918. Relates to systems employing trunk circuits extending from operators' positions of switchboard to chief operators' desks, information and supervisory operators' positions and like positions.

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The Low Cost of Lighting

IT IS a very small part of his cost of living that the householder pays to the electric utility for lighting his home. A report of the National Industrial Conference Board on "War-Time Changes in the Cost of Living" states that from 4 to 6 per cent of the expenditure of the average American wage earner's family is for fuel and light. The bulk of this is, of course, for fuel for heating or cooking, and only a little of it goes for electric lighting. Under conditions in most communities, where the average wage earner would use electricity either for lighting alone or for lighting and simple incidental household uses, the total annual electric bill would be almost lost to sight in comparison with the other items which make up the old bugbear, high cost of living. Even when the toaster and grill, the iron, the curling-iron heater, the vacuum cleaner and the washer are used by milady, the expense is an unimportant feature in the budget. It is the cost of heating the home, cooking meals and washing that is responsible for most of what we find frequently expressed in the statistical compilations as expense for "fuel and light"; and it is therefore confusing, if not misleading, to bring "light" into the compilations in the way that has been done.

In the main the electric utilities have made the increases in rates resulting from higher war costs so that the burden falls upon the large users of energy for power purposes and have refrained from asking the householders to share in it. This practice has not been universal, however, and from the standpoint of equity there is no reason why, if basic rates are fair as between the different classes of users, an increase in the cost of supplying all should not be shared by all. For reasons of policy many of the companies have wisely thought it best to continue domestic rates without advance, thus ignoring the additional cost fairly allottable to the consumers of this class. Naturally, the very small plants having little or no power load cannot do otherwise than raise rates to all if they are to try to offset the heavier operating charges.

Electric central stations may invite with confidence a full investigation into their aloofness from all participation in the unjustified high-cost-of-living visitation which has been inflicted upon the public. They have not got out of their customers as much increase as the increased cost of doing business. They are like the railways in suffering a heavy addition in all costs, but, unlike the railways, they have no single courageous government hand to make an arbitrary increase in all classes of their rates. They have had to prove their case for more adequate rates before the public service commissions and before their communities and individual consumers. They have proved it. They are entitled to credit as efficient public servants for having continued to do business steadily under most trying conditions of operation without taking the unfair advantage which we have seen taken in many industries by predatory corporations and predatory individuals alike. They are not profiteers; they have not lost the discriminating sense of being quasi-public, of holding a position of trust.

Another Phase of Interconnection

WE HAVE repeatedly noted the good effects of interconnection in the case of large hydroelectric systems. Its advantages are so obvious that they would hardly here call for comment were it not for the divers conditions accompanying particular cases and sometimes throwing new light on the economies of the situation. Such an instance is described by R. H. Halpenny in the current issue. The peculiarity of the interconnection with which he deals is that it does not involve the matter of auxiliary steam plants commonly enough found, nor yet the possibility of gain from uniting plants on different watersheds. It is a case confined to economy of water gained through diversity of load. The plants involved are those of the Nevada-California Power Company and the Southern Sierras Power Company, five in number and all situated on the same stream only a few miles apart.

The distribution systems of the two companies, however, are widely different. That of the first-named company is devoted to the service of the southern Nevada mining country. It has about 270 miles (435 km.) of line all told, on wooden poles and operated at 55,000 volts, "Y"-connected with grounded neutral. The second company has a double-circuit steel-tower line 239 miles (385 km.) long and reaching the southern California country around San Bernardino, which represents entirely different load characteristics. The load, too, has grown so rapidly that in spite of hydroelectric power steam reserve is necessary at the peak, which comes at an hour differing materially from the peak on the Nevada load. The situation was met by installing a control station for interchange of power to the extent of 6000 kw. The southern California line is intended to work at 87,000 volts delta or 140,000 volts "Y," although temporarily operated at 55,000.

Experience shows it to be undesirable to connect the lines directly, one being "Y" and the other delta, and the higher voltages for the longer line require transformation in any event. An outdoor transforming plant was therefore installed and has proved its usefulness. It enables the water in this single stream to be worked at best advantage, the necessary plants which supply the load being kept in operation either working directly on their own systems or interconnected so that each may supply the needs of the other. It is an admirable example of the advantages of interconnection as related to the simple issue of varying load conditions on the two systems involved.

American Colleges and the Nation

IT IS a trite remark that a great war cannot be won without fighting. To fight in a great war means to produce and maintain great armies. About four per cent of the soldiers must be officers—that is to say, men who have to assume responsibility—so that an army of a million men needs about forty thousand officers. These officers have to possess not only a considerable amount of general civilian knowledge but also a large amount of technical military knowledge. The amount of necessary technical military and naval knowledge, including all arms of the service—infantry, cavalry, artillery, aviation, staff, ships, drill tactics, strategy, roads, railroads, signaling, communication, supplies, gas, medicine, surgery, law, etc.—is so great that no officer can possibly know more than a small part of it, and each officer has to be, in some sort, a technically trained specialist.

Officers are produced either by promotion from the ranks or by selection and training from civil life. Some of the best officers in the army are raised from the rank and file of the men, but in practice the supply of officers through this avenue is too limited. The bulk of the supply has to come from the colleges, which provide the special preparatory training that is needed in languages, history, mathematics, chemistry, physics and military sciences.

In order to provide an adequate supply of officers for the American army on the present scale of production the government has virtually commandeered the colleges all over the country, so that youths from the high schools may be inducted into the army as privates, entering college on regular pay and subsistence. They become enrolled in the Students' Auxiliary Training Corps and live in college a military life. They sleep in barracks, are bugled to meals and studies and march to regular drill. Their studies are assigned to them at regular intervals, for eight hours a day. This process continues for twelve months in the year. After a certain period those who carry on their training successfully are likely to receive promotion to commissions as junior officers, while those who fail to keep up drop out into other grades.

This militarization of the colleges means for most of them a great change in their habits and modes of thought. The technical colleges undergo the least change, because a relatively small revision of their schedules enables them to prepare their students for the various branches of military engineering. The change is greatest in the classical colleges, where the regular curriculum is necessarily much altered to meet military needs. There is no doubt, however, that the plan of college militarization is adapted to meet the urgent military necessities of the nation.

Some persons believe that the plan of the governmental control of the colleges, now in operation, is destined to survive the war and that the colleges will never return to their original status after the destruction of the Teutonic domination by force and the return to long-sought-for peace. In one sense, at least, this is likely to be true; namely, that the influence of the war training on the colleges is likely to persist and have recognizable effects long after the war is over. We do not believe, however, that the present system will be continued perennially into peace times. The whole world's history will have been so profoundly changed by the war that it is very difficult to foresee clearly what will follow in any country. It is unsafe to prophesy or to dogmatize. It would, however, be very unfortunate to maintain war standards either in education or in manufacture during times of peace. During war time all fine arts and beautiful but unessential things must go into neglect. In the untroubled times of peace, however, any person should be permitted to study at college any subject which he desires to master. A machine-made college course, administered governmentally to all students alike, would be a sad aftermath of war, for the government, the people and the world at large.

Power-Factor Correction

WE PUBLISH this week an article by Will Brown supplementing his former comment with a little closer study of the difficulties and remedies of the power-factor situation. He cites several striking instances of loads extremely bad as regards power factor. They are usually due to underloaded motors, especially in the case where individual drive is carried to such an extreme that many small motors are in operation all normally somewhat underloaded. In such cases the power factor may drop to an astounding extent, in one instance to 35 per cent, and accompanied by a 35 per cent load factor at that. The result is overloading of the generators and of the transformers, to say nothing of occasional trouble on the line. The difficulties at the present moment are enhanced by the trouble in getting a supply of motors of the right sizes, so that their rated output can be properly adjusted to the requirements of the load. Remedial measures consist in the main of using synchronous machines whenever possible with the excitation set to relieve the general power factor and in readjusting so far as possible the load upon motors which prove to be of improper size for their work.

It is not a difficult matter to test general and local power factors so as to find the seat of the trouble in any particular distribution system. Sometimes the evil conditions can be directly traced to a particular point at which they are easily remedied; at other times the difficulty seems to be widespread and demands a good deal of care in investigating local conditions in order to obtain data for remedying the trouble.

Considering the extent to which this particular mischief has grown, there is certainly justification for punitive measures on the part of the supply companies. These companies should, however, take every precaution to avoid bad installations and by friendly coöperation to detect and remedy the bad conditions already existing.

Certainly a plant which is called upon to supply 200 kva. where only 100 kw. is necessary has justifiable cause for complaint, especially nowadays when the limit of capacity is constantly confronting the companies. Whether it will actually be necessary to sell electrical energy for induction motors on a kva. basis may perhaps be open to question, but some general remedial scheme for poor power-factor conditions is assuredly badly needed.

Operation of Joint Pole Lines

IN CASES where distribution lines have to be erected along public ways there is often raised, and with reason, an objection to the duplication of pole lines. These are frequently unsightly and also in many instances unnecessary, and there has been a steady tendency toward joint operation wherever possible. A brief paper by T. N. Bradshaw gives some account of the regulations tending to this end which are now enforced in the State of Connecticut. Pressure has been brought to bear on operating companies of all sorts to utilize joint lines under careful regulation wherever it is practicable, and there are some 1700 miles (2750 km.) of such line now operating in the state referred to. The wires accommodated are those of the electric light and railway companies and telephone and telegraph lines. The main features which have to be looked after in the interests of safety are sufficient vertical clearance space between the several systems and climbing room on one side or the other of the pole line to provide opportunity for making safe and convenient repairs.

A minimum of 40 inches (102 cm.) has been taken as standard clearance in the Connecticut practice; the occupants, however, often prefer to have more. Thirty inches (75 cm.) is required for adequate climbing space. The light and power wires are so far as is possible kept on opposite sides of the poles, and their vertical runs to services keep to their own side. Circuits fairly to be classified as high-tension are better run on separate rights-of-way, and this is generally done. The Public Utilities Commission of Connecticut has promulgated a set of rules and specifications dealing with the matter which seem to have produced very satisfactory results. The gains by joint usage are material both to the community and to the operating companies The former escapes unnecessary duplication of poles, and the latter frequently finds that by thus owning a portion of a complete system the construction costs are materially lower.

Mr. Bradshaw points out in his article an important additional advantage in that the lines thus constituted are in general of rather sturdier construction than usual and hold up better under storms. Furthermore, they are likely to get more frequent inspection and better maintenance.

The Increasing Use of Induction Generators

ANOTHER instance of the admirable engineering in the hydroelectric plants on the Pacific Coast is furnished in the little article by L. J. Moore describing the gain of additional power by special automatic generating stations worked from induction generators. These plants are on the system of the San Joaquin Light & Power Corporation, which was pressed for additional output. The main plants of the company are fed from a storage reservoir secured by a dam 125 feet (38 m.) high. There is at times available at this dam nearly its full head, while when the reservoir is nearly empty the head for the most part disappears. This head due to the dam had not been utilized, the reservoir simply being tapped to supply water for the intake of the conduit lines proper. Now the water thus drawn is to be passed through the wheel of the auxiliary plant supplied with a 1000-kw. induction generator, which is used so far as the head permits, thus saving energy which would otherwise inevitably go to waste.

A second plant of a very similar character and somewhat less than half the capacity has been installed 12 miles (19 km.) down the line to pick up a hitherto unused 45-foot (14-m.) fall. Both plants are operated without governors, using all the water available and working without attendance. There is automatic motor control of the turbine gates determined by the water level in the intake, and provision is made for shutting down the unit in case the plant should be disconnected from the main system. The induction generator lends itself particularly well to this sort of usage on account of the simplicity of its switching arrangements and the ease with which its operation becomes practically automatic. There are many cases in which falls of comparatively modest character can be utilized effectively in this way as an auxiliary to the power house which is charged with the main burden of the transmission work.

The Coming Issues

INASMUCH as curtailment of lighting is a subject that has been before the public frequently since the war began, and because it involves a movement which may be injudiciously carried out unless some guidance is given, some very valuable suggestions by the Illuminating Engineering Society committee on war service will be published shortly. A third installment of Will Brown's articles on how to improve power factor will also be presented. From the Pacific Coast an article has been received relating how one of the hydroelectric companies has rehabilitated its water conduits, water turbines, etc., so as to utilize water power more economically. M. M. Samuels and F. Bechoff, joint authors of articles that have appeared in the Electrical World on safety features in switching installations, will discuss another phase of this subject in an early issue.

Economy of Water Effected by Interconnection

Two Hydroelectric Companies, Operating Plants on Same Stream, Are Interconnected Through a 6000-Kva. Transformer—Difference in Load Characteristics Permits Increasing Total Load with Same Flow of Water

BY R. H. HALPENNY
Electrical Engineer, Southern Sierras Power Company

AT THIS time, when every effort of a nation at war is being made to conserve fuel, it is a patriotic duty as well as a business necessity for every electric power company to give special study to the finding of possible economies. In order that the greatest amount of conservation be possible, it is essential that companies operating in the same or adjacent territory make a study of load conditions peculiar to each with a view toward determining what possible economical advantage is to be had by an interconnection of the systems. There are valleys in the daily load curve of the Nevada-California Power Company that allow the plants operating on that system to deliver 6000 kva. to the Southern Sierras Power Company system through the three-phase tie-in transformer, and to do this without the use of any greater quantity of water than that required by the Southern Sierras plants operating on the same stream.

When two or more companies make use of both hydroelectric and steam-electric generating plants it is often possible to profit by the dissimilarity in the load curves of each company to effect a saving in fuel by the more advantageous use of available excess hydro power resulting from an interconnection of the systems. By such interconnections of their systems various groups of power companies in this country have made possible the use of great quantities of coal and fuel oil for other purposes. A typical interconnected group is that of southern California. The magnitude of the resultant fuel conservation and the extensive character of the interconnection have been presented to the readers of the ELECTRICAL WORLD in the interesting article of R. J. C. Wood in the issue of Aug. 24, 1918.

It is not the intention in this article to deal with the subject of fuel conservation as accomplished by the tying together of a number of large systems. It is proposed instead to describe an interconnection of two electrical systems that makes possible the greatest economy in the use of the same storage water by certain of the generating plants of both systems.

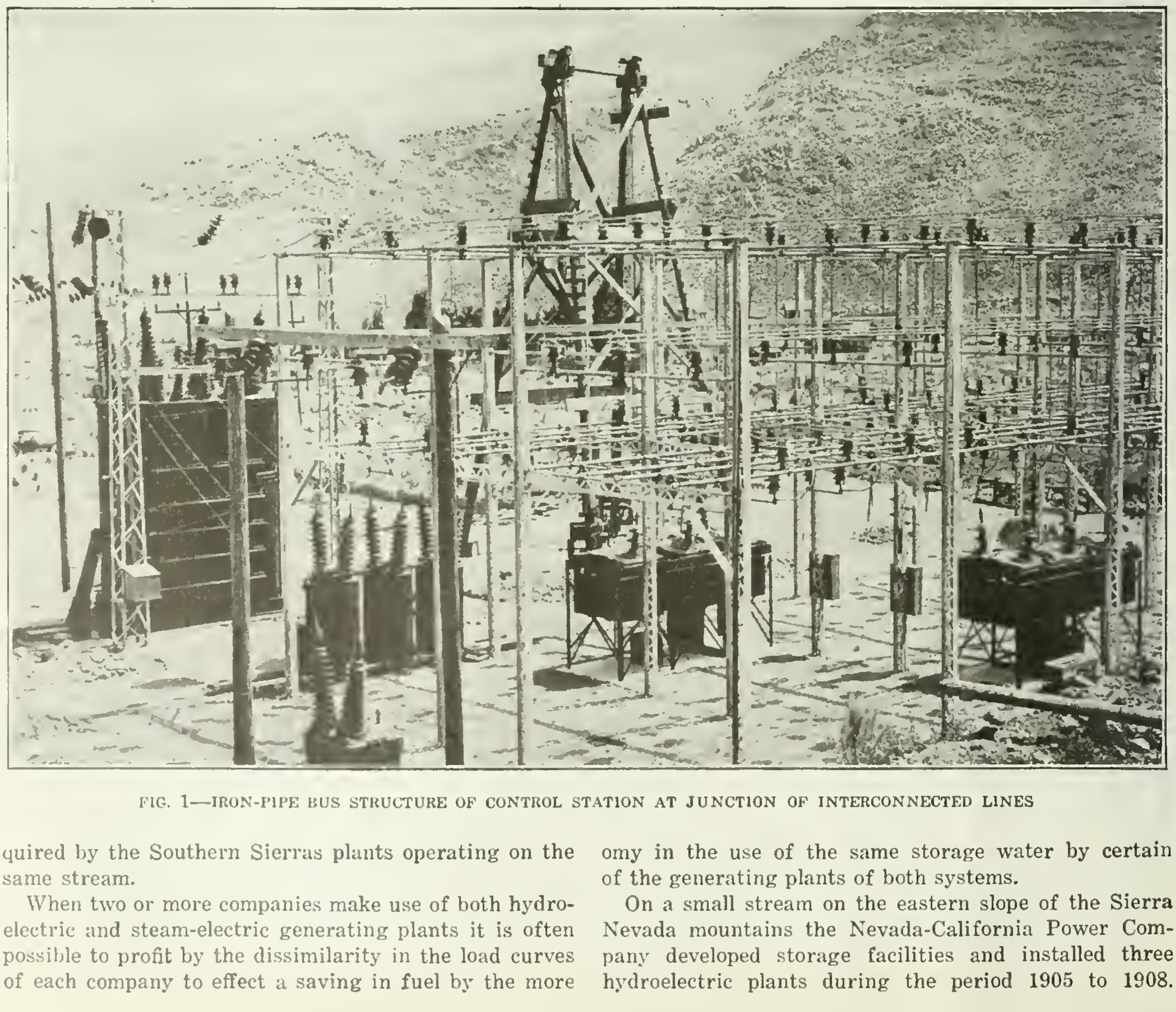


FIG. 1—IRON-PIPE BUS STRUCTURE OF CONTROL STATION AT JUNCTION OF INTERCONNECTED LINES

On a small stream on the eastern slope of the Sierra Nevada mountains the Nevada-California Power Company developed storage facilities and installed three hydroelectric plants during the period 1905 to 1908.

Typical of many streams in the Sierra Nevada range this one, known as Bishop Creek, is served by a watershed of considerable area and has a rapid fall, dropping more than a mile (1.6 km.) in 14 miles (22 km.) of length. The area comprising the watershed is about 39 sq. miles (10,000 hectares) in extent and is made up of three separate run-off areas from which issue the North, Middle and South Forks of the creek. Natural storage sites on the south and middle branches of the creek were utilized, and by the construction of dams a total storage capacity of 21,000 acre-feet (25,800,000 cu.m.) was developed.

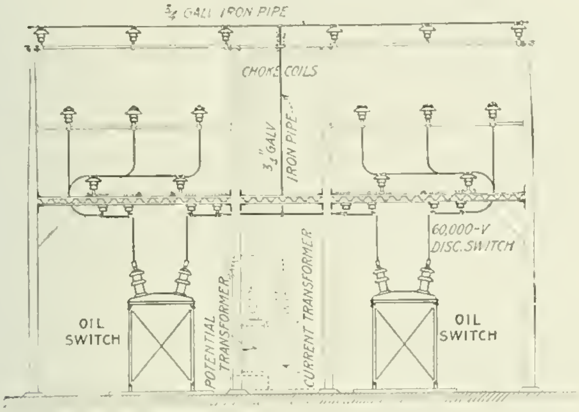


FIG. 2—CROSS SECTION OF OUTDOOR SUBSTATION SHOWN IN FIG. 1

The natural flow of the stream varies from 20 second-feet (0.6 cu.m. per second) to 700 second-feet (20 cu.m. per second) at different seasons of the year, and it is evident from this that storage is essential for the continuous operation of generating plants; in fact, during four months in the year it is necessary to depend on storage water to a very large extent.

Two transmission lines were built into Nevada for the purpose of serving the mining district in and around Goldfield, Tonopah, Manhattan and other southern Nevada mining towns. This transmission system, with a mileage of 270 miles (430 km.), is of wood-pole construction and is operated at 55,000 volts "Y," with neutral solidly grounded at generating stations and substations.

SYSTEMS INTERCONNECTED

During the years 1912-1913 the Southern Sierras Power Company constructed two plants on Bishop Creek, making a total of five plants on the one stream. The erection of a double-circuit steel-tower line 239 miles (385 km.) in length and terminating to the south of San Bernardino, Cal., made possible the transmission of this additional power to an entirely different section of country from that served by the Nevada-California Power Company, and permitted a more complete utilization of the power development.

The design of the tower line is such that operation at 140,000 volts "Y" is possible, although a transmission voltage of 87,000 volts was decided upon as best suited for the period during which a market for the power was being developed. At the time the line was put into service certain conditions made it desirable to operate it for a time at 55,000 volts, and all transformers were accordingly provided with a 55,000-volt tap. By reason of the capacity in synchronous units available at the southern end of the line it has been possible to operate the line up to the present time at 55,000 volts with reasonably good voltage regulation. This synchronous capacity consists of generating units in the reserve steam plant at San Bernardino and synchronous condenser and frequency-changer sets at the end of some of the more important feeders leaving the San Bernardino station, making in all over 20,000 kva. capacity available for regulating purposes.

Since the Southern Sierras system has been operated at 55,000 volts delta and the Nevada-California system at 55,000 volts "Y," with grounded neutral, it was not considered advisable to operate the two systems as one because of the severe strain that would be imposed on the transformers of the "Y" system by a grounded condition of one of the line conductors, owing to the delta-connected transformers of the plants on the other system. In emergencies it has been necessary to switch one of the "Y"-connected plants to the delta-connected system, but this operating condition has been avoided as much as possible for the reason that a heavy ground on several occasions put one or more of the "Y"-connected transformers out of commission if the latter were operating on the delta system at the time.

It has already been stated that there are five plants on Bishop Creek. These plants are known as Nos. 2, 3, 4, 5 and 6, numbering down-stream. The wheels at No. 2 plant discharge into the intake of No. 3, which plant in turn discharges into the intake of plant No. 4, and in this way the water is not allowed to seek the natural channel or creek bed from the time it enters No. 2 intake until it is discharged from the tailrace of plant No. 6, from which point it is given over to irrigating purposes.

It will be evident from the foregoing that the greatest economy would result from the operation of the five plants in such a manner that all the water passing through the wheels of one plant would in turn pass through each of the other plants. This is a condition that it is impossible to maintain with limited forebay capacity and varying loads on the different plants. The load curve of the Nevada-California Power Company systems differs materially from that of the Southern

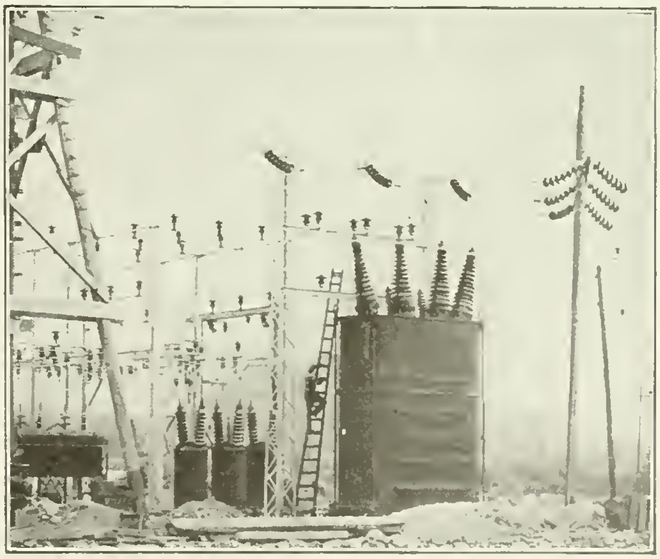


FIG. 3—CONSTRUCTION VIEW OF 6000-KVA. TRANSFORMER. INSTRUMENT TRANSFORMERS AND OIL SWITCHES AT LEFT

Sierras Power Company, and as a result the load demands on the individual plants do not occur at the same periods of the day. The load on the latter system has grown so rapidly that in spite of the addition of the recently completed Rush Creek plant with a capacity of 10,000 kw. it is necessary to make use of the steam reserve plant to handle the peak load. This condition makes it particularly desirable to have some means of connecting the plants operating on the two systems so that any excess capacity of the one group could be utilized by the other system, at the same time allowing each plant to operate at a capacity determined by the amount of water passing through Plant No. 2, the plant furthest up stream.

DATA ON BISHOP CREEK PLANTS OF INTERCONNECTED SYSTEMS

	Capacity, Kw	Elevation, Ft	Static Head, Ft	Effective Head, Ft.	Kw. per Sec.-Ft.
Plant No. 2	6,000	7,100	938	850	55
Plant No. 3	6,000	6,280	814	725	45
Plant No. 4	6,000	5,156	1,180	1,000	62
Plant No. 5	1,500	4,728	438	350	22
Plant No. 6	2,000	4,461	280	20	13

On account of the undesirable condition resulting from a direct tying together of the two systems it was decided to connect the two by means of transformers, this being all the more necessary because of the fact that the voltage of the Southern Sierras system is to be raised to 87,000 volts within a few months. A three-phase, 6000-kva., 87,000-140,000/55,000-volt ("Y") General Electric transformer was recently installed for the purpose of tying the system together, it being the intention to install a second unit of the same capacity in the near future.

Location and Construction of Control Station

At a point near Plant No. 5 is the northern terminal of the tower line referred to above, and it is to this point that it is proposed to bring the lines from all of the hydroelectric plants in that district, making it a control switching station. This center is known as the control station, and it was the natural location for the intallation of tie-in transformer equipment.

Plans for this station provide for two distinct parts, one to operate at 55,000 volts "Y" and the other at 87,000 volts delta or 140,000 volts "Y." The 55,000-volt section has been partly completed, and a brief description will be given. The natural slope of the ground in that locality made it advisable to level off the required area in terraces, and these terraces form a natural division for the two parts of the station. On the upper terrace are the 55,000-volt bus structure and three-phase transformer.

Fig. 1 shows the type of structure and the arrangement of buses, disconnecting switches, meter transformers and oil switches. Unit-type construction has been used, as is the practice of this company in building all of the more important stations. Latticed-steel columns form the upright members of the structure, while 2-in. (5-cm.) iron pipe serves as horizontal supports for the bus insulators and disconnecting switches. Each set of four posts forming one of the structural units is tied together with light fabricated beams, which also carry the pipe supports of the disconnecting switches. The bus is made of 1-in. (2.5-cm.) galvanized-iron pipe with ¾-in. (1.8-cm.) iron pipe risers from disconnecting switches to bus. All of the pipe and steel frame is galvanized.

Fig. 3 shows the partly completed structure and the 6000-kva. transformer. Only a few of the oil switches have been installed. Plans for the completed station provide for two oil switches on each line, so that the lines can be readily transferred to either bus at will. These switches are equipped with remote control; in fact, all of the switches at this station, in both the 55,000-volt and the 87,000-volt sections, will be operated from a 110-volt direct-current bus supplied by storage battery.

The condition of the market at the present time as regards structural steel and electrical construction material has delayed the beginning of work on the new 87,000-volt section of the station. For the present the 87,000-volt lines will be connected to the 87,000-volt single bus of the older portion of the station. A temporary line on wooden poles will serve to connect this bus to the 6000-kva. transformer.

Saving Resulting from Interconnection

The installation of this transformer and the erection of the 55,000-volt section of the station were pushed as rapidly as possible in order to anticipate the seasonal increase of load in August and the months following on the system of the Southern Sierras Power Company. This accounts for the incomplete condition of that part of the station just installed, but does not decrease in any way the gain in available power that the installation has made possible. The water required by the Southern Sierras company is thus used by the Nevada-California company to generate additional energy above its own load requirements, this excess energy being delivered to the former company through the 6000-kva. transformer installed for the purpose. The direct result of this is a saving in fuel oil that would otherwise have to be used in order to make up the power deficit on the Southern Sierras Power Company system. An additional advantage resulting from the interconnection is that both systems have practically acquired 6000 kva. or reserve capacity against the possible temporary loss of a generating unit or plant.

MATERIAL REQUIRED FOR SIX-CIRCUIT STRUCTURE

Seven structural units.
Seventy-two 60,000-volt disconnecting switches.
Twelve three-pole remote-controlled 60,000-volt outdoor-type oil switches.
Eighteen dead-end fittings.
Eighteen ½-in. guy thimbles.
150 pin-type insulators and top clamps (for bus supports).
1400 ft. ¾-in. galvanized-iron pipe (for bus conductor).
550 ft. 1-in. galvanized-iron pipe (for bus conductor).
300 ft. 1¼-in. galvanized-iron pipe (disconnecting switch supports).
1750 ft. 2-in. galvanized-iron pipe (supports).
228 clamp tees.
Thirty clamp crosses.
156 high-tension cast pins.
112 U-bolts.
Sixty pipe caps.

The mileage of the already extensive interconnected system of the southern California companies has also been increased by the addition of the Nevada-California system, which heretofore has had no physical connection with the group. The importance of this additional reserve capacity to all of the companies in the interconnected group has already been demonstrated. On the occasion of the loss of a large generating unit by one of the companies, the completion of the installation just described made it possible for some 5000 kw. to 6000 kw. to be delivered continuously to the company which was in need of assistance, and in this manner a serious power shortage was averted.

The installation of a large transformer in a locality removed some distance from the railway presented some difficulties in transportation and handling. The core of the 6000-kva. unit weighed something more than 36,000 lb. (16,000 kg.), and in order that this piece could be hauled 15 miles (24 km.) over roads that are in only fair condition it was necessary to make a special rig so that the load could be distributed on two wagons, since no wagon in that district was capable of carrying the entire load.

In order to keep the center of gravity as low as possible the core was slung between two trussed beams. These beams were made up of cedar poles and two sawed timbers that were fortunately available. The wagons were trailers that had been used for tandem haul with tractors, and each had a capacity of 10 tons.

INDUCTION-GENERATOR PLANTS IN CALIFORNIA

Two Hydroelectric Plants Under Construction Will Utilize Water Otherwise Wasted—Plants to Be Automatically Operated

BY L. J. MOORE

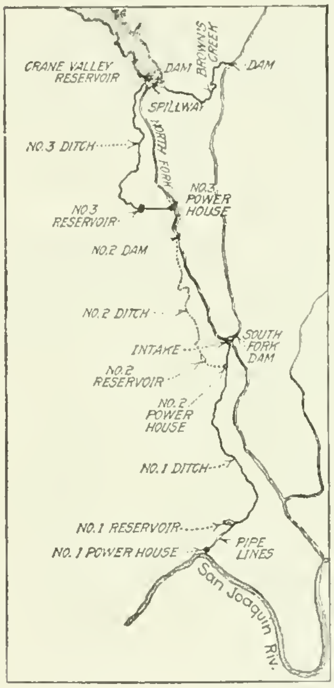
San Joaquin Light & Power Corporation

TWO small induction-generator power houses are being erected in the Crane Valley district by the San Joaquin Light & Power Corporation of Fresno, Cal., developing two small heads of water which have hitherto not been utilized. Induction-type generators were chosen in order to make the plants more or less automatic and thus effect a saving in attendance.

The larger of the two plants is installed at the Crane Valley dam and has a capacity of 1000 kw. at an average head of 100 ft. (30 m.). The present Crane Valley chain of power houses is on the North Fork of the San Joaquin River and is fed by the Crane Valley reservoir, having approximately 45,000 acre-ft. (55,000,000 cu.m.) of storage capacity impounded by the Crane Valley dam a short distance from North Fork. This dam is approximately 125 ft. (38 m.) in extreme height. The head available varies from approximately 118 ft. (36 m.) maximum to a very low value when the storage capacity is practically exhausted. No use has been made in the past of this potential energy, the water simply being released from the reservoir through a tunnel under the dam and discharged into the conduit line to the company's power house No. 3. The conception of the plant was due to the necessity during the past year of making some repairs to the outlet gates from the reservoir into this tunnel. It was then decided to go farther than to simply make repairs, and to install a waterwheel and generator to make use of this available head.

The new plant will when placed in operation act as a regulating valve on the discharge tunnel from the reservoir. A steel pipe 48 in. (122 cm.) in diameter has been embedded in concrete in the lower end of the tunnel and will connect with the inlet of the turbine. The amount of water allowed to pass down this conduit will be regulated by the opening of the wicket gates on the turbine, the output of the generator, of course, varying with the amount of water discharged. The plant will operate without governors because it is necessary for the flow in the conduit to the power house below to be maintained at a constant volume according to the orders from the load dispatcher. A 1740-hp. Pelton-Francis turbine directly connected to a 1000-kw. Westinghouse induction-type generator is being installed at this point.

The second plant is situated at the forebay reservoir of the San Joaquin No. 1 power house, about 12 miles (19 km.) below the Crane Valley dam. At this point there was available an unused fall of about 45 ft. (14 m.) in the conduit to the No. 1 power house where it empties into the reservoir. A wood-stave pipe is being constructed to connect the lower end of the conduit with the reservoir, and a turbine designed for a head of 39 ft. (12 m.) is being installed to discharge directly into the reservoir. The unit consists of a 600-hp. end-inlet Pelton-Francis turbine direct-connected to a 425-kva. induction-type Westinghouse generator. The water from the conduit formerly discharged through a pipe and flume into the reservoir, and no use was made of the fall of the water. This pipe and flume will be retained as a by-pass for the water in case of any trouble in the wood-stave pipe or with the unit in the power house. In the installation just mentioned it is necessary to conduct all of the water in the conduit through the turbine so as to generate every kilowatt possible. Therefore, the unit will operate without a governor, but a reversing electric motor will be connected to the wicket gates of the turbine and be operated from a float at the intake to the wood-stave pipe. This float will be arranged to open or close the gates of the turbine as the water level in the intake rises or falls beyond certain predetermined levels. The motor will also be connected to shut down the unit in case the plant should be disconnected from the main transmission system. A spillway into the by-pass already mentioned is provided at the intake to the wood-stave pipe, so that when the unit is shut down in case of a runaway the water automatically rises and discharges through the by-pass into the reservoir, thus causing no interference with the supply of water to the No. 1 power house.



MAP OF CRANE VALLEY SYSTEM

These plants utilize undeveloped heads of water in a system already constructed and thus provide an additional 1400 kw. to the generating capacity at a minimum of expenditure inasmuch as the conduits and dams were of 10 tons.

already constructed and the additional expenditure required was simply for the generating units, buildings and accessories. Induction-type generators were chosen because of the small amount of switching apparatus required and the minimum of attendance necessary to their successful operation. No operators will be provided in either case. The reservoir tender at the No. 1 forebay will occasionally visit the plant at that location, and the Crane Valley dam tender will likewise look after the plant at the Crane Valley dam portion of the San Joaquin system, in which induction-generator plants are being installed.

Attitude of Central Stations on Rates

Economic Conditions Due to the War Cause Changes in Rate Making—Discussion as to the Extent and Duration of the Changes in Policies of the Companies

This article gives views of central-station officials in addition to those printed in the issue of Sept. 7, 1918, page 445. Bearing directly upon the great question of the effect of companies given below recognize that far-reaching much general interest.

RATE questions will have an important part in the policies of the central stations during the changes which are to be anticipated. The views of officials of companies given below recognize that far-reaching economic changes are possible.

RATE INCREASES AN ECONOMIC NECESSITY

Alex Dow, president Detroit Edison Company, said that the rate increases by electric utilities are an economic necessity, resulting from the high operating costs arising from the war. Without more revenue than they received under the old conditions the utilities cannot continue to render satisfactory service.

ECONOMIC CHANGES TO LAST MANY YEARS

The executive of a large company states to the ELECTRICAL WORLD that he expects the economic changes due to the war will last many years. He doubts if even such recent lighting rate advances as 0.5 cent per kilowatt-hour, on a 7-cent or 8-cent basis, will be restored to the old levels. Coal cost bids fair to remain higher than in 1914, and so does labor expense. Higher rates, relatively, tend to induce more care in use of electricity, to cut down income and make net operating revenues lower. Recently renewed power contracts show bills from 50 per cent to 100 per cent greater in some cases owing to increased cost of coal. This executive is not very optimistic regarding future net revenue prospects.

CONVINCE THE PUBLIC BY DIRECT ARGUMENT

Morse DellPlain, vice-president and general manager Northern Indiana Gas & Electric Company, Hammond, Ind., in replying to the inquiry of the ELECTRICAL WORLD, says:

"I believe that the conditions prevailing at the present time with regard to central-station costs will mean a permanent change in central-station policies as to rate making.

"One feature which present conditions have emphasized is the necessity for making rates, especially those which deal with competitive business, of such a form as to allow enough flexibility to provide for changes in the cost of service.

"In spite of the many arguments advanced by public utilities in favor of basing their rates on the 'value of service,' I believe that, so long as public utilities are privately owned, the general public cannot be convinced that the 'value-of-service' theory is economically sound in so far as a basis for establishing rates for electric energy is concerned.

"The public is getting more and more in the frame of mind where arbitrary rates do not satisfy its ideas in regard to charges for public utility service, and central stations must henceforth place themselves in a position to justify fully any rate which they propose to establish.

"I believe that the only rates which the public will accept as being logical, and therefore justifiable, are those which can be shown conclusively to be based on the 'cost of service.' I would go a step further and say that one of the central-station policies which is responsible for the demand for public ownership of public utilities is our insistence in using the 'value-of-service' theory in making our rates.

"To the general public the 'value-of-service' theory means nothing more or less than an effort to justify a higher return on the capital invested, and no amount of argument can convince it otherwise.

"If we are entitled to a higher return on actual capital invested, and I believe we are, we should convince the public by direct argument. I am convinced that direct argument and honest figures will accomplish far more with the general public than many of the indirect means which appear so popular among too many public utility operators."

INCREASED COSTS NOT FULLY COUNTERACTED

An official of a holding company reports that about one-quarter of the operating subsidiaries have already been granted increases in rates and adds:

"We do not believe that any general rule may be laid down as to the amount of the increase warranted, inasmuch as our properties are distributed and the conditions brought about by the war have affected different localities to a greater or less extent. We have generally found that the rate increases amount to about 15 to 20 per cent.

"The commissions have been inclined to view our applications from a practical standpoint, and as yet we have experienced no serious difficulty in securing the increases already applied for, and we expect to apply for increases on the remainder of our properties as rapidly as the information can be compiled in a proper manner for presentation to the respective commissions having jurisdiction.

"As a general rule the increases which we have secured offset the increase in fuel, and possibly in some instances a portion of the increased cost of labor and supplies, but have not fully counteracted all of the increases in operating and general expenses.

"So far the rate increases which we have obtained have applied to all rates in effect with the exception of rates for municipal service, but not to all classes to the same extent.

"The present emergency will undoubtedly preclude the commissions from giving each rate increase the detailed consideration which they have felt warranted in giving in the past, and undoubtedly if the results of the present increases are satisfactory, this will tend to eliminate some of the extensive investigations that have been previously thought necessary."

Power Load Will Continue Large

George W. McQuilkin, Jr., assistant general manager Central Power Company, Canton, Ohio, expects that the power load of central-station companies will continue to be large after the war. He writes:

"It is my opinion that the present war conditions will not have any effect on the rates and rate-making policies of the central station in the immediate future and in the period after the war. Practically every central-station company of any size is operating from 50 per cent to 90 per cent (the latter being our percentage) of war business.

"It is just possible that the utilities commission will act most promptly in the approval of rates and probably will issue mandatory orders that the central stations must change their rates before facing a deficit of revenue due to the increase in the price of material and labor and principally coal cost.

"It is very probable there is going to be such a large power load on the lines of the central-station companies after the war that future development will be largely confined to residential business. This will be necessary in order to offset the bulk quantities of power that will be wholesaled at low rates."

Increased Rates Do Not Offset Increased Costs

An official of one of the large holding companies, operating a number of properties, says:

"All of our operating electric companies have obtained or are now seeking increases in rates to overcome higher costs in operation. We find that, in almost every case, there is a willingness on the part of the public, or the commissions, to allow some increases, although usually not as much as asked for. The rate of increase varies widely from about 10 per cent to approximately 30 per cent.

"The increases in some places apply to nearly all classes of business, while in others they apply only to the power business. In hardly any of the cases did the increase fully offset the increases in operating costs. In some cases substantial changes in rate-making methods will be the eventual outcome of present conditions. In other cases present methods may continue for some time to come."

Coal Clauses Will Stay Permanently

Fred H. Smith, assistant general manager of the Worcester (Mass.) Electric Light Company, says:

"I do not expect the present level of electric utility rates to go back in general to the pre-war level after the war. They very probably will drop in time to a minimum at least 25 per cent above pre-war rates. I expect that coal clauses will remain permanent features of power contracts and do not anticipate normal coal prices again, measured by 1914 standards. Lighting rates will go pretty nearly back to pre-war bases, in my judgment."

Strength of the Central Station

An interesting forecast of long-lasting economic changes is contributed by the official of a company operating combined hydroelectric and steam plants, as follows:

"It is my opinion that the policy adopted will be determined largely by local conditions. For instance, in our own case we have had for a number of years rates which were exceptionally low for combined water-power and steam generation, and after the war period it is my opinion that our present rates will be sustained for a considerable length of time, or at least until improvements in the art of generation and additional water supply and coal supply can be obtained which would produce a reduction in generating costs sufficient to warrant reduction in price. Economic changes due to the war will cause with us a change lasting for many years in our rate policy. This change with us is manifested principally in power rates, and it is my opinion that throughout the country retail and wholesale power business has yielded the largest increase in rates.

"There have been many economic changes due to the war which I believe will continue for a long period of time. It is my opinion that these economic changes will reduce the power of competitive business to gain any strength to meet the economy and adaptability of electric energy for light and power uses.

"There remains, however, the great field of heating (reduction furnaces) into which as yet the electrical industry has not thoroughly plunged except in certain sections of the country. Whether there will be sufficient development of water power and other generating plants to warrant meeting competition in this field or not is a matter of some uncertainty."

We have not asked for exemption thus far for any employee. We have helped each drafted man to put his affairs in order, and we have recommended and helped into the service men who had not been drafted but who were the type of men that the government asked us to find. We propose to continue along these lines, although we cannot tell how long we shall be able to do so, particularly in view of the changes in the army law. So many men have gone now from all departments, and so many of our highest skilled and ablest men have gone, that we are seriously feeling their loss. But we are proud of all Edison men, both those who have gone to serve the nation directly and those who are serving the nation by sticking to their every-day job—which is not always the easier thing to do.—*Alex Dow, President Detroit Edison Company.*

Power-Factor Correction—An Urgent Necessity

Overlapping of Fall Lighting and Power Loads Together with Fuel Scarcity May Curtail Power Unless Power Factor Is Improved—Causes of Low Power Factor, How to Locate Them and the Proper Remedies to Apply

BY WILL BROWN
Electric Machinery Company

In the last issue of the ELECTRICAL WORLD the writer called attention to the urgent necessity of the producers and users of electricity improving power factor if adequate power is to be expected this winter and if maximum use is to be obtained from equipment. The deleterious effect on the entire electrical system is referred to, and typical examples are given of plants that are suffering because they neglected to consider power factor. This article and succeeding ones will point out how causes of poor power factor can be looked for and removed.

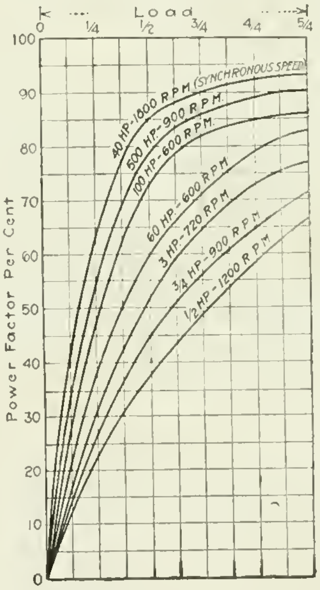
WHILE certain types of alternating-current apparatus are undesirable in point of power factor, they have not been generally developed commercially or if they have they are not used extensively. Therefore the usual cause of poor power factor is not so much the result of poor design as it is of poorly planned installations. This is evident from the fact that most commercially developed induction motors produce a power factor as high as 90 at full load and never much lower than 75 in the smaller sizes and lower speeds. On the other hand, however, if the motors are incorrectly applied to the machines (that is, if the average load is much less than the rated load of the driving motor), the power factor will be considerably lower than it would be if the motor were properly loaded as shown by the accompanying curves. Thus it may be seen that unless careful attention is given to diversity of load in grouping machines and to actual power requirements, very low power factor may result, especially since it is usually the practice to provide a liberal margin of power instead of to depend on the overload capacity for carrying peaks. What is true of induction motors regarding power factor is also true of nearly all alternating-current apparatus—the farther below rated load it is operated the lower the power factor produced. Single-phase arc furnaces are sometimes productive of low power factor even when working at normal rating.

Some engineeers argue that individual drive is best because then motors can be selected for a definite load and can hence be operated at the best power factor as well as the best efficiency. Others maintain that the advantage which can be taken of diversity makes group drive preferable because such a large margin of rating does not have to be provided for peak loads. Each argument has something in favor of it, but it will usually be found that the average load on a well-applied group-drive motor is closer to the motor rating than is the case with an individual-drive motor, so the resulting power factor must necessarily be better for group-drive motors.

The application has a great deal to do with the results, however. Among the principal breeders of power-factor troubles are hoist motors, which draw a large current in starting, and individual drive motors that require large amounts of power in starting and carry fluctuating loads. For instance, with reciprocating pumps it is not uncommon for the load to vary from zero to full load periodically. Meanwhile almost as much current is drawn from the line at part load as at full load.

In textile mills where many small induction motors are driving individual machines there is also apt to be low power factor. This typical example comes from an official of the Titusville (Pa.) Light & Power Company:

> Several years ago as manager of a central station I made a contract with a new silk mill for power at a rather low rate. Instead of group drive, which we thought the mill owners would use, they installed some 350 or 400 ½-hp., three-phase motors, one to each loom. When a loom was started it required very little power to keep it in operation, resulting in a 35 per cent power factor and a 35 per cent load factor during period of operation, fifty-four hours per week.
>
> We ran a special circuit from our plant to a substation at this mill, which was situated close by, and installed in the substation three 100-kva. transformers. When the mill was not in operation and no energy was being used, our instruments showed that the silk-mill circuit was using in capacity and core losses 25 kva., about 5 kva. of which was core loss, the rest being due to the low power factor of the unloaded transformers. As there were some motor-driven fire pumps connected, it was impossible to cut out the circuit during the time the mill was not in operation. Under these conditions this was a very poor contract for us.
>
> This matter was discussed at the 1910 meeting of the Pennsylvania Electric Association. At that time I found no company in this state penalizing a customer on account of lower power factor. Since then I have endeavored, wherever it is possible to do so, to place large power customers on synchronous converters or synchronous motor-generator sets. It is usually possible to do so as most manufacturing plants desire variable-speed motors.



PROBABLE POWER FACTOR WITH INDUCTION MOTORS

Low power factor may also be produced by using direct-connected induction motors to drive low-speed machines like compressors. At Punxsutawney, Pa., for instance, there is a certain railroad shop where four 100-hp. induction motors were driving air compressors. These reduced the power factor at the plant to 65 or 70 per cent, causing considerable trouble owing to insufficient fuse capacity and excessive overload at the power house. These power users have now installed synchronous motors which float on the line and correct the power factor. It would have been much better from all standpoints if the original compressor motors had been of the synchronous type.

Where direct-current power is required it has often been the practice in the past to use direct-current generators driven by induction motors. These always give considerable trouble because of the reactive (wattless) component they produce. The following extract from a report concerning the Jamestown (N. Y.) Light & Power Company describes a case in point:

> There was a certain large power consumer who had ordered a 200-hp. induction motor-generator set. We immediately showed him that he could improve his power factor by installing a synchronous motor-generator set. He changed his order and took a synchronous motor of a larger capacity, which gave a surplus beyond the actual power required and gave a lot of condenser capacity for power-factor correction. We gave him a better rate for this, which made him see that he could afford to pay the additional cost of the motor. He is glad that he made the change.

Line shafts driven by induction motors are frequently responsible for power-factor troubles, because the load is bound to be somewhat variable and the motor must be of ample size to take care of short peaks. Of course, the diversity factor generally allows the motor to be smaller in capacity than would be required for individual motors driving the same loads. Whenever the motors are running underloaded, however, they produce comparatively poor power factor. Examples of this are seen in large rubber factories in Akron, Ohio, and other centers, practically all of which have installed synchronous apparatus of sufficient capacity to counteract the lagging power factor produced by the slip-ring motors on the line-shaft drives.

How Lagging Power Factor Works in a Circle

Lightly loaded transformers introduce considerable reactance in a circuit. Here we can see the effects of lagging power factor working in a circle. When power factor is low, excessive current must be carried and this necessitates larger transformers. These transformers in turn, when lightly loaded at off-peak times, tend still further to lower the power factor on that feeder circuit. Many of these oversized transformers scattered over a system have considerable to do with lowering the over-all power factor.

Regarding this cause of low power factor, the Penn Central Light & Power Company states:

> We have had several cases of trouble with power transformers caused by low power factor, the transformers being overloaded in kva. while the actual output in kw. was far below the transformer rating. We have also experienced some trouble with overloaded lines due to highly inductive loads.

While poor power factor is usually a result of negligence in planning an installation, it is now being caused to a great extent by the inability to secure the right size of motor for an installation. Since the principal problem before manufacturing plants has been to produce quickly, they have installed larger motors than necessary where it was difficult to secure the right size, being willing to invest more money and forego the better efficiency and power factor of the correct motor for the more expedient method.

In other cases poor power factor has resulted because of change of load due to change in use of machines. This has no doubt contributed considerably to the poor factor now obtained, since many plants have changed their business entirely to engage in war service, utilizing their old equipment, but for entirely different duties.

Even those which have not changed their ordinary business may handle such totally different products one month from what they do another that the average loads on the motors, and consequently the power factors, will be considerably altered. The improper use of starting and speed-control devices may also cause poor power factor.

What to Do When Poor Power Factor Is Evident

When it becomes evident that there is a condition of bad power factor something should be done to discover the real sources of trouble. For the central station it is relatively simple to locate the general sources by means of permanently or temporarily installed power-factor meters in the industrial plants it serves. (The Wisconsin Light & Heat Company says: "The power factor of any customer's load, where we have any doubt as to its being maintained at the proper figure, is tested by temporarily installing the necessary graphic power-factor meter.") To locate the individual causes will take more time but will not involve the use of many or expensive instruments. This last task is really up to the industrial plants, although they might be instructed how to conduct tests if they are not well enough equipped with electrical engineering help to undertake them alone.

Plants which have separate feeders to each motor with ammeters, voltmeters and wattmeters, etc., permanently installed on each circuit can determine the power factors of their motors so readily that these will be passed over. Many plants, however, have feeders running to different distributing panels and have no instruments on each individual motor. In such cases portable test sets can be quickly rigged up at small expense and arrangements made so they may be connected in circuit without interrupting service. This detail can be left to each individual's ingenuity, although one or two methods which might be used will be mentioned.

For example, arrangements can be made for clamping test cables to the jaws and hinges of the motor's main switch, and then when everything is in readiness for making the tests the main switch can be opened and readings taken. Instead of clamping the testing cables to the switch jaws, they might be attached to the end contacts of blown fuses inserted in the regular fuse clips. Of course, in such cases fuses rated to protect the motor should be included in the test circuit, and in any case the instruments must be of such size that they will not be injured.

Since load surveys should be made periodically, it would be advisable to arrange the main switches for ready connection of the testing equipment. For the same reason the testing equipment should be assembled permanently in portable form. As power factor is so closely associated with the load factor of motors, it will usually be satisfactory to test only for load to see if it is near the rating of the motor, unless there is some question as to whether the motor is the proper type to use. To obtain records which will be suitable as a basis for making changes, graphic charts should be taken, and preferably over a period which will include all ordinary fluctuations.

Such records will not only indicate which motors are responsible for the poor power factors but will also give a basis for replanning the motor drives. Although at first it may be necessary to select the size of motor on the basis of the power requirements as given by the machine manufacturer, it would be advisable finally to determine the nature and magnitude of the load by careful tests and then readjust the motor drives to agree therewith.

The power factor of other apparatus than motors can be determined in a similar manner.

How to Correct Power Factor

If the poor power factor seems to be due to some inherent characteristic of the apparatus operated, about the only remedy is to have the manufacturer adjust it or else provide some corrective apparatus such as synchronous motors, synchronous condensers or static condensers. When time is limited these remedies are particularly effective, as they may be applied without interrupting service. In view of the fact that synchronous motors can now be used for various applications* as well as power-factor corrective purposes, it is well to bear them in mind when making new installations and decide whether they should not be installed in the first place. Since most cases of poor power factor are due to poorly planned induction-motor drives, the remedy is to make use of load rocords in reapplying them. From such records it can be determined whether individual or group drive is best and which machines should be grouped together. The selection of group or individual drive and the grouping of machines depends on so many factors that they will not be discussed here, but the reader is referred to other articles which have appeared in different issues of the Electrical World. In this connection the writer does wish to emphasize, however, that care should be exercised in selecting the type of motor to use and then so to apply the motors that they will operate as near rating all the time as possible. Sometimes substituting a smaller motor for a large one and equipping it with a flywheel to help carry the peak loads will improve power factor.

Individual motor drive can often be carried too far. There are times when improvement can be brought about by combining a number of machines to be driven from the same line shaft. In some cases a synchronous motor of liberal capacity, either belted or directly coupled, could be installed to drive the line shaft. This would serve the double purpose of providing ample power to carry the load over all peaks and providing additional condenser capacity at periods of light load for supplying magnetizing kva. to the rest of the system. Whatever slight losses or inconvenience might be caused by the belts and shafting would be more than offset by the decreased I^2R losses throughout the plant. The result would be better voltage regulation and possibly a better rate for maintaining higher power factor.

It is interesting to note that numerous plants have been saved from power-factor troubles by the use of synchronous motor-generator sets. Many central-station companies have induced customers to install synchronous motors of sufficient kva. rating to maintain at all times a power factor of 90 per cent leading (or lagging) while driving the direct-current generators.

How to Encourage Power-Factor Improvement

Decreased efficiency itself is not always a sufficient spur to make the plant owner look for a remedy. The possibility of not getting any power at all unless correction is made may wake up some indifferent power users. On the basis that poor power factor is usually caused by underloaded motors another inducement can be advanced—that improving power factor will release equipment to take on new loads caused by growth in business. Possibly a penalty for low power factor is needed to make some factories act. Plant owners would discover that they could put in smaller motors and move the old motors up to larger loads, and thus really save money on original motor costs. They would also obtain a better rate for good power factor. The power-factor penalty clause would not remain as a fixed charge against factory production, but would bring about increased savings both to the power customer and to the central station supplying the power.

As an example of the savings effected by proper changing about of induction motors, the Lockport (N. Y.) Glass Company was able to bring its power factor from 70 per cent up to 88 per cent or better by reason of tests and recommendations made by competent engineers. This plant has made a saving of approximately $2,000 a year in its power bill.

The Department of Public Utilities, Division of Light and Heat, Cleveland, Ohio, makes the following statement:

> We have among our power consumers any number of power plants ranging from 50 kw. to 1000 kw. each whose power factor has been raised from 5 per cent to 20 per cent by our engineering department coöperating with the engineering department of the consumer. This consists in the rearranging of motors and their connections with a view to preventing excessive idle running equipment.
>
> Where synchronous motors can be advantageously used and the consumer can be shown such advantage he is induced to make the necessary expenditure. We find that this practice together with that of inducing the consumer to maintain a high load factor has resulted in a very material benefit to our plant, the average power factor being approximately 86 per cent and our average daily load factor for a year being close to 70 per cent.

The Cleveland Electric Illuminating Company relates the following instance:

> A certain 2300-volt feeder was overloaded and the terminal pressure was low. A 100-kw. load fed through a synchronous motor-generator set was added and the set operated at about 70 per cent power factor leading. The total load on the feeder in amperes dropped to below full load, the kw. load increased 20 per cent, and the pressure came back to normal. The line losses in this feeder were reduced by half, and savings in losses were made between power house and substation as well.

Among the many large central stations now suffering from power shortage due to war conditions the Public Service Electric Company of New Jersey is a typical example. It states its experience as follows:

> We have been making tests of our larger customers' operating conditions, with an improvement of power factor in mind. As showing how this works out in actual practice, a prospective power customer desired 50 kw. for motors. On account of shortage of generating and transmission-

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*For applications to which synchronous motors are suited see Electrical World, March 23, 1918, p. 604.

line capacity, due to abnormal war demands, we could not furnish the power. However, we entered into an agreement whereby the customer would install a 112 kva., 2400-volt, two-phrase synchronous motor to drive the existing 50-kw. direct-current generator, thereby releasing 50 kw. in boiler and engine capacity to be devoted to a single heavy drive. The equipment is now being installed, and our company is satisfied that the 62 kva. to be devoted to power-factor correction will nearly offset the demand required to drive the generator.

Case Where Suggestions Were Not Followed

J. S. Jenks of the West Penn Power Company tells of a certain power consumer whose plant was considerably over-motored. Mr. Jenks himself made an investigation of the plant and found that the ratings of the machines and the motors happened to be so related that if the largest motor were removed and the other motors moved up in succession to larger machines they would be in about the right proportion for the machines they were driving. It so happened that the gear ratios allowed this change. The power company then tried to induce the plant manager to arrange his motors on this basis and to equip his largest machine, a compressor, with a synchronous motor to compensate for the wattless component of the rest of the induction motors when they would be running light. However, since the power company had no penalty clause regarding power factor in its contract, it was unable to do anything with the customer. The power company was forced to put up larger transformers and reinforce its lines in order to carry the reactive component of this load back to the substation, where it was operating synchronous condensers.

Writing Power-Factor Clauses in Contracts

In order not to be confronted with this obstacle to power-factor improvement, many central stations have embodied power-factor clauses in their contracts with industrial plants. The writer has on file scores of such contracts, but the following one only is quoted, as it is typical of the policy companies are now adopting all over the country. This supplement is attached to all power contracts of the Central Illinois Public Service Company:

> The company undertakes to supply the energy called for by this agreement at a power factor of approximately unity, but it will permit under the prescribed rates the use of apparatus which shall furnish during normal operation an average power factor not lower than 90 per cent, either lagging or leading, in the accepted technical meaning of these terms, and the annual maximum demand shall be based on these conditions.
>
> The company shall have the right to make a test at any time and from time to time to determine the average power factor during normal operation, and if it be found on any such test that the average power factor is less than 90 per cent, either lagging or leading, then in such case the annual maximum demand shall be made to cover the added investment in generating equipment, transmission lines, transformers, etc., necessitated by the lower power factor.
>
> In case the consumer by changes in this installation or by methods of operation shall improve his average power factor, he shall have the right, upon serving written notice to the company, to have the power factor during normal operation tested in the presence of his representative, and the company will then base the annual maximum on the results of such test, provided that not more than four tests may be requested in any one maximum-demand yearly period of this agreement.

WORK OF ENGINEERS AT ST. MIHIEL'S HIGHLY PRAISED

Tribute from Major-General Edwards to the Qualities Displayed and the Results Accomplished by Them in the Operation Against Salient

Col. George W. Bunnell, who was president of the Power Construction Company, Worcester, Mass., before leaving for France, and who commands the 101st Regiment of Engineers in the American Expeditionary Forces, has received a letter of commendation from Major-General C. R. Edwards, commanding the Twenty-sixth Division, regarding the part the engineer troops played in the reduction of the St. Mihiel salient in September. This division pushed through practically unknown enemy country from Les Eparges to Vigneoulles, a distance of 14 km., in two days, and in his letter General Edwards said in part:

"In a brilliant dash of this sort the advancing troops are always hailed with the acclaim which they well deserve. The multitude applauds them. But to those of us who know the inside points of the game there comes the thought of those others without whom the success could not have been accomplished.

"The duties of the engineer troops seldom lead to the path of glory. Their labors and the fruits of them are seldom recognized by the laymen. But there are some of us who know of the work which your regiment has done. In this last advance I cannot compliment you too highly on it. The 101st Engineers not only did the pioneer work at the front, which was their specific duty, but also repaired the roads in the rear, which should perhaps more properly be done by corps engineers. Your officers and men repaired roads that were filled with shell holes, wire and other obstacles, roads which in some cases were entirely obliterated. They accomplished their mission in a minimum of time under difficulties which seemed insurmountable. They continued their work day and night, laboring unceasingly under fire, making it possible to carry ammunition and supplies to the troops, that they might hold the ground that they had taken. Without the supreme effort of your regiment our work would have gone for naught."

Readers of the Electrical World will recall that a considerable part of the system of the New England Power Company was designed and built under Colonel Bunnell's direction.

It should perhaps be added that, while General Edwards' tribute applies specifically to one regiment, it is equally expressive of the appreciation our high command feels toward the work of the engineers throughout the American armies in the war zone.

The great business that we are all connected with is really the central-station business. I don't care whether a man be a central-station man or an electrical manufacturer or an electrical jobber or an electrical supply dealer, none of us can build up successfully and permanently his own particular business unless that portion of the business which is fundamental, namely, the production and distribution of electric energy, continues to be a successful business.
—*Samuel Insull.*

Arrangements to Avoid Operating Difficulties—II

Description of the Turbine Room at the New Dayton Plant—Electrical Features Are So Designed as to Assure Great Flexibility of Operation—Switchboard Laid Out on Oval Plan—Novel Characteristic of Lighting Plan

The two 12.500-kw. turbines in the new plant of the Dayton (Ohio) Power & Light Company, which was described in part in the Electrical World for Oct. 19, are of the nine-stage Curtis horizontal type. At 200 lb. (14 kg. per sq.cm.) gage pressure, 125 deg. superheat and 1 in. (25 mm.) absolute back pressure, these machines are guaranteed to have the following economy:

Load (kw.)	Steam per Kilowatt-hour (lb.)
6,250	12.4
9,375	11.95
12,500	12.4

As the station now stands there is room for a 25,000-kw. machine in the turbine room.

The condensers for the two units already installed are of the two-pass Westinghouse surface type. The circulating pumps are set directly on the intake pipes and are driven by a motor on one end of the shaft and a turbine with a reduction gear on the other end, so that a heat balance can be obtained at different plant loadings by throttling or opening the control valve to the turbine and proper use of other motor-driven auxiliaries. Each pump is operated as a separate unit. The air pumps for the condensers are of the Le Blanc type.

The peak load of the company on its former stations was 21,000 kw., but this does not represent the full height to which the peak would have gone had it not been suppressed last winter. A voltage of 6600 was chosen for the generator potential, because so much of the company's load was already distributed at this pressure and because it was such a short distance from the plant to the city. Moreover, the necessity of a transformation to arrive at 33,000 volts for the company's large outlying transmission system would not have been relieved by going to any available standard potential higher than 6600 volts.

The Electrical End of the Station

Each generator is equipped with a compound-wound interpole exciter on the main turbine shaft. In addition to this there is one 100-kw. Westinghouse turbine-driven exciter in the turbine room. This is driven through a reduction gear.

A feature of the electrical end of the turbo-generator is that the main leads are brought out through the base of the turbine into a terminal chamber above the floor level. This makes the leads more accessible. The generator is Y-connected, and the neutral is brought out, but it is not used for any purpose.

The arrangement of electrical circuits has been worked out to give great flexibility of operation. A one-line diagram of these circuits and connections is shown herewith. The generator leads are taken through tile ducts below the floor to the generator oil switch on the first floor of the four-story electrical gallery. From the oil switches the cables go through ducts to the current-transformer pits in the floor and thence will later go to the middle point of the generator reactors, when these are installed. From each end of the reactors they will be taken through disconnecting switches, oil switches and a second set of disconnecting switches to the buses on the second floor. In parallel with each generator reactor is another oil switch for tying the ends of the buses together to complete the ring system when the generator is not in operation.

The bus is laid out in the form of a six-section ring. Three sections are on the north and three on the south side of the station. The feeders are arranged in groups of two, which can be connected either to the north buses or to the south buses through a system of feeder group selector oil switches. To facilitate this arrangement the north and south buses are tapped through oil switches to a common point, where connection is made to feeder oil switches and current transformers. From here the leads are taken through three-conductor, lead-covered cable to the distribution tower outside of the station. The feeder oil switches and current transformers are on the third floor of the electrical gallery.

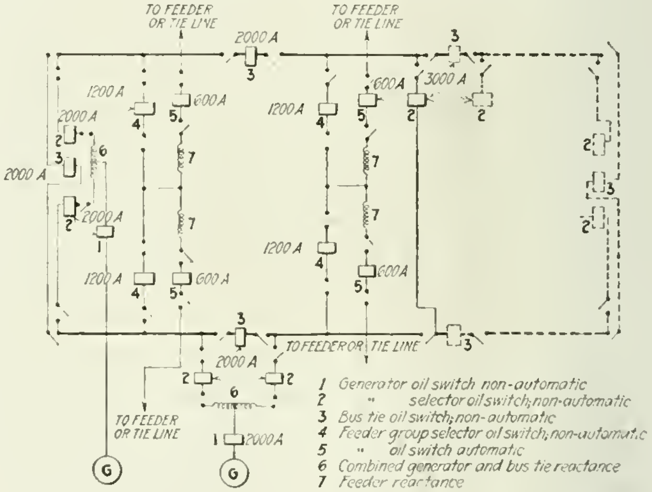


FIG. 1—FLEXIBILITY OF WIRING SHOWN IN ONE-LINE DIAGRAM

All oil switches except the generator switches are provided with manually operated disconnect knife switches on each side. Moreover, all feeders which cross the river on towers are provided with means for disconnections on both sides of the river span, so that this section of the line can be isolated when men have to work upon it. Air-break switches are used for making this disconnection on one side of the river and G. & W. disconnecting potheads are used on the other.

Automatic protection is a feature of the feeder layout. This consists of induction-type, definite-time-limit overload relays and trip free relays. The latter were installed to hold switches in the open position when short circuits which cause the switches to open originally are still on the line at the time an attempt is made to reclose the breaker. Only four sections of the switching equipment described have been installed, but tile ducts and iron conduits for all are in place.

The oil switches are all of the remote-controlled solenoid-operated type. Direct-current energy for operating these switches is supplied from a 116-cell, 160-amp.-hr. "Exide" storage battery which is charged by a 12.5-kw. motor-generator set in the switchboard room. All of the oil switches are non-automatic except the feeder swiches. For the generator oil switch, generator selector switches and bus-tie switches Westinghouse type O-2 units are employed. For feeder-group selector switches Westinghouse type E-8 and for feeder switches Westinghouse type E-6 were installed. Ratings of these switches are given on the one-line diagram.

The generator reactors which are to be installed at a later date are to be of the Metropolitan single-phase type with three units installed for each turbine. When operated as generator reactors these units will provide 4 per cent reactance and when operated as bus-tie reactors they will provide 11 per cent reactance. The feeder reactors are of the Metropolitan three-phase type and are rated at 5 per cent. At the present plant rating this selection of reactors will limit short-circuit current to five times normal full-load values.

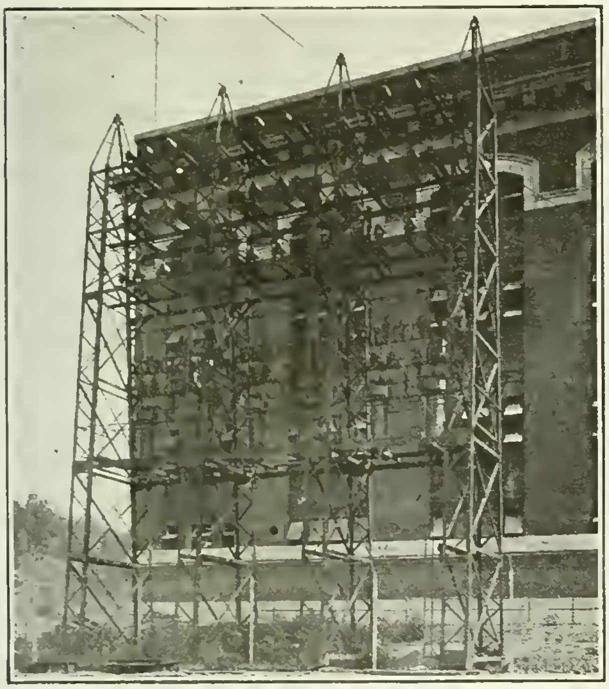


FIG. 2—TERMINAL TOWER AT NEW DAYTON STATION

The operating room, from which a view of practically the entire turbine room is obtainable, is on the third floor of the electrical gallery. It contains four sections of switchboard arranged on an elongated oval. One section is a seven-panel desk board; another is an eight-panel exciter and generator voltage regulator board; another is a ten-panel feeder switchboard; the fourth is a three-panel battery, ground detector and instrument board. This layout provides for the ultimate rating of the plant and is complete except for instruments for machines not yet installed.

The generator desk board is made up for six generator panels and one signaling panel. It controls the main generator oil switches and governor control motor. Besides the usual meters an indicating wattless component meter is used on each of these panels. On top of the desk of this board is a miniature bus with small lamps to indicate the switches on the ring bus.

On the base of the control panel is a set of signal lamps working in conjunction with signal pedestals at the turbines. These bear such signals as "stop," "shut down," "slow," "fast," "O. K.," etc. The switchboard operator also has manual control of the load sign in the boiler room, which is operated in conjunction with a bell and lamp signal each time he changes the setting.

The feeder board controls sixteen feeders, the bus-tie oil switches and feeder group selector switches. CO induction relays are used on each feeder. On the tie lines with other stations are watt-hour meters with ratchets to check the interchange of energy.

In a room adjacent to the turbine room is a seven-panel auxiliary exciter board on which rheostats and similar apparatus are installed to eliminate the necessity of carrying heavy direct-current leads to the switchboard room.

On the three-panel battery and instrument board are installed temperature indicators for all turbines, ground-detector lamps for all six buses, a graphic voltmeter and a graphic frequency meter, together with switches and circuits for the storage battery.

Station light and power is supplied through two banks of transformers. Each bank consists of three delta-connected units used for power purposes and one unit equipped with a low-voltage induction regulator for lighting. Provision has been made for another similar bank of power and light transformers in the ultimate layout. Arrangement has been made for automatically switching over a number of emergency lights at vital points around the station to the storage battery in case of failure of the usual alternating-current supply. The

INFORMATION REGARDING IMPORTANT APPARATUS

BOILERS, STOKERS, ETC.	
Type of boiler	B. & W. cross-drum water-tube
Steam-making surface (sq.ft.), per boiler	13,730
Pressure for which boilers are designed, lb. per sq.in.	225
Superheat, deg. Fahr.	100
Type of stoker	Taylor
Floor space occupied by each boiler and stoker, sq.ft.	640
Coal	West Virginia high volatile
Capacity bunker, tons	975
Yard storage, tons	100,000
Locomotive crane	McMyler Interstate
Coal hoist	Mead-Morrison
Boiler-feed pumps	Platt-Sturtevant centrifugal
Feed-water heater	Platt open-type
Heater capacity (lb. per hour), each	500,000
TURBINES	
Type and make	Horizontal Curtis (General Electric)
Rating (kw.), each	12,500
Steam pressure, lb. gage	200
Floor space covered by unit, sq.ft.	415
CONDENSER	
Make	Westinghouse
Surface, sq.ft.	15,000
Circulating pump	Westinghouse centrifugal
Air pump	Le Blanc
Condensate pumps	Turbine-driven centrifugal on same shaft with air pump
MISCELLANEOUS	
Two fire pumps	Platt pumps driven by Sturtevant turbines
One No. 18 Peterson oil filter.	
Two 500-cu.ft. Chicago Pneumatic Tool Company air compressors.	
One 300-gal.-per hour Vater water softener.	
GENERATOR AND OTHER ELECTRICAL EQUIPMENT	
Make	General Electric
Rating	Three-phase, 60-cycle, 6600-volt, 12,500-kw.
Crane, make and rating	75-ton Whiting
Oil-switch equipment, switchboard and lightning arresters	Westinghouse

central station was designed by T. E. Murray, consulting engineer, New York. W. Weissenberger, Jr., of New York was architect. Among the contractors were the Kenn-Well Company of New York and the United States Structural Company of Dayton, Ohio.

The operating staff of the Dayton Power & Light Company consists of F. M. Tait, president and general manager; O. H. Hutchings, associate general manager; Thomas F. Kelly, commercial manager; O. B. Reemelin, general superintendent; C. H. Spiehler, engineer of power stations; J. K. Himes, superintendent of distribution, and R. D. Gillespie, chief engineer.

Joint Usage of Poles—A War Economy[*]

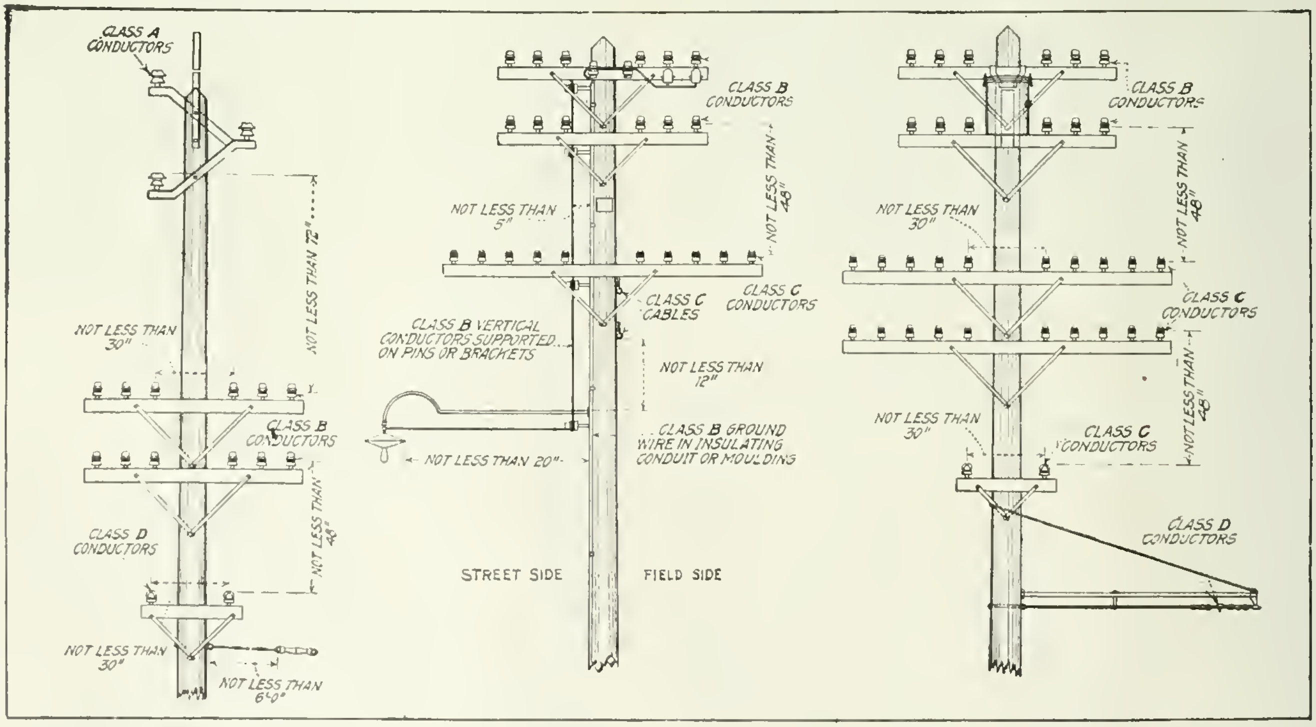
Statement of the Civic, Economic and Safety Advantages Resulting from the Adoption of This Practice—Opinions Regarding the Form of Construction Which Should Be Employed in Carrying It Out

BY T. N. BRADSHAW

Chairman of Committee Which Drafted Connecticut Rules on Joint Usage

TWO or more lines of poles erected on the same side of the street or highway are not only unsightly but represent an economic loss and a waste of timber. Where the wires on such conflicting lines are carried at or near the same level a serious electrical hazard to persons or property is liable to be created owing to the proximity of the wires of different classes and the liability of contact between them or the possibility of employees working on one class of wires coming in contact with another.

The most practical way of eliminating the losses and hazards referred to in connection with lines located on the same side of the street appears to be a properly constructed joint-use line having a well-defined space for the wires and fixtures of each occupant. These spaces should be separated from one another by an ample vertical clearance space. They should also be provided with a suitable climbing space so that employees of the various companies using the poles can ascend and descend them without coming in contact with the wires through which they may have to pass.



RELATIVE POSITIONS OF POWER, SIGNAL AND TROLLEY WIRES ON JOINT POLES ADVOCATED BY CONNECTICUT COMMISSION

A wide experience covering a number of years with lines constructed as outlined above seems to indicate that the clearance space should be not less than 40 in. (102 cm.) vertically between signal wires and attachments and electric light or trolley-feed wires and attachments. Experience also shows that a climbing space of not less than 30 in. (76 cm.) wide on either the back or field side of the pole is necessary in order to provide for climbing and for the raising or lowering of transformers. It is, of course, preferable to provide a greater vertical separation than 40 in. between signal wires and wires carrying high voltages, and many companies endeavor to have this space not less than 6 ft. (183 cm.) particularly with new lines, using the minimum clearance of 40 in. only on old lines that are made joint after the line has been in service for some length of time.

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[*] Paper presented before International Association of Municipal Electricians, Atlanta, Ga., Sept. 23-27, 1918, by A. L. Pierce.

The street side of the poles should always be reserved for the vertical runs of the electric light or power wires, and the field side for the vertical runs of signal wires. Owing to the fact that there is no known protective device that can be placed on a signal circuit that will afford adequate protection against the potentials carried on high-tension circuits, it is not considered advisable to place telephone, fire-alarm or other signal circuits on the same poles with such circuits. High-tension lines should wherever practicable be constructed on rights-of-way remote from those occupied by the signal lines. (By high-tension circuits are meant the following: Constant-potential, alternating-current, neither side grounded, exceeding 5000 volts; constant-potential, alternating-current, one side or neutral grounded, exceeding 2900 volts to ground; constant-current, series-metallic, line current exceeding 7.5 amp., and constant-potential, direct-current circuits including feeders and trolley-contact wires, one side grounded, exceeding 750 volts to ground.)

Pole lines located on the opposite sides of a street or highway are not considered as conflicting, but the same precautions should be observed, when erecting separate lines of poles, regarding the relative levels of the wires of different classes. That is, electric light or power wires should be carried on a taller pole line and the signal wires carried on a shorter pole line. This will enable electric light service wires crossing the streets to be carried over the telephone wires, and telephone wires from the opposite side of the street to be carried under the electric light wires. This practice prevents the interlacing of the service wires, which is liable to be a serious problem in congested streets.

In order to bring about the conditions outlined in the foregoing it is necessary to have some form of inter-company agreement covering not only specifications and methods of construction and the reservation of space requirements but also a fair division of the construction and maintenance costs. In Connecticut the matter is helped along by fair-minded legislation, and the Public Utilities Commission of Connecticut has promulgated in its Order "D" docket,† No. 1447, a set of rules and specifications under which most of the wire-using companies of the state have been operating for some time with very satisfactory results.

Since most of the lines in Connecticut have been placed on a joint-use basis and the construction standardized there has been a marked decrease in the number of fatal accidents to the employees. This is undoubtedly due to the fact that employees working on signal circuits no longer have to climb through electric light wires in order to get at their own work, and the electric light wires are generally placed so far above the signal wires that electric light employees are not apt to come into contact with grounded conductors of another class while working on high-voltage wires.

There is another feature which appears to make joint use preferable, particularly in cities and towns where there is considerable local distribution; that is, that the city or town is more completely covered by the pole lines of the two companies, and many companies have reasoned that it is better to own one-half of all the poles in a locality rather than to own all of one-half the poles.

In order to insure the success of any joint-line arrangement, particularly where electric light and signal lines are to occupy the same poles, the broadest possible coöperation must be indulged in between the various occupants for eliminating inductive interference. Electric light lines should always be kept free from grounds that might upset the electrostatic balance to ground, also long single-phase taps from three-phase circuits should be avoided wherever practicable. The voltage wave developed by the generators should be as free as possible from noise-producing harmonics, and consideration should be given this fact before the generating machinery is purchased from the manufacturer. Deviation from the pure sine wave should not be allowed to exceed the limit set by the American Institute of Electrical Engineers. These precautions are quite necessary in connection with electric light or power circuits, because it is not always possible to transpose telephone lines, for instance, so as to eliminate all inductive interference. In many instances it has been found necessary to place transpositions in the electric light or power circuits to coördinate with those in the telephone circuits.

In Connecticut alone there are approximately 1700 miles (2700 km.) of pole lines used jointly by electric light and telephone or other signal lines. Practically all of this joint line mileage is standard as regards location of the wires and vertical or lateral separation, so that it is fair to say that the joint-use line is, under proper regulation, a success, simplifies the distribution problem and works toward safety.

While it is sometimes more expensive to erect a joint line, the cost to each occupant is usually less than a separate line or poles would be. The maintenance costs are also less because of this division of the charges. The lines appear to stand up better under the influence of severe storms because of the fact that such joint-use networks are usually much better guyed or braced than a single line would be. Moreover, such lines receive more attention from the engineers in order to make them satisfactory to all parties concerned.

The conservation of coal is vital, for fuel and food will win the war, it is claimed. The conservation of coal by mining it more carefully and completely is important. But vastly more important is the conservation that comes of more scientific application and more efficient utilization, because coal in the ground is coal only, whereas coal at the point of consumption is fuel, plus labor and transportation costs and complications, and thus is of far higher intrinsic worth. Every available heat unit should be used now on the score of economy, on the score of conservation, and to reduce the congestion of the railroads and lighten their burden as much as possible.—*J. F. Christy, before the Arkansas Public Utility Operators.*

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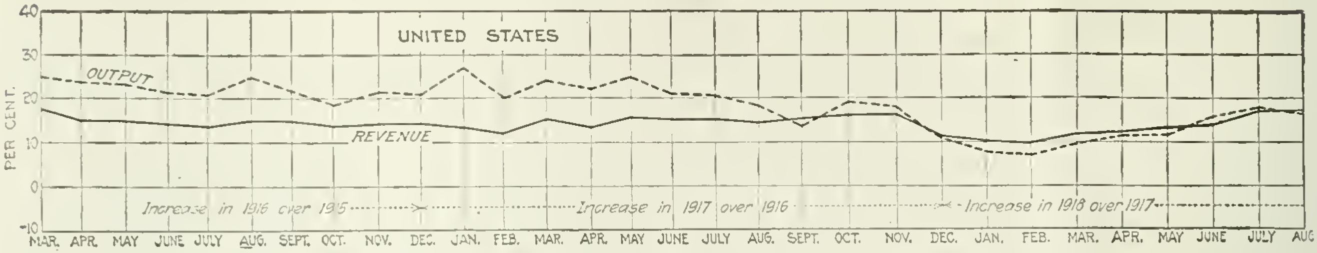
†Can be obtained by addressing secretary of commission, Henry F. Billings, whose address is Hartford, Conn.

Central Station August Operations



THE AUGUST RETURNS SHOW ANOTHER LARGE INCREASE OVER THE PREVIOUS YEAR

CENTRAL-STATION returns for August show another large increase over the record for August, 1917. There is a slight falling off in the percentage of gain in both revenue and kilowatt-hour output, as compared with July, but when the increase is 17 or 18 per cent a small difference of 1 per cent does not count seriously. The increase in revenue over August, 1917, was 17.9 per cent; the increase in kilowatt-hour output was 17.3 per cent. These statistics are based on the reports of 46 per cent of the total industry. Undoubtedly the epidemic of Spanish influenza has delayed the returns somewhat.

That the electric central stations still continue their production of energy on so enormous a scale is, of course, the conspicuous feature of the returns. To show in each of two consecutive years an increase of 17 or 18 per cent over the corresponding month of the previous year in the height of summer is abundant evidence that the industry is going at top speed to meet the war needs of the nation.

It will be noted that the lines of percentage of increase in revenue and kilowatt-hour output, which have crossed several times in the last year, have again crossed in the August returns received up to this date. Now, after several months, the rate of increase in revenue is greater than the rate of increase in kilowatt-hour output. Attention has been called repeatedly to the changes and tendencies in the relative position of the two items. The change is so small that it would be difficult to draw any accurate conclusions from it.

Based on the return from 46 per cent of the industry, the ELECTRICAL WORLD estimate for August for the entire industry is: Revenue, $38,671,000; output, 2,413,480,000 kw.-hr.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Industry Represented	Revenue from the Sale of Energy			Kw.-Hr. Output		
		1917	1916	Per Cent Increase	1917	1916	Per Cent Increase
Aug.	63	$22,718,000	$19,972,000	13.8	1,451,928,000	1,223,373,000	18.7
Sept.	63	23,861,000	20,896,000	14.3	1,376,370,000	1,219,117,000	13.8
Oct..	62	25,748,000	22,334,000	15.4	1,522,149,000	1,279,140,000	19.5
Nov.	62	26,665,000	23,183,000	17.0	1,485,370,000	1,292,113,000	15.7
Dec..	58	28,144,000	25,026,000	12.4	1,517,001,000	1,362,299,000	11.0
		1918	1917		1918	1917	
Jan..	62	27,035,000	24,977,000	8.2	1,508,353,000	1,422,121,000	6.3
Feb.	60	24,690,000	22,307,000	10.6	1,254,217,000	1,168,288,000	7.1
Mar.	60	25,396,000	22,702,000	12.3	1,418,222,000	1,294,561,000	9.4
Apr.	60	25,864,000	22,966,000	12.6	1,450,221,000	1,297,843,000	11.5
May	62	25,365,000	22,426,000	13.1	1,537,527,000	1,372,935,000	11.9
June	60	26,070,000	22,599,000	15.3	1,531,099,000	1,319,444,000	16.0
July	56	21,935,000	18,559,000	18.2	1,370,461,000	1,156,692,000	18.5
Aug.	46	17,789,000	15,086,000	17.9	1,110,201,000	946,246,000	17.3

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States			Percentage of Industry Represented	Pacific and Mountain States		
			1917	1916	Per Cent Increase		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase
REVENUE	Sep........	64	$2,811,000	$2,362,000	19.0	64	$9,139,000	$7,963,000	14.7	53	$7,232,000	$6,177,000	17.1	87	$4,636,000	$4,355,000	6.4
	Oct ...	64	3,057,000	2,530,000	20.7	66	10,683,000	9,173,000	16.5	52	7,422,000	6,304,000	17.8	85	4,586,000	4,327,000	6.1
	Nov......	64	3,391,000	2,834,000	19.7	65	10,159,000	8,873,000	14.5	52	8,454,000	7,063,000	19.7	84	4,661,000	4,410,000	5.9
	Dec......	64	3,483,000	2,999,000	16.1	58	10,834,000	9,949,000	8.8	48	8,935,000	7,464,000	19.7	82	4,892,000	4,614,000	0.6
			1918	1917			1918	1917			1918	1917			1918	1917	
	Jan....	63	3,393,000	2,990,000	13.8	64	9,677,000	9,517,000	1.6	53	8,862,000	7,639,000	16.8	86	5,113,000	4,831,000	5.8
	Feb.......	62	2,995,000	2,272,000	8.0	57	9,473,000	8,658,000	8.6	53	7,779,000	6,746,000	15.3	84	4,443,000	4,131,000	9.5
	March.....	62	2,985,000	2,724,000	9.2	59	9,904,000	8,922,000	11.0	53	7,947,000	6,735,000	18.0	84	4,560,000	4,321,000	5.5
	April.....	62	2,890,000	2,578,000	12.1	59	10,054,000	8,946,000	12.4	53	8,431,000	7,103,000	18.7	84	4,489,000	4,339,000	3.5
	May.....	62	2,810,000	2,530,000	11.5	64	9,929,000	8,613,000	15.3	53	8,217,000	6,956,000	18.1	83	4,805,000	4,327,000	12.0
	June......	63	2,925,000	2,584,000	13.3	63	10,048,000	8,761,000	14.7	49	8,124,000	6,824,000	19.0	84	4,973,000	4,432,000	12.2
	July.......	62	3,037,000	2,511,000	20.9	62	9,278,000	7,961,000	16.5	42	4,998,000	4,116,000	21.4	88	4,622,000	3,971,000	16.4
	Aug...	59	2,965,000	2,428,000	22.1	48	7,569,000	6,633,000	14.1	27	3,452,000	2,818,000	22.5	73	3,803,000	3,207,000	18.5
			1917	1916			1917	1916			1917	1916			1917	1916	
KW.-HR OUTPUT	Sept.......	64	114,339,000	92,319,000	24.0	64	482,112,000	405,070,000	19.0	53	399,480,000	345,953,000	15.5	87	379,221,000	374,685,000	1.4
	Oct.......	64	121,666,000	94,853,000	28.5	66	589,242,000	472,619,000	24.5	52	417,018,000	351,713,000	17.0	85	394,223,000	359,955,000	9.6
	Nov.......	64	130,311,000	108,561,000	20.0	65	532,301,000	445,537,000	19.6	52	443,374,000	384,480,000	15.2	84	379,384,000	357,535,000	6.1
	Dec.......	64	135,703,000	111,342,000	21.8	58	548,316,000	486,368,000	12.7	48	437,264,000	367,534,000	12.8	82	395,518,000	377,058,000	4.8
			1918	1917			1918	1917			1918	1917			1918	1917	
	Jan.....	63	125,212,000	111,339,000	12.4	64	477,200,000	466,158,000	2.3	53	486,291,000	453,009,000	7.3	86	419,651,000	391,624,000	7.3
	Feb.......	62	110,454,000	102,562,000	7.7	57	438,721,000	403,122,000	8.3	53	358,276,000	342,257,000	4.5	84	346,766,000	320,025,000	8.4
	March....	62	121,518,000	111,576,000	8.9	59	501,320,000	452,250,000	10.8	53	398,166,000	356,860,000	11.5	84	397,218,000	373,875,000	6.2
	April.....	62	117,416,000	101,888,000	15.2	59	497,460,000	431,786,000	15.2	53	437,054,000	392,304,000	11.4	84	399,126,000	372,465,000	7.1
	May.....	62	121,751,000	105,601,000	15.3	64	512,202,000	455,977,000	12.3	53	441,202,000	404,560,000	9.0	83	462,372,000	406,797,000	13.6
	June	63	125,809,000	103,292,000	21.8	63	527,773,000	461,396,000	14.4	49	423,439,000	366,382,000	15.5	84	454,078,000	388,374,000	16.9
	July.......	62	135,960,000	105,373,000	29.0	62	518,566,000	439,464,000	18.0	42	254,189,000	216,296,000	17.5	88	461,746,000	395,559,000	16.7
	Aug......	59	135,979,000	107,001,000	27.1	48	438,592,000	379,111,000	15.7	27	169,482,000	148,006,000	14.5	73	366,148,000	312,128,000	17.3

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

PROTECTING LAGGING ON SOOT-BLOWER PIPING

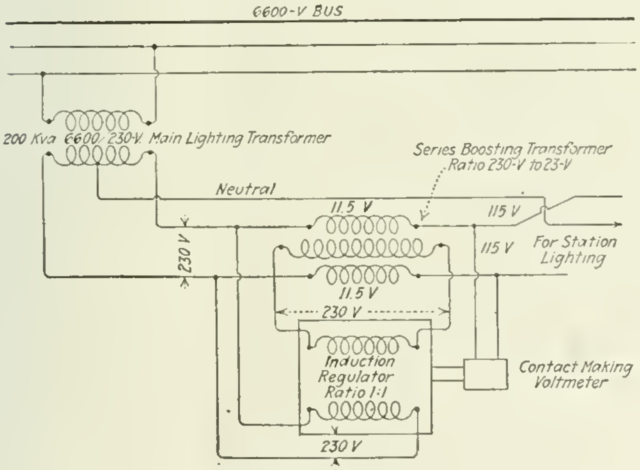
Usual Covering of Magnesia and Duck Supplemented by Galvanized Iron to Give Greater Permanence to Job

Sometimes when the side doors in a boiler setting are opened the flash of flame which comes forth is sufficient to burn the cloth covering from the magnesia which surrounds the adjacent soot-blower steam piping. The result is that the covering becomes very unsightly and the magnesia soon begins to drop from the pipes, leaving them uninsulated. Without a covering on the pipes condensation of the steam will occur, and this is undesirable in blowing soot. To eliminate this trouble the Dayton (Ohio) Power & Light Company in its new power house at Miller's Ford has covered all pipes adjacent to the doors with galvanized iron. The sheet metal is applied after the magnesia and duck are in place.

HOW TO REDUCE COST OF STATION REGULATOR

Shifting Unit Into Lower-Tension Network Accomplishes the Desired Purpose at Less Expense than Purchase of New Instrument

Conditions with the Dayton (Ohio) Power & Light Company made it seen necessary to regulate the voltage on circuits supplying station lighting in the new power house at Miller's Ford. To keep from buying a high-voltage regulator to operate at the generator potential of 6600 volts the scheme of connections illustrated here was worked out. From the 6600-volt bus these circuits were taken through the 200-kva., 6600/230 and 115-volt transformer which fed all station lighting circuits. In the outside lines of the three-wire secondary of this unit was connected a series boosting transformer with a ratio of ten to one, the high-voltage winding being designed for 230 volts and the low voltage for a total of 23 volts, 11.5 volts in each half. The high-voltage winding of the boosting transformer receives from 0 volt to 230 volts from one winding of a low voltage one-to-one ratio induction regulator, the other winding of the regulator being energized from the outside lines of the secondaries of the main 200-kva. transformer. Connections to the contact-making voltmeter as shown completed the job. The unit is now operating satisfactorily.


6600-V BUS
200 Kva 6600/230-V Main Lighting Transformer
Series Boosting Transformer Ratio 230-V to 23-V
Neutral
11.5 V
115 V
115 V
For Station Lighting
230 V
11.5 V
230 V
Induction Regulator Ratio 1:1
Contact Making Voltmeter
230 V

REGULATOR ARRANGEMENTS MADE TO AVOID BUYING HIGH-VOLTAGE UNIT

GROUND PLATE PLACED UNDERNEATH LINE POLE

Eliminates Necessity of Digging Additional Hole for Ground—Method of Connecting and Protecting Ground Lead

To eliminate the necessity of digging an additional pole for ground plates, the Binghamton (N. Y.) Light, Heat & Power Company has adopted a standard method of placing the plate underneath the pole. When the pole line is constructed the hole is dug slightly deeper than necessary and a copper ground plate 22 in. (56 cm.) by 16 in. (40 cm.) is dropped into it. A copper wire wound spirally is soldered to the plate and connected to the neutral of the line. This method eliminates the digging of an additional hole at least 6 ft. (1.8 m.) deep and provides a permanent ground for the pole as well as the line. For about 8 ft. (2.4 m.) above the ground the wire is protected by a wooden molding, which helps to prevent the wire from being broken by teams or boys.

PROVIDING FOR OVERLOADS WHILE AWAITING DELIVERIES

Rotary Converter Floated Between Overloaded Alternating-Current and Direct-Current Generators to Take Advantage of Diversity Factor

To carry a peak load of 425 kw. to 450 kw. with only 375 kw. in generating equipment has been the problem of the Pascagoula (Miss.) Street Railway & Power Company of late. Part of the load is direct-current and part alternating-current, and separate generators are used for each system. As a result each unit had to care for its own peak loads and could not be helped out by the other unit in times of stress. Both the alternating-current and the direct-current loads were of a highly unsteady character, creating high peaks, so it was believed that if some means was provided for exchange of surplus power between the alternating-current and direct-current generators considerable advantage could be taken of the diversity factor. Consequently a 150-kw.

rotary converter was connected between the two machines (150 kw. a.c. and 225 kw. d.c.).

While several engineers who had heard that this scheme was being considered did not believe it would give satisfaction, the results have been all that could be desired, according to L. J. Fohr, manager of the property. Unlike the case where the alternating-current switches of a rotary converter are opened and direct current allowed to feed back, it is possible with this system to feed energy through the converter in either direction without causing a runaway because the speed is governed by the frequency of the alternating current.

Signs of trouble are being watched for, but it is expected that this arrangement will tide over the period until the company can install an additional 500-kw. unit which it is now preparing to put in.

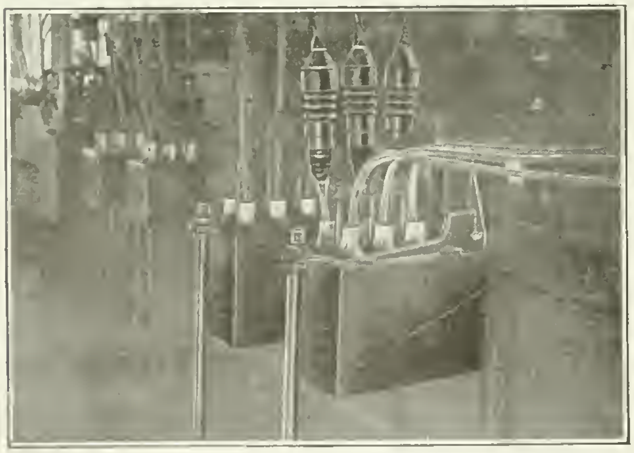
UTILIZING POTHEADS AS OIL-SWITCH "DISCONNECTS"

Disconnecting-Type Potheads Between Main Station Bus and Oil Circuit Breaker on Feeder Circuit Solve Space Problem

BY R. P. HINES

In a central generating station used for furnishing power to coal-mining operations in Kentucky the oil circuit breakers on the 4000-volt, three-phase feeder circuits were originally installed without any knife-blade disconnecting switches or other means of disconnecting the leads on either the bus or the load side. There is a common 4000-volt bus into which the alternators feed and whence the feeder circuits are taken.

After the initial installation it was desired to provide some means to disconnect the leads of one of the feeder-oil circuit breakers from the 4000-volt bus. The first indication was to provide the usual single-pole knife-blade type disconnecting switches for this purpose, but further investigation showed that there was insufficient room to make a satisfactory installation of this type of switch, and there were also obstacles to providing sufficiently rigid supports.



DISCONNECTING POTHEADS PROVIDED TO TAKE PLACE OF DISCONNECTING SWITCHES OMITTED

It would only be required to disconnect this oil circuit breaker from the bus, in case of trouble making it necessary to repair it, so that the operation of the means employed to disconnect it would be only at infrequent intervals and not a part of the daily routine operation of the station. The G. & W. Electric Specialty Company disconnecting type of potheads were finally installed as a possible solution of the problem. They were selected on account of their small size, simplicity and ease of installation and operation, and they have thus far served as a satisfactory solution to the problem involved in this particular case.

STANDARDIZING THE RATING OF ROLLING-MILL MOTORS

Would Permit Bids Being Made on Common Basis, and Motors Could Be Designed to Best Advantage if Steel Mill Engineers Agree

Standardization of steel-mill motor ratings, so that one motor will not be called a 5000-hp. motor in one place and a 10,000-hp. (short-time rating) in another, is very much needed, said K. A. Pauly before the Association of Iron and Steel Electrical Engineers recently. This would help the steel men to compare bids on motors offered by different manufacturers.

Up to the present time it has been the practice for manufacturers to rate motors for different lengths of time and for various maximum temperature elevations. Mr. Pauly advocated using the single-standard continuous rating allowing 50 deg. C. rise, as provided in the Standardization Rules of the A. I. E. E. Further advantages of standardizing ratings are that with a common understanding of what is meant by the horsepower rating on a motor nameplate engineers will have more confidence in the size of motor advocated for any certain mill and that there will thus follow naturally a tendency toward standard capacities. In opposition to a lower temperature rise such as 35 deg. C., which has been commonly used for steel-mill motors, the author said that these motors are really worked up to a 50 deg. C. rise, but that from 5 to 15 per cent more output can be obtained from the same material if the motor is designed for a 50 deg. temperature rise instead of for 35 deg. rise and operated at overload. It is further pointed out that steel-mill engineers will soon become accustomed to the new "names" for motors and there is good reason for using A. I. E. E. standards for the new horsepower rating.

This paper was discussed by about eighteen persons, fourteen of whom favored a standard rating and five of whom went on record as ready to adopt the A. I. E. E. method of rating as proposed by Mr. Pauly. No one offered valid objections to the proposal, so it will probably be formally adopted in the near future.

J. E. Fries pointed out that a statement of the maximum torque developed by the motor may be put in specifications, but that such additions need not interfere with the single standard of temperature rise for continuous load. It was pointed out that insulation of coils does not often break down because of temperature rise, but rather owing to insufficient bracing and to dirt.

D. M. Petty suggested the appointment of a committee to draw up formal statements for the standard rating of steel-mill motors.

Some of the others taking part in the discussion were H. H. Craiglow, W. B. Snyder, Gordon Fox, H. C. Crank, D. W. Duncan, Brent Wylie, T. E. Tynes and R. B. Gerhardt.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

PAYING DEMAND-METER INSTALLATION EXPENSE

Conditions Sometimes Exist Under Which Customers Will Be Glad to Stand This Burden if Properly Approached

When a Middle Western central station began to install demand meters on its larger industrial customers' installations it found quite frequently that services were taken into the premises from two or more widely separate points. To rearrange the wiring so that the total instantaneous demand could be measured on a single meter meant a considerable expenditure. The company did not feel that it could afford to go to the expense of making the change. At the same time it realized how much to the benefit of the customer it would be if the change were made. To induce the customer to pay for the change in this wiring, therefore, was the problem.

In most cases the difficulty was cleared up by measuring the demands on the separate services and presenting a bill based on the total of the separate readings, together with an explanation of the reduction which could be made if the owner would change his wiring so that the demand could be measured at a single point to give him the advantage of his load diversity.

FREE RENEWAL OF FUSES DISCONTINUED IN HARRISBURG

Pennsylvania Utility, in Addition, Makes Charge for Visit of Troubleman to Consumer's Premises to Renew Fuses

The Harrisburg (Pa.) Light & Power Company has recently adopted a new policy in connection with the distribution or renewal fuse plugs. It had been the practice of the company to renew fuse plug burn-outs without charging. This free renewal has been discontinued. Moreover, where it is necessary for the company's troubleman to visit the customer's residence for the purpose of installing fuse plugs, a service charge of 40 cents is made to cover the visit and the installation of one fuse with a charge of 10 cents for each additional fuse installed. Fuses called for at the office by consumers are now sold for 10 cents each, instead of 5 cents, as before.

This innovation has had an immediate effect in reducing the number of trouble calls for fuse installation, while the revenue derived from the necessary calls which are still being made, and paid for, is taking care of the troubleman's time and putting him on a self-supporting basis. Special pains are being taken to instruct the consumers how to install fuse plugs in order that they may take care of their own burn-outs, and it is believed that it will not be long before most Harrisburg householders will provide themselves with extra fuses so as to be prepared to take care of any trouble which may develop. There will then be no call on the utility to send a man when it is simply a case of unscrewing a burned-out fuse and putting in a new one.

SHORT EXTENSIONS ARE FINANCED BY CUSTOMERS

Elmira Company Borrows $11 per Short Extension at 6 per Cent Interest—Loan to Be Returned as Soon as Securities Can Be Placed on Market

The problem of line extensions during war times has in most instances been solved where long extensions were to be made. Short extensions, merely connecting a service on existing line, also require capital, and the expense involved may easily run into a good many hundreds of dollars in a short time. The Elmira (N. Y.) Water, Light & Railroad Company has found a way of obtaining the required money by applying a customer-financing method to even the small extensions.

Each prospective customer is approached frankly and told of the conditions faced by the utility in war times and of the necessity for having financial assistance wherever extensions are required. It is pointed out that utilities must refrain from issuing securities at the present time unless authorized to make an issue and that consequently funds are not available for line extensions. It is further shown that the increased costs of labor, materials, fuel, etc., have reduced the net income to such an extent that financial assistance must be had from prospective customers.

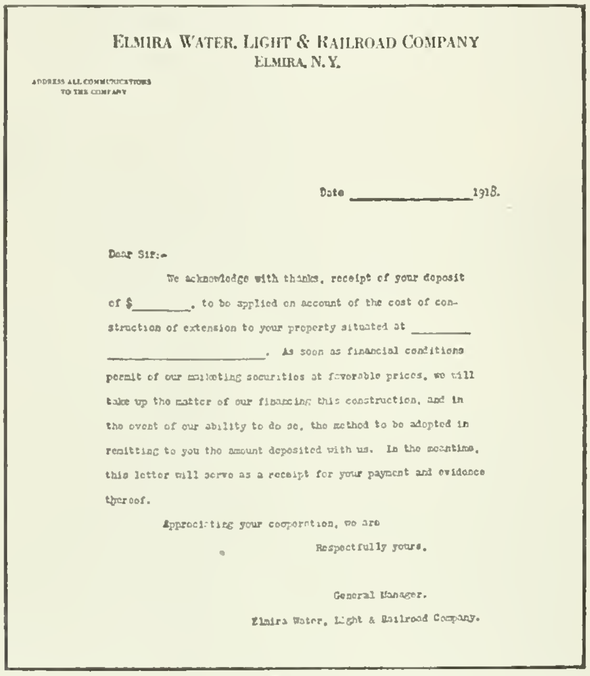
However, the customer does not pay for the line but only lends the necessary money at 6 per cent for such time as the company needs it. The company guarantees to recall all of the outstanding certificates that it has issued and refund the total amount of the money that has been advanced with interest added. Care has been taken to impress upon all customers this fact that they are not buying or paying for the service, but are merely assisting the company in financing the purchase of the necessary material and labor. The company does not refuse to run any extensions, but points out to the customer that unless financial assistance is rendered the company will not be able to make the extension until some other way has been found to finance the proposition.

Where it is necessary to extend the wires a distance of 300 ft. to 500 ft. the company first finds out from the line department what the cost of these extensions will be. On ordinary service, however, where the secondaries run right up to the house the company has been asking the consumer to advance $11. This has been found to be about the average cost of service during the months of June and July. Prior to that time the cost was a trifle less, the increase being due to the gradual advance in the cost of material and labor.

Should a prospective customer point out that it is impossible for him to advance the cost of the extension, he is then asked to go to the bank and borrow the money, and this has been done in some instances.

The Elmira company has been wiring about 100 houses a month this year, and in each instance the customer has been asked to assist in the service construction. Almost always he has advanced the money.

It was also found necessary to impress upon all employees the necessity for taking this step so that they can speak intelligently on the subject to any one. In addition, each of the electrical contractors in the city and surrounding counties has been notified what the company is doing so that no consumer will have his house wired without being absolutely familiar with the conditions of connection to the company's mains or secondaries.



ELMIRA WATER, LIGHT & RAILROAD COMPANY
ELMIRA, N. Y.

ADDRESS ALL COMMUNICATIONS
TO THE COMPANY

Date ______________1918.

Dear Sir:-

We acknowledge with thanks, receipt of your deposit of $________, to be applied on account of the cost of construction of extension to your property situated at ______________________. As soon as financial conditions permit of our marketing securities at favorable prices, we will take up the matter of our financing this construction, and in the event of our ability to do so, the method to be adopted in remitting to you the amount deposited with us. In the meantime, this letter will serve as a receipt for your payment and evidence thereof.

Appreciating your cooperation, we are

Respectfully yours,

General Manager.

Elmira Water, Light & Railroad Company.

CERTIFICATE OF RECEIPT FOR MONEY ADVANCED BY CUSTOMER

NEW SERVICE RULE BOOK NOW IN USE IN PITTSBURGH

Duquesne Light Company Issues Pamphlet for Consumers Who Are Likely to Make Changes in Their Equipment

A few months ago the Duquesne Light Company of Pittsburgh issued to the local wiring contractors and architects a service rule book. The book was not intended to be given to customers as a matter of course, but only to such users of the company's service as would be likely to have changes made in their equipment. At first the books were numbered in order to keep track of where they went, but it was later found that the work thus involved was too much and the numbering was discontinued.

In introducing the book the company makes the following statement to electrical contractors, architects and customers: "The following deals with the relation between the company and those parties who design, install and use systems for interior wiring, and gives the practice of the company in the form of rules and regulations as far as practicable. In any case where the rules and regulations are thought restrictive, the installation department will be glad to give the case individual consideration. Inspectors from the installation department will render assistance in the case of meter locations, service, etc."

The book tells where to apply for service and what systems for distribution are available in the different districts. Charges for services both overhead and underground in the different districts are made clear.

CUSTOMERS TO PAY EXCESS OVER 1914 COST ON LINE EXTENSIONS

Original Customer Refunded Normal Cost by Company at Rate of $20 per Additional Customer, and 90 per Cent of Abnormal Cost by New Customers

A new system of service charges has been adopted by the Alliance (Ohio) Gas & Power Company, effective Nov. 1, for residences and commercial loads of 5-kw. rating and less. This applies in any instance where the company is required to make an expenditure (1) for the installation or construction of additional or specific overhead lines on streets, alleys, highways, rear lot and side lot lines, including poles when necessary, and usual equipment, wire, lightning arresters, line switches, ground wires or connections, or for any work on existing poles with all of the attendant equipment for increasing the existing distribution system or transmitting direct to the applicant's premises; (2) for transformers wherever installed, excepting only standard service transformers, and (3) for construction on applicants' premises exclusive of overhead service loops, meter and any overhead or underground construction on rear or side lot lines as already described.

The applicant is required to deposit with the company an amount equal to the estimated cost of the work done upon the understanding that the work constructed shall remain the property of the company. However, a refund to the amount of the estimated cost of this work, except construction on applicants' premises, as of July, 1914 (called normal cost), will be made to the depositor at the rate of $20 for each customer's installation connected to this work within ten years. This refund shall not exceed the amount of the normal cost and shall not be payable unless written notice is given by the applicant to the company of the consumers' installations connected to this work. No interest is allowed on the amount deposited. Furthermore, the company has the right to refund at any time all or any part of the unrefunded portion of the normal cost of the work.

Moreover, each additional customer on this line connected within ten years of original contract date shall pay one-tenth of the cost of this construction above the normal cost at the time of filing his application for service, which amount shall be refunded to the original depositor until nine-tenths of this abnormal cost shall have been refunded, when such collections from applicants and refunds to depositors shall cease.

The Alliance company is a Doherty property, and it is stated that other Doherty properties in Ohio will probably follow this method, which has received the approval of the Ohio Public Utilities Commission.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Load Division Between Synchronous Frequency Changers Operating in Parallel—I.—QUENTIN GRAHAM.—The paper treats of the fundamental elements that must be considered when two or more synchronous frequency-changer sets are to be operated in parallel.—*Power*, Oct. 8, 1918.

Practical Construction of Diagrams of Operation for Three-Phase Asynchronous Motors with Short-Circuited Rotors.—J. DAMIEN.—The author's endeavor is to simplify the diagrams referred to by reducing to a minimum the number of factors of which the preliminary determination is necessary in this construction, and thus to make the employment of the diagrams immediate and rapid without recourse to complicated formulas or to remote factors such as the coefficient of distribution, the ratio of transformation, etc. His method, while not absolutely rigorous, is practically applicable.—*Revue Générale de l'Electricité*, Sept. 7, 1918.

Current Distribution in Polyphase Commutator Armatures.—T. SCHMITZ.—Investigations are made of the distribution of current in polyphase commutator armatures for simple and double sets of brushes. It appears that with the double set of brushes there are in general two groups of conductors carrying different currents. Formulas are given to calculate the currents in the conductors in terms of the current supply to the brushes, and the space distribution of the two groups of conductors is determined. The latter depends on the angle between the brushes and differs for the cases of an even or odd number of phases. Expressions are also obtained for the reactance voltage of the armature. The results obtained are applied to several examples and collected in tables.—*Science Abstracts, Section B*, Aug. 31, 1918. (Abstracted from *Elektrot. Zeits.*, 39, April 25, 1918.)

Lamps and Lighting

Incandescent Electric Lamps.—ALBERT TURPAIN.—An exhaustive and well-illustrated study of the history of the incandescent lamp and its development up to the present time. The following are some of the author's divisions of his subject: The carbon-filament lamp and its perfectionment; the theory of radiation; the metallic-filament lamp and its perfectionment; the construction of a bulb for the metallic-filament lamp; the filaments, including half-watt filaments; measurement and output, including lamps with carbon, Nernst, Tantalus, pressed-tungsten, drawn-tungsten and half-watt filaments; photometry; characteristic curves, and formula for ascertaining the cost per candlepower-hour.—*La Technique Moderne*, July, 1918.

Naming of Optical Glasses.—W. ZSCHOKKE.—Describes the developments which have taken place in the production of glass for optical purposes. The paper concludes with a table giving the dispersion at various parts of the spectrum for the different glasses produced at the Sendlinger works.—*Science Abstracts, Section A*, August, 1918. (Abstracted from *Zeits. Instrumentenk.*, 38, April, 1918.)

Effects of Gases and Metallic Vapors on Selenium of the Hexagonal System.—W. E. TISDALE.—It has been shown that the various light-electrical properties of selenium crystals of the hexagonal system may be altered by subjecting them to the action of different gases. The effect of the gas seems to be more detrimental the higher its atomic weight. The effect of making crystals in gases is little different from making crystals in vacuum and then subjecting them to gas. It is pointed out that the effect of metallic vapors is to form a conducting film on the surface that may under certain conditions give an apparent light-negative action to crystals that are normally light positive.—*Physical Review*, October, 1918.

Electric Force in the Mercury Arc.—C. D. CHILD.—The electric force in the mercury arc increases as the density of the vapor increases. It is approximately a linear function of the density of the vapor, but does not become zero when the density is zero. The temperatures of the mercury arc were found to be higher than those usually ascribed to it.—*Physical Review*, October, 1918.

Generation, Transmission and Distribution

Clean Coal.—In a report submitted to the National Research Council on the problem of better utilizing our coal resources, the J. G. White Company says that the elimination as far as possible of slate and other ash-forming impurities in coal before delivery to railroad cars will prevent serious economic waste in its utilization and transportation. These wastes may be briefly summarized as follows: (1) Reduction in heating value of coal due to presence of ash. The presence of ash in coal not only reduces its heating value but as the percentage of ash increases the percentage of combustible lost with the ash also increases, thus greatly reducing the boiler efficiency and hence lowering the economic value of the coal. (2) Increase in coal consumption for a given power. The reduction in boiler efficiency greatly increases the amount of coal that must be purchased to produce a given amount of work. This is a direct financial loss, since the consumer is not only paying for unnecessary ash but is losing good fuel which is carried off through the boiler grates with the excessive ash. (3) Influence of high ash on boiler capacity. The presence of excess ash seriously reduces the boiler capacity, because sufficient coal cannot be burned on the grates to do the necessary work. This is possibly the effect which is felt most seriously by the consumer, inasmuch as he finds it impossible to get sufficient steam from his boilers to do the work demanded of them and is compelled either to reduce his output or purchase additional boiler capacity. (4) Increase in transportation equipment due to high ash. About 85 per cent of all the coal mined in this country is carried by the railroads, hence unnecessary ash means an unnecessary task given to the railroads. Each per cent of avoidable ash adds to the work of the railroads about 5,000,000 tons of unnecessary freight per annum. Some shipments of coal contain 18 or 20 per cent non-combustible. Such coal requires 65 per cent more cars and locomotives than a reasonably clean coal of say 10 per cent ash.

Steam-Boiler Regulation and Control.—Albert A. Straub.—That the proper handling of the damper for controlling the draft for steam-boiler furnaces is of great importance is brought out in this article. Charts showing the variation in the temperature of gases escaping from the boiler and of the steam pressure are shown, each indicating a condition of damper control.—*Power*, Sept. 24, 1918.

Power-Plant Management.—Robert June.—This is the second of a series of articles by the author on power-plant problems, dealing particularly with coal and its selection. The author outlines data which would be given consideration in making up specifications for the purchase of coal.—*Central Station*, September, 1918.

Some Factors in Fuel Economy in Boiler Plants.—Robert H. Kuss.—In this paper data are given showing the amount of coal used under stationary steam boilers, in railway locomotives and in household furnaces. The author gives an idea of the relative efficiency attained in burning coal under these three different conditions. It is pointed out that the greatest possible saving should be made in connection with boiler plants under the control of technical engineers. He discusses particularly considerations connected with the proper draft.—*Journal A. S. M. E.*, October, 1918.

Hydroelectric Development at Rochester.—A description of a 25,000-kva. hydroelectric plant near Rochester on the Genesee River is given in this article. The development is briefly described and well illustrated.—*Power Plant Engineering*, Oct. 1, 1918.

Aluminum Transmission Lines.—J. A. Montpellier.—A comparison of aluminum with copper lines, with special reference to the scarcity and cost of the latter metal in Europe. In order to replace a copper line 10 sq. mm. in section constructed for a current of 48 amp. an aluminum line of 17 sq. mm. is required. For a line 1000 m. in length the copper will weigh 89 kg., the equivalent aluminum not more than 46 kg. Supposing the price of the two metals to be the same, an economy of 48 per cent would be realized by the substitution of aluminum. This, the author says, is the actual case, adding that numerous instances of excellent results from aluminum lines more than ten years old justify its employment from the technical and the economic points of view alike.—*L'Industrie Electrique*, Sept. 10, 1918.

Installations, Systems and Appliances

Electric Welding.—H. A. Hornor.—This paper covers a brief review of the uses of electric spot and arc welding in this country prior to the formation of the electric welding committee of the Emergency Fleet Corporation. It compares the status of the art at the present time and emphasizes the developments that have been made in apparatus in the last six months. It treats of the activities of the welding committee in applying electric welding processes to the shipbuilding industry and points the way to the general applicability of this method to other industries. It shows that the results obtained by investigation and physical tests prove that the applications of this process to heavy work are satisfactory.—*Proceedings A. I. E. E.*, October, 1918.

Performance of Electrically Driven Mills.—"Electrically Driven Mills" was the title of a paper presented by J. T. Sturtevant of the Bethlehem Steel Company at the annual convention of the Association of Iron and Steel Electrical Engineers held recently at Baltimore. The author gave data on the layout, equipment, power consumption and tonnage of eleven installations at the Lehigh plant of the Bethlehem Steel Company. These data should prove valuable for engineers desiring specific performance of electrically driven mills. Incidentally the author explained some trouble which developed with wound-rotor induction motors on the system. Frequent breakdown of rotor insulation was traced by oscillographic records to the fact that the controllers in use necessitated opening the stator windings when the rotor circuits were open, thus producing destructive voltages in the rotor windings. The trouble was readily corrected by changing the control wiring.

Construction and Operation of an Electrolytic Copper Refinery.—J. E. McAllister.—A detailed description of the probable cost of construction of an electrolytic refinery to handle 50,000 tons of blister copper annually is given. Economic aspects are discussed, the basis of cost estimate is defined, proposed practice is outlined, and estimated initial and operating expenses are printed.—*Engineering and Mining Journal*, Aug. 24, 1918.

Relations Between Heating and Current-Carrying Capacities in Various Conductors.—The subject is discussed under the following headings: losses by convection and radiation, fusing effects, carrying capacities of various materials and advantages of electrical heating.—London *Electricity*, July 12, 1918.

Electric Welds.—Ernest Edgar Thum.—In this outline is given a brief discussion of welding machinery, and particular attention is devoted to the properties and microscopy of the welds. A peculiar occurrence known as the Widmanstattian structure is explained.—*Chemical and Metallurgical Engineering*, Sept. 15, 1918.

Earthing Power-Station Equipment.—P. H. Adams.—It is the purpose of the article to discuss the earth connections of station equipment and reasons for making them.—*Power*, Sept. 24, 1918.

Electric Extra Pressures and Systems of Protection.—L. Lombardi.—This article is the text of an experimental lecture the origin of which is to be found in the experiments made upon the artificial line already described (*Abs.* 60—1918). The author's experiments were made in order to study the extra pressures caused by sudden variations of the conditions of a line and the efficacy of the different types of dischargers. In conclusion, the author estimates that the best protection for installations consists in their rational construction in making equal as much as possible the characteristic constants of the different parts and in avoiding, especially at the ends of the different branches, the association of inductances and capacities.—*Science Abstracts, Section B*, Aug. 31, 1918. (Abstracted from *Elettrotecnica*, 5, May 15 and May 25, 1918.)

Electrophysics and Magnetism

Direct-Current Lifting Magnets.—J. A. MONTPELLIER.—A description of the five types of electrical lifting magnets constructed by the Société l'Eclairage Electrique for the handling of pig iron, shavings, etc., as well as of rails, bars and other finished products. Two magnets coupled in tandem are often used to good effect. The magnets are built to operate at 240 volts direct current with specially constructed controllers immersed in oil which make it possible to demagnetize the apparatus rapidly by means of a feeble reverse current.—*L'Industrie Electrique*, Aug. 25, 1918.

Simple Boiling-Point Apparatus for Testing Mercury Thermometers at Temperatures Over 100 Deg. C.—G. DIMMER.—For testing mercury thermometers at high temperatures the author recommends the use of vapor baths. The thermometer is hung in a long-necked flask which contains a suitable substance of known boiling point (aniline, 184.1 deg.; naphthalene. 218 deg.; benzophenone, 306 deg.; sulphur, 444.6 deg.). This flask is surrounded by a wider tube with a trumpet-shaped opening at the lower end. By this means the hot gases ascending from the heating burner are caused to surround the inner boiling tube and so to form a hot-air mantle which greatly increases the constancy of the temperature within the boiling tube. The bulb of the thermometer is surrounded by an inverted Al cone which prevents the condensed vapor running down the bulb. Circulation of the vapor of the boiling liquid round the bulb is, however, secured by perforating the sides of the protecting cone.—*Science Abstracts.* (Abstracted from *Zeits. Instrumentenk.*, 38, March, 1918.)

Conditions for Equilibrium in a Circuit Containing a Reactor and a Condenser.—H. GÖRGES.—If a condenser of suitable capacity be connected in series with a reactor having an iron core and an alternating voltage be applied across the combination and gradually increased, the current, the voltage across the condenser and the power taken remain small until a certain degree of magnetism of the core of the reactor is reached, when a sudden very large increase takes place in these quantities. Görges now presents a method of determining the conditions of equilibrium when the magnetization curve and the curve for the power consumption of the reactor are given. He employs a graphical construction representing the main voltage by the base of a triangle and plotting from the data the loci of the extremes of the two sides, which represent the voltages across the reactor and condenser respectively. The height of the triangle is proportional to the power consumption. He shows that for a certain range of voltage these loci intersect at two points, yielding inclosed triangles corresponding to two different states of stable equilibrium. A third point may occur at which the equilibrium is unstable. When the core of the reactor contains an air gap, only one point is found. Results of measurements are compared with the theoretically determined voltages and agree satisfactorily.—*Science Abstracts, Section B*, Aug. 31, 1918. (Abstracted from *Elektrot. Zeits.*, 39, March 14, 1918.)

Measurement of Dielectric Absorption. — LINDLEY PYLE.—The writer extended the time of discharge of paraffined paper condensers to many hours and shows that the total absorbed charge may readily exceed by many hundredfold that charge which is of the order of magnitude of the free charge.—*Washington University Studies*, 1918.

Electrochemistry and Batteries

Remelting of Aluminum Pig in Electric Furnace.—DWIGHT D. MILLER.—Electric melting offers advantages in control of atmosphere, temperateure and application of heat. A description is given of a plant which replaced an oil furnace, with comparison of costs.—*Chemical and Metallurgical Engineering*, Sept. 1, 1918.

Miscellaneous

Power Factor and Energy Tariffs.—A. BARBAGELATA.—Two schools actually hold the field concerning the manner of allowing the consumer to pay for the energy due to magnetizing current. One proposes to let the consumer pay at a certain rate for the reactive energy, while the other proposes to let him pay a certain price for the apparent energy. The author considers the discussion rather academic, as it is impossible to determine exactly the charge which is to be borne by the central station in each particular case, since for a given consumer's power factor the charge varies as a function of the total load of the main, of the distance of the consumer from the central station, of the hour of the day, etc. Practically both schools arrive at the same result, which consists in charging the consumer the same price both for $EI \cos\Phi$ and for a fraction of $EI \sin\Phi$.—*Science Abstracts, Section B*, Aug. 31, 1918. (Abstracted from *Elettrotecnica*, 5, June 5, 1918.)

Prevention of Vibration in Power and Ventilating Plants.—CHARLES L. HUBBARD.—In this article are given causes of vibration and forms of foundations, hangers, supports and connections to prevent its communication to building structure.—*Power Plant Engineering*, Oct. 1, 1918.

Applying Electricity to Agriculture.—A summary of a comprehensive report made to the French Academy of Agriculture by M. Dabat, director of the Department of Streams and Forests in the Ministry of Agriculture, in which he considers the progress made in utilizing electricity for agricultural purposes, the question of state aid and the extent to which rural communities are now served by transmission lines, advocates the extension of coöperative methods among farmers to include electric service, and describes some of the manually controlled apparatus used on farms.—*Revue Générale de l'Electricité*, Sept. 7, 1918.

Ignition Magneto Construction.—H. R. VAN DEVENTER.—In this paper the construction of magnetos for both automobile and aeroplane vehicles is discussed. The method of magnetizing as well as the testing of magnetos is also considered.—*Journal of Society of Automotive Engineers*, October, 1918.

Petroleum: A Resource Interpretation.—CHESTER G. GILBERT and JOSEPH E. POGUE.—The bulletin deals with the occurrence, production and refining of petroleum, and also with the problem of ultimate exhaustion.—*Smithsonian Institution*, Bulletin 102, Part 6.

Are There Advantages in Welding Boiler Plate?—HOWARD L. BOYD.—The author points out the dangers of using metal for welding boiler plate which is of a chemical composition different from that of the metal in the plates.—*Power*, Oct. 1, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

NEW RULES GOVERNING ELECTRICAL PRIORITIES

Supplement No. 2 to Circular No. 4 of the Priorities Division of the War Industries Board Gives Rules Affecting Electrical Products

The Priorities Division of the War Industries Board has issued Supplement No. 2 to Circular No. 4, embodying rules and regulations governing priority in production. Effective as of Oct. 15, Sections 5, 7, 8, 9 and 23 of Circular No. 4 and Supplement No. 1 to Circular No. 4 are repealed and substitutes are provided. The following excerpts affect the electrical industry:

"Section 5. Class C comprises all orders and work not covered by priority certificates issued by the Priorities Committee or not taking an automatic rating in accordance with the provisions of Sections 7, 7-A, 7-B, 8 and 8-A hereof, which orders and work are placed by and are to be utilized in connection with an industry or plant appearing on preference list No. 2, promulgated and published by the Priorities Division under date of Sept. 3, 1918, and all amendments and substitutes therefor, or which orders and work are to be utilized in furtherance of one or more of the following purposes or uses: (a) For the maintenance of existing equipment for the supply of heat, light, power and sanitation; (b) for the necessary supplies and essential repairs (not extensions or replacements) to existing buildings and manufacturing plants."

Section 7-B deals with automatic rating for orders placed by transportation, telephone and telegraph facilities.

Section 8, giving automatic ratings for defined purposes, includes:

For the manufacture of turbines (all classes), A-4.

For the production of electrodes, A-5.

For the manufacture of electric and hand traveling cranes, shipyard cranes, track pile drivers, portable electric hoists, electric monorail hoists, grab buckets, I-beam trolleys and chain blocks, save such as are under construction for the United States Army, the United States Navy or the United States Shipping Board Emergency Fleet Corporation, B-1. Those for or under direct contract with the three government agencies mentioned are A-5.

For the manufacture of electrical equipment (excepting turbines) for the generation, distribution and utilization of electrical energy for power, traction and light, of radio apparatus, of electromedical apparatus, of electric welding apparatus, of electric furnaces, of electric signal and communicating systems and of such electrical supplies only as are essentially required in the installation or use of such electrical equipment or systems, on strict compliance with the provisions of this section and with the provisions of Circular No. 53 issued by the Priorities Division of date Oct. 15, 1918, B-2.

For the manufacture of telephonic and telegraphic instruments and equipment for use in connection with the military program, A-4.

For the manufacture of steam condensers, A-6.

For the manufacture of high-pressure boilers, superheaters and circulating pumps, B-1.

For the manufacture of automatic stokers, B-2.

For repairs to gas, light, water and power plants operated as public utilities, A-5.

PLAN FIFTY MILLION DOLLARS FOR POWER-PLANT RELIEF

Joint Resolution Reported to the United States Senate to Empower War Industries Board to Take Prompt Action

A joint resolution of the Senate and House of Representatives to empower the War Industries Board to expend $50,000,000 for power-plant construction was reported on Oct. 28 in the Senate by Senator Fletcher from the committee on commerce.

The bill provides that for the purpose of securing such increases in electrical or mechanical power as it may deem necessary to carry on the manufacture of war munitions and the construction of ships during the existing war the War Industries Board is authorized and empowered, within the limits of the amounts appropriated and subject to the limitations prescribed, to aid in equipping or expanding any private power plant to such extent as it may deem necessary by making advances to the owner or operator of such plant upon such terms and conditions as may be prescribed by the War Finance Corporation. Such terms may include an agreement that if at a time provided for in the contract, which shall not be later than five years after the termination of the war as proclaimed by the President, it shall appear that the actual reasonable cost of constructing, equipping or expanding such plant shall have exceeded a sum fixed in or to be ascertained by a method prescribed in such contract, repayment of the whole or any part of such excess will be waived. Such contract may provide further for determining the amount of such excess by arbitration or otherwise, provided that no contract for the advance of any such moneys shall be made except under the supervision and with the approval of the War Finance Corporation.

For the purposes of providing the money authorized there is appropriated out of any funds in the treasury not otherwise appropriated $50,000,000.

All authority granted by the provisions of this act shall cease upon the proclamation by the President of the termination of the war, but the termination of such authority shall not affect any contract made, act done or any right or obligation accruing or accrued or any suit or proceeding had or commenced under the terms of this act prior to such termination.

It is understood that this bill is proposed to grant emergency relief pending final action on the larger appropriation of $175,000,000 or $200,000,000.

DR. GARFIELD UPON THE WINTER'S COAL OUTLOOK

Ready for an Unusually Severe Winter, but We Are Still Dependent Upon Public Co-operation in Fuel Conservation, He Says

The fuel outlook for the winter is outlined in a statement by Dr. Harry A. Garfield, United States Fuel Administrator.

"The Fuel Administration approaches the winter season well organized, with stocks of coal on hand far in excess of the stocks of other years," the report says. "We are ready for an unusually severe winter, but we are still and shall continue to be dependent upon the coöperation of the people of the United States in conserving fuel and upon the several agencies concerned in the production and transportation of fuel to enable us to carry through our program to the end of the year.

"The people of the United States have demonstrated their willingness to make any sacrifice necessary, but they must be satisfied that what is asked is necessary and reasonable. The highest testimony to democracy has been furnished by the way in which the people of the United States have met the requests of the Food and Fuel Administrations, even when those requests have imposed upon them personal inconvenience and sacrifice."

Of the bituminous-coal situation Dr. Garfield says in part:

The following schedule tells the story of increased production of soft coal since 1913:

Year	Short Tons	Increase Over Previous Year, Tons
1913	478,435,297	(Decrease)
1914	422,703,970	55,731,327
1915	442,624,426	19,920,456
1916	502,519,682	59,895,256
1917	551,790,563	49,270,881
1918 (estimated)	600,000,000	48,000,000

Increase 1918 over 1913, approximate, 122,000,000.

The enormous increase for the present year has been made possible by cordial coöperation between the three agencies involved, namely, the mine workers and operators, the Railroad Administration and the Fuel Administration. What is our situation to-day? The coal year begins April 1. During the first six months to Oct. 1 we had produced 37,000,000 tons bituminous more than we produced in the corresponding period last year. By produced I mean placed in railroad cars and delivered either as coal or coke.

What the public wishes to know is whether this coal is being distributed in any way to meet the needs of the country and whether we have been far-sighted enough to stock coal against the winter's needs. The important item here is how much coal we have managed to store up. Briefly, the answer is, more than ever before. Taking the country as a whole, we have in stock coal sufficient to last for a period of eight weeks.

Never until the present year has an attempt been made to ascertain the stocks on hand. The Statistical Bureau of the Fuel Administration receives a weekly post-card report from each of the great and most of the small industrial plants and coal dealers of the country. Tens of thousands of small manufacturing establishments are included in the weekly returns of public utilities supplying them with power and light. An average of more than ten thousand cards are received and tabulated daily. Errors and omissions are diligently followed up. Final tabulations of these reports are at the outside only six weeks behind. The following schedule tells the story of requirements for the year, the deliveries for the first six months and the stocks on hand in the several states:

Total estimated requirements of bituminous coal, April 1 to Sept. 30, 1918, without allowance for conservation or curtailment of industry, net tons	361,730,000
Production of bituminous coal, April 1 to Sept. 30, 1918, net tons	312,282,000

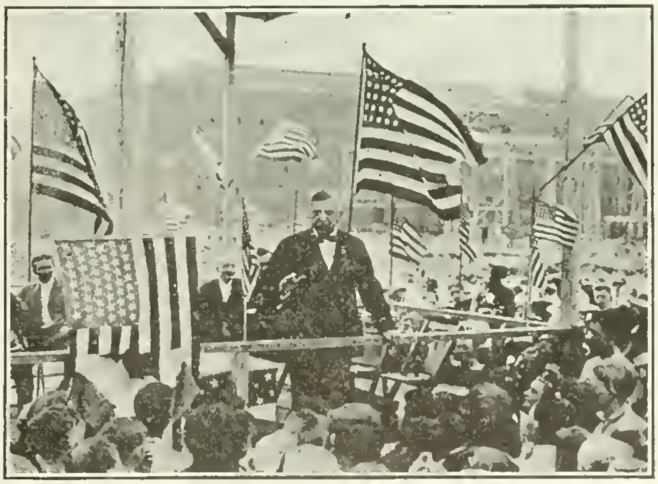
NUMBER OF WEEKS' STOCKS OF BITUMINOUS COAL ON HAND OCT. 1 OF INDUSTRIES, PUBLIC UTILITIES AND COAL DEALERS

States	No. of Weeks	States	No of Weeks
Alabama	2	Nebraska	4
Arkansas	10	Nevada	15
Arizona	4	New Hampshire	18
California	6	New Jersey	10
Colorado	4	New Mexico	4
Connecticut	17	New York	6
Delaware	10	North Carolina	5
Florida	10	North Dakota	11
Georgia	6	Ohio	6
Idaho	5	Oklahoma	9
Illinois	6	Oregon	3
Indiana	5	Pennsylvania	7
Iowa	6	Rhode Island	12
Kansas	5	South Carolina	8
Kentucky	3	South Dakota	7
Louisiana	7	Tennessee	3
Maine	17	Texas	4
Maryland	5	Utah	4
Massachusetts	19	Vermont	15
Michigan (upper peninsula)	20	Virginia	4
Michigan (lower peninsula)	12	Washington	4
Minnesota	20	West Virginia	4
Mississippi	8	Wisconsin	9
Missouri	6	Wyoming	5
Montana	5		

Note.—The upper peninsula of Michigan and the states of Wisconsin and Minnesota and in part North Dakota and South Dakota have their winter supply of coal assured through the movement of coal to the head of the lakes, which is going forward on schedule.

The clean-coal campaign, inaugurated to relieve users of bituminous coal from the handicap they suffered last winter in the use of improperly graded or entirely unprepared coal, is being rigidly prosecuted. During the week ended Oct. 26 thirteen mines were ordered to cease shipping. Prior to that time eighty-six mines had been closed—sixty-seven because the producers would not properly prepare their coal for shipment, and nineteen because the coal produced was entirely unsalable. In addition to these mines closed, several hundred mines have been ordered to cease taking coal from poor veins.

Schwab at Essington



Charles M. Schwab, director of the American shipbuilding activities, hurled verbal "hot shot" at the Kaiser in a recent speech at the Essington Works of the Westinghouse Electric & Manufacturing Company, South Philadelphia. The occasion was the rasing of a flag and the formal dedication of the works and the workmen to the task of making every effort to equip the ships needed to win the war. H. T. Herr, vice-president of the Westinghouse company, introduced Director Schwab.

PLANS MADE FOR RELIEF IN FUEL AND IN POWER

Charles E. Stuart, Now Chief of the Power Section of the Bureau of Production, Outlines Comprehensive Conservation Measures

Charles E. Stuart, who has done much effective work in the conservation of fuel as an official of the United States Fuel Administration, has now been appointed chief of the power section of the Bureau of Production of the Fuel Administration.

Mr. Stuart has sent to production managers of the Fuel Administration throughout the country the outline of a plan for organized relief of acute fuel and power conditions. It is believed that the plan will enable the Fuel Administration to extend a service which will be valuable not only under present conditions, when the power situation throughout the country is in a critical condition, but also when efficiency and economy will be of as great importance as or greater relative importance than to-day.

Activities of the Power Section

The power section has in the past followed up all reports of power trouble and has done what has been possible to alleviate these troubles. The past activities of the power section in this respect are briefly outlined below:

1. Survey of power conditions where bad service has been reported.
2. Analysis of requests from mines for purchased power and submission of these requests to the Priorities Board of the War Industries Board.
3. Assistance to the central stations serving mines where these stations have been unable to finance through the usual channels. This assistance, of course, has been in the way of indorsement to the War Finance Corporation of the Capital Issues Committee.
4. Assistance where there have been right-of-way difficulties in the running of power lines.
5. Questions of rate relief.
6. Survey with the object of locating independent isolated plants that might be opened up, where power systems have been overloaded.
7. The establishment of a coöperative basis with other administrations at Washington, such as the War Industries Board, War Department, Navy Department and Emergency Fleet Corporation. In this connection a representative of the power section of the Fuel Administration is also a member of the power committee of the War Industries Board.

In certain districts the work has gone farther; for instance, in central Pennsylvania an effort has been made to bring the attention of the operators to those elements which go to make up bad power conditions and which in turn lower production.

It will be the object, Mr. Stuart says, to bring before the production committee of every mine in a simple and graphic manner those elements which have the greatest bearing on coal production from the standpoint of efficient utilization of power as well as of electrically driven machinery and to enlist their study and coöperation.

The central stations in nearly every coal-producing center of the country are overloaded, and eliminating the question of power demand for additional mines, the rate of growth of power demand of mines already in operation is rapidly increasing to a point where the stations in many cases will be unable to carry their load. "We believe that by coöperation along these lines great service can be rendered," Mr. Stuart adds.

The plan for the organization of the work is set forth by Mr. Stuart as follows:

I. Function of Power Section of the Production Bureau at Washington

1. Survey of power conditions as affecting mines. In this connection the following contingencies are faced:

(a) Unless we have the needs of the various coal fields fully in hand and in greater detail than at present we shall be unable to arrange that the needs be promptly and properly cared for when the Sims bill passes. We now have a superficial knowledge of the requirement, but in nothing like the detail that is necessary. Money appropriated by the bill is going to be very rapidly expended.

(b) We have found considerable inertia among certain of the power companies. In cases of existing difficulty in financing and in the obtaining of material this inertia is on the increase. There is a tendency on the part of the power people to throw up their hands and say that we are doing all that can be done. We have found that the presence of our engineers in the field has tended to bring prompt and thorough action from the power companies. We have had a number of comments to this effect from the production managers.

(c) The loads on the different power companies are growing rapidly. The tendency of the power company is to take all load that is offered. In many cases there is no reserve even at the present time. The ordnance and other departments, of course, are looking after their own, and in some localities load is being taken on which sooner or later is going to interfere with service to mines. To provide adequately against such shortage from this angle, we have simply got to know the facts in a way that is only possible through both careful study and careful follow-up.

(d) Emergency Section.—In case of break-down or when power facilities are unequal to demand our engineers should be able to step in at a moment's notice and advise the administration of the situation. We have done this in cases, but only after delay incident to getting men to the ground.

2. Analysis of requests from mines for purchased power and submission of these requests to the Priorities Board of the War Industries Board.

3. Assistance to the central stations serving mines where these stations have been unable to finance through the usual channels. This assistance, of course, has been in the way of indorsement to the War Finance Corporation or the Capital Issues Committee.

4. Assistance where there have been right-of-way difficulties in the running of power lines.

5. Questions of rate relief.

6. Survey with the object of locating independent isolated plants that might be opened up where power systems have been overlooked.

7. The establishment of a coöperative basis with other administrations at Washington, such as the War Industries Board, War Department, Navy Department and Emergency Fleet Corporation. In this connection a representative of the power section of the Fuel Administration is also a member of the power committee of the War Industries Board.

8. To stimulate interest of the operators and mine men in the proper utilization of power, in the maintenance of good power conditions within the mines and in the efficient utilization of electrically driven mine machinery.

9. To supervise power companies' service to the miners of the country in such manner as to see that continuity of service is supplied to mines and that the necessary means to that end are taken.

10. To supervise the power companies in such manner as to prevent their taking on additional loads which will interfere with service to those loads already connected.

II. Proposed Power Committees and Their Duties

In each production district there will be a power committee or committees, composed each preferably of three men. This committee or committees will be appointed by the production manager of each production district. These men shall have the following qualifications: They shall be fundamentally of electrical or mechanical training; preferably they shall be technical men. Every field has groups of mines with particularly high-class power men or electrical engineers. In some of the fields there are general operating men whose training has been primarily of a mechanical or electrical character. The chairman of this committee will be known as the United States Fuel Administration district power engineer. Primarily the function of this committee will be stimulating, through production committees and otherwise, the production in the various mines by the following means:

(1) The maintenance of good power conditions in the mines.

(2) The efficient utilization of all machinery at the mines.

(3) The efficient maintenance of all apparatus in and about the mines, and in case of trouble of any sort to render such relief and advice as is within their power.

(4) To coöperate and advise with the field representatives in all matters.

(5) To distribute information and stimulate the study of efficient application and utilization of power and equipment.

(6) Coöperation with the power section at Washington with respect to other functions indicated.

III. Field Organization and Its Duties

There will be five field engineers. The twenty-eight production districts will be divided among the field engineers. The work of these field engineers will be as follows:

(1) To assist the production managers in organizing their committees.

(2) To keep in close touch with the power committees of the several districts over which they have jurisdiction, keeping them stimulated in their work.

(3) To respond immediately to calls in case of trouble.

(4) To represent the personal contact between the power committees and Washington.

(5) To coöperate with the power committees in the handling of the field work with respect to all functions of the power section.

IV. Duties of Mine Production Committees as Related to Power

These functions will be set forth in bulletin form and in such manner as to be readily comprehended by the production committees. Broadly speaking, however, the function will be to coöperate with the power committees along the following lines:

(1) To assist the production managers in organizing their committees.

(2) To keep in close touch with the power committees of the several districts over which they have jurisdiction, keeping them stimulated in their work.

(3) To respond immediately to calls in case of trouble.

(4) To represent the personal contact between the power committees and Washington.

(5) To coöperate with the power committees in the handling of the field work with respect to all functions of the power section.

The production managers, who are asked for their indorsement, if they approve the plan as submitted, or for constructive criticism, if they see opportunity for improvement, are:

Name	Address	Field
Charles O'Neill	Altoona, Pa	Central Pennsylvania
F. B. Reimann	301 Butler Co. Bank Bldg., Butler, Pa	Western Pa. north of Pittsburgh
R. W. Gardiner	Farmers' Bank Bldg., Pittsburgh, Pa	Pittsburgh and Pan Handle district
James S. Amend	Court House, Greensburg, Pa	Westmoreland, Irwin Gas, Ligonier, Latrobe, Greensburg
W. L. Byers	Uniontown, Pa	Connellsville region
H. P. Brydon	Cumberland, Md	Cumberland, Piedmont and upper Potomac, Md., and W. Va., Somerset-Meyersdale, Pa.
F. M. Lockhart	Somerset, Pa	Somerset-Meyersdale
Brooks Fleming, Jr.	Fairmont, W. Va	Fairmont-Clarksburg
J. J. Roby	826 Guardian Bldg., Cleveland, Ohio	Eastern and central Ohio
Wm. H. Wallace	Eddy Bldg., Saginaw, Mich.	Michigan
J. H. Pritchard	515 Outlook Bldg., Columbus, Ohio	Southern Ohio
H. F. Price	Ashland, Ky	Big Sandy and Elkhorn
A. L. Allais	Hazard, Ky	Hazard
J. W. Dawson	Charleston, W. Va	High volatile fields of southern W. Va.
E. E. White	Glenwhite, W. Va	New River and Winding Gulf
R. D. Patterson	Bluefield, W. Va	Tug River and Pocahontas field
G. D. Kilgore	Norton, Va	Clinch Valley and southwest Va.
Howell J. Davis	Holsten Bank Bldg., Knoxville, Tenn	Harlan field in Kentucky, Tenn., and gas
H. C. Selheimer	Birmingham, Ala	Alabama
W. G. Duncan	Greenville, Ky	Western Kentucky
W. J. Freeman	Trust Bldg., Terre Haute, Ind.	Indiana
F. C. Honnold	Fisher Bldg., Chicago, Ill.	Illinois
Ira Clemens	Railway Exchange Bldg., Kansas City, Mo	Iowa, Missouri, Kansas, Arkansas, Oklahoma, Texas
A. K Craig	Acme, Wyo	Montana and northern Wyoming
Thomas Sneddon	Diamondville, Wyo.	Utah and southern Wyo.
J. F. Welborn	Boston Bldg., Denver, Col.	Colorado
Geo. T. Brown	Gallup, N. M	New Mexico
D. C. Botting	Seattle, Wash	Washington

Combined Accident and Fire Prevention Code

The Bureau of Standards has prepared as an experiment a combined code to see what could be done in covering both accident prevention and fire prevention in one set of rules. This code is now in a tentative state and has been submitted to members of the electrical committee of the National Fire Protection Association and to a committee of municipal electricians for study and criticism before any publicity is given to the rules.

ACUTE SHORTAGE IN THE PRODUCTION OF BRASS

Reasons Why Electrical Manufacturers Must Find Substitutes—Use of Soldiers in the Naugatuck Valley Brass Mills

B. M. Baruch, chairman of the War Industries Board, authorizes the following:

The United States is face to face with a serious shortage of brass. Radical measures of relief must be undertaken if the actual war needs of this government and its allies are to be met. Production is now running approximately 40 per cent below the demand, and despite the most vigorous pruning of civilian demands, the supply falls short even of the requirements for ordnance.

On Aug. 29, 1918, according to figures compiled by Everett Morss, chief of the non-ferrous tubing section of the War Industries Board, the situation stood thus:

	Pounds per Day
SHEET BRASS	
Requirements for ordnance, ammunition, etc.	2,220,000
Incidental requirements	1,000,000
Total demands	3,220,000
Actual production	1,800,000
Shortage	1,420,000
ROD BRASS	
Requirements for ordnance, ammunition, etc.	840,000
Incidental requirements	300,000
Total demands	1,140,000
Actual production	1,000,000
Shortage	140,000

Since then, owing to the widespread effect of the influenza epidemic among employees of the brass mills, as elsewhere, the situation has grown materially worse and may, in fact, be said to have reached a crisis.

Three measures of relief, in the opinion of the chief of the non-ferrous tubing section of the War Industries Board, appear to be immediately demanded. They are:

1. For the government to release soldiers from the camps and assign them to the brass mills in sufficient number to make up lost production due to shortage of labor.

2. For the War and Navy Departments to eliminate to the utmost possible extent the use of brass in various accouterments and equipment for the army and navy. Major General Goethals, chief of the division of purchase and supplies of the War Department and a member of the War Industries Board, has already been advised by Mr. Morss that all brass buttons on uniforms must be abolished, as there is not enough of the metal available for this purpose.

3. A more vigorous pruning by the government of its demands for other uses and the employment of sharper restrictions to prevent the various departments from demanding more than their actual needs. Specifications must be revised.

Even if given all the men they could find employment for, it is doubtful, in the opinion of Mr. Morss, whether the mills, owing to lack of machinery and other facilities, could meet the demand as it exists to-day. Private industries have already had their supply of the metal curtailed to the utmost, and most of the further cuts must be made by the government departments themselves.

Last week 1000 soldiers from Camp Devens, Mass., were sent into the mills in the Naugatuck Valley, which includes the brass mills of Bridgeport, Waterbury and Ansonia, Conn., but more will be needed. When the detailed estimates of the situation as of Aug. 29 were made, the rolling mills were short 9600 men, or approximately one-third their labor requirements, and production rate in the mills had been cut down to 15 per cent less than the actual production rate during the six-month period ended June 30, 1918, in spite of the increased demand. The manufacturers frankly admitted they were desperate. With the coming of cooler weather there was for a brief spell a slight improvement in the labor situation, but last month, when the influenza epidemic was raging, between 20 and 40 per cent of the mill employees then on the payrolls were laid off sick.

What the aggregate lost production has been in consequence of this it has been impossible as yet to estimate. Meanwhile the demands for the metal in the war program of the government grow steadily. For example, the requirements of the government and its allies for brass for small-arms ammunition and artillery shells up to 4.7-in. caliber amount of themselves to approximately 2,000,000 lb. a day.

As stated in last week's issue of the ELECTRICAL WORLD, electrical manufacturers are taking steps rapidly to introduce substitutes for brass.

DANGER IS THREATENED TO WATER-POWER LEGISLATION

Prospect of Action by Congress Will Be Lessened, It Is Believed in Washington, if Senator Shields of Tennessee Is Not Re-elected

Students of the water-power situation and friends of the administration in Washington who have at heart the early passage of water-power legislation are earnestly hoping that Senator John K. Shields of Tennessee may be returned to office at the coming elections, Nov. 5. In the Washington circles mentioned it is believed that the prospect of water-power legislation would be hampered if Senator Shields were not returned to office and if, before any bill could be enacted, it became necessary for a successor to make the important studies of water-power legislation he has made.

Senator Shields is confronted with a fight in his own state on his record in regard to water-power legislation, but it is said in Washington that there are the best of reasons for believing that this fight does not extend to all of the people of Tennessee who will be called upon to pass on his candidacy and that many of them do not understand the questions involved in water-power legislation.

Senator Shields is credited in Washington with having sound economic views on the development of the water-power resources of the country. He has had a successful career in the Senate since he went to Washington in 1913 and has served as a member of the important committees on foreign relations, the judiciary, commerce and the Mississippi River. In addition, he is now occupying the important position of chairman of the conference committee of the Senate in charge of water-power legislation.

RECONSTRUCTION COMMISSION BILLS PENDING IN CONGRESS

Contest Threatened in Washington Upon Character of Agency to Guide American Industry in Period After the War

BY WINGROVE BATHON

Washington Representative "Electrical World"

A great fight is about to be staged in Congress, according to the view of well-informed Washingtonians, based upon what character of reconstruction commission or agency shall be intrusted with the work of guiding American industry during the period after the war.

Two important bills have been introduced in Congress dealing with this subject. One bill is fathered by Senator John W. Weeks of Massachusetts, the other by Senator Lee S. Overman of North Carolina. The bill introduced by Senator Weeks, which is in fact a proposed concurrent resolution of Congress, would provide for a congressional committee on reconstruction, to consist of three senators to be named by the Democratic senatorial caucus, three senators to be named by the Republican senatorial conference, three representatives to be named by the House Democratic caucus and three representatives to be named by the Republican House conference.

No provision is made in Senator Weeks' plan for appointing business men in private life on his proposed reconstruction agency. On the other hand, Senator Overman's bill would establish a federal commission on reconstruction, to be composed of five commissioners who would be appointed by the President of the United States. The plan of Senator Overman is known in Washington as the administration plan and is said to have the sanction of President Wilson. Senator Overman's plan also, it is understood, contemplates the appointment by the President, as commissioners, of business men in private life, who shall have the authority to employ and consult economists, investigators, special experts, etc., and the sum of $500,000 is appropriated under the bill to carry out its provisions. In this respect Senator Overman's plan follows the line of suggestions made by the Washington representative of the ELECTRICAL WORLD in these columns last spring.

Both measures specify the character of the investigations to be made—namely, problems affecting labor, capital and credit, public utilities, the results from the demobilization of industrial and military war resources, foreign trade, the condition of existing industries and the establishing of new industries, agriculture, adequate production and effective distribution of coal, gasoline and other fuels; shipping, including shipyards and the sale, continuance of ownership or leasing of yards and ships; housing conditions and the disposition of houses constructed by the government, war legislation now on the statute books, technical education and industrial research, the organization of government departments with a view to putting the government on an economic and efficient peace basis, etc.

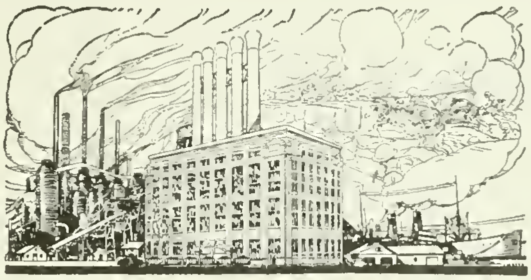
It is pointed out in Washington that Senator Weeks' proposal would place any reconstruction agency formed under his bill in the hands and in control of Congress and that, by reason of the manner in which his proposed reconstruction committee is to be named, it would be difficult, if not impossible, in many cases to have questions decided upon a basis other than their political merits.

Senator Overman's proposal, on the other hand, contemplates the appointment of business men, who might be expected to treat problems coming before them from a business point of view.

The Washington representative of the ELECTRICAL WORLD suggests that because of the radical differences in character between these two proposed reconstruction agencies it would be highly desirable if public hearings were held on the proposed bills, so that the business men of the country might have an opportunity to express their views.

It is suggested that those who take an interest at this time in these bills should write to members of the House and of the Senate urging that hearings be held on the bills before either of them is acted upon in committee.

Conserve Lamps and Energy



Over Here and Over There

Our boys are on their way to Berlin!

At home every instrumentality of our Government and private industry is being urged to speed up to insure speedy, conclusive victory

Back of the firing line there must be National solidarity, National unity—National *energy.*

Electric Service is in urgent demand because it is the one vitalizing force that is indispensable to the winning of the war.

In home, office, mill, shipyard, shop, factory—on the docks, in the mines, efficient, economical

Electric Service

is toiling, toiling, ceaselessly to further war work.

It is the strong, right arm of labor, the dependence of capital.

Don't waste your Electric Service

Follow these suggestions of the Fuel Administration, and the War Industries Board, and you will just so surely be helping win the war

Overhaul your lighting equipment. See that you are not using costly, wasteful, old style carbon lamps. In their place substitute new tungsten lamps, of right wattage to operate on your lighting circuits (see your company)

Turn out lights when you are not using them, do not use two lamps where one will do. The same applies to Electrical appliances Use them to the utmost to save fuel, food, time and labor, but do not waste current. Turn them off when you are through using them.

Do not use a lamp of excessive candle power when a smaller lamp will give satisfactory service

For information on the question of conserving, saving Electric Service, phone this company (insert your number).

(Name of Lighting Company Here)

The Society for Electrical Development, New York, has prepared, at the request of the National Committee on Gas and Electric Service, a number of very effective announcements for use by public utility companies "as another step in the vast program of coöperative construction which the electrical industry is carrying on for the furtherance of war work." These announcements are being sent to every central station in the country.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Residential Extensions During War Time.—Following is an extract from the minutes of a meeting of the District of Columbia Public Utilities Commission: "The commission had before it the request of the Potomac Electric Power Company that it consider the propriety of extending its service mains to residences which are at the present time equipped with and using gas for illuminating purposes. It was held by the commission that, in view of the request of the federal government that all corporations refrain during the war from the use of material and labor where it is not absolutely necessary, an extension of a conduit to a residence already supplied with another form of illuminant is non-essential and the Potomac Electric Power Company is justified in refusing to make any such extensions during the period of the war."

Putting Power Contract on War Basis.—Increased rates were allowed the Sierra & San Francisco Power Company in a decision of the California Railroad Commission, the opinion being written by Commissioner Frank R. Devlin. They represent a part of the increased cost of power to the company, the remaining part being left unprovided for as the utility's share of the burden of war conditions. The schedule of surcharges fixed by the commission follows: Municipal street lighting, 15 per cent of monthly bills; residence and commercial lighting, 1½ cents per kilowatt-hour; power, including heating and cooking, 3 mills per kilowatt-hour; electric railways, 1½ mills per kilowatt-hour; other electric utilities, excepting the Coast Valleys Gas & Electric Company, 1½ mills per kilowatt-hour; Coast Valleys Gas & Electric Company, 2½ mills per kilowatt-hour. At the time of the hearing of the application opposition was made on the part of the United Railroads, the largest consumer, to any disturbance of its charges because of the existence of a contract antedating the jurisdiction of the commission over such matters. To meet this issue, the commission, on its own initiative, made an inquiry into the status of this contract. The United Railroads consumes about 70 per cent of the electrical energy produced by the Sierra company. The opinion states: "The surcharge of 1½ mills per kilowatt-hour applicable to energy sold to electric railways is intended to cover service to the United Railroads with the following reservations, namely, that for the energy supplied by applicant the United Railroads shall pay the Sierra company such additional revenue as will result in an increase of 1½ mills per kilowatt-hour on all energy supplied over and above the revenue that the same quantity of energy would have yielded to applicant under the terms of the United Railroads contract with oil at 66 cents a barrel. . . . Applicant practically owes its existence to the United Railroads contract, which has provided it in past years with a source of revenue that has been sustained through a development period. Under this contract the United Railroads has assumed the burden of stabilizing the Sierra & San Francisco Company and has expressed in the record its willingness to continue its support under present abnormal conditions, reserving, however, any rights which it has under its contract." The Sierra company based its request for increases on the higher cost of labor, fuel oil, insulators and lumber. The surcharges granted are expected, the opinion states, to increase the gross revenue to an amount which will give to the company a surplus of $41,661. "This is a comparatively small margin for surplus," says the opinion. "It is thus evident that the company's consumers will not carry the entire burden of increased costs, but applicant itself will be required to bear a substantial portion thereof and in so doing will suffer an actual loss in earnings with a corresponding reduction in surplus."

Power Rates.—In approving new rates for the Southern Illinois Light & Power Company, Hillsboro, the Illinois Public Utilities Commission criticised its power rates in the past, saying: "The increases of rates which are proposed for power service are very material. It appears from the record that the company in the past has had in effect a heterogeneous schedule of power rates. The company has had in effect fourteen different rates for power service, and several of these rates have been used for billing only one power consumer. The rates charged by the company for power service have been as low as 0.63 cent to certain consumers. Power rates of this character cannot be too strongly condemned, since they are obviously discriminatory and are certain sooner or later to lead to difficulty, and instead of developing the business in accordance with the apparent desire of the utility, they result in driving away legitimate power business, or, if not, they result in the taking of this business at rates which return no profit to the company. Under the conditions existing in this case several of the rates appear to have resulted in an actual loss to the company for every kilowatt-hour sold. Under these conditions the utility can have no complaint if it fails to earn a return upon its entire business until such time as it has placed its business on a businesslike basis. During the past year or two the Southern Illinois Light & Power Company has secured considerably increased revenues from its power consumers by changing the consumers from one rate to another."

Associations and Societies

The Directory of Electrical Associations, which is regularly printed in the first issue of each month, appears on page 871 of this number.

San Francisco Electrical Development League.—Major George F. Sever, United States Corps of Engineers and special representative of the War Industries Board, spoke on "Electric Power Needs of the Pacific Coast" at the Oct. 16 meeting of the league.

New York State Industrial Safety Congress.—A tentative program has been issued for the New York State Industrial Safety Congress to be held at Syracuse, N. Y., Dec. 2, 3, 4 and 5. Among the speakers to address the opening meeting of Dec. 2 will be William B. Wilson, United States Secretary of Labor, and Charles M. Schwab, Director-General United States Emergency Fleet Corporation. The general topic for discussion on that day will be "Safety of Women in Industry." On Dec. 3 the congress will devote its attention to the general subject "Industrial Good Housekeeping," and papers will be given on "When, What and How to Inspect" and "Maintenance and Repair and Their Relations to Safety." In the afternoon of Dec. 3 the general topic for discussion will be "Safe Practices in the Shop," and one of the papers which should be of interest is "Machinery Layouts and Their Relation to Safety." The headquarters of the congress is to be the Hotel Onondaga.

American Institute of Electrical Engineers.—The 343d meeting of the American Institute of Electrical Engineers will be held Nov. 8, at 8:15 p. m., in the Engineering Societies Building, New York City. The meeting will be held under the auspices of the industrial and domestic power committee. A paper will be presented entitled "The Application of Electric Drive to the Cement Industry," which has been prepared by R. B. Williamson, C. A. Kelsey, A. M. Dudley and R. Weichsel, a sub-committee of the industrial and domestic power committee appointed to compile a typical survey of the application of electric motors to a representative industry, standardizing methods for the selection of motors, which it is hoped will serve as a model for the survey of this phase of other industries. The discussion will be open upon the general subject of the recent large development in the use of electric motors in the enormously increased manufacturing facilities of the country designed to meet war conditions, including the effect of electric drive upon the design of factories and upon the economic problems arising from this rapid development. A large number of engineers have been invited to contribute to the discussion.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Explosion at Memphis, Tenn.—The explosion of a steam pipe early on Monday of this week at the Memphis Gas & Electric Company plant put practically all power service out of commission for the day. The company completed repairs and light was turned on at 10 p. m.

St. Lawrence River Power Project.—The New York & Ontario Power Company has asked the International Joint Commission to approve plans to construct a dam across the Little River on the south branch of the St. Lawrence River at Ogden Island. The Dominion government will oppose the application made by the New York & Ontario Power Company.

Great Business Convention on Reconstruction.—The war service executive committee of the Chamber of Commerce of the United States has announced plans for a convention at Atlantic City on Dec. 4, 5 and 6 of the more than 300 industrial war service committees. Problems of war emergency and reconstruction will be discussed. National councilors of the chamber, representing the more than 1100 commercial and industrial organizations which make up its membership, will meet at the same time and place.

Reconstruction of California Lines.—The Sierra & San Francisco Power Company has applied to the California Railroad Commission for an order extending the time in which it shall reconstruct its overhead lines in order to comply with the law of safety in reference to telephone and other electric lines. The applicant says that its service to the public has been so important that it is felt that the service should not be interrupted to make these changes at this time. A similar application has been made by the Coast Valleys Gas & Electric Company for similar reasons.

Spokane Competitors Agree on Rates.—The Washington Water Power Company and the Spokane Heat, Light & Power Company have filed a new schedule of rates with the State Public Service Commission, asking for a restoration of the minimum rate of $1 for residential users of electric light and power, an advance from 70 cents, effective on Nov. 10. The rates were filed by both companies in accordance with an order of the commission that the two companies get together and file uniform rates to avoid price cutting. The present rate of 7 cents for the first 20 kw.-hr. and 3 cents for the subsequent hours are not changed. The minimum of $1 means that instead of using 10 kw.-hr. and paying 70 cents, a consumer must pay for 14 kw.-hr. or he may use 15 kw.-hr. at a cost of $1.05. The wholesale light and power rates are the same, with the exception of a change in discounts which makes an increase of $25 on a bill of $400. It is said this affects only about twelve consumers.

Mid-Day Closing Discountenanced by New England Fuel Administration.—James J. Storrow, New England Fuel Administrator, has issued a statement condemning the proposed noonday closing plan which has been under considerable discussion at Boston, Mass. Closing of stores throughout Massachusetts between 12 noon and 1 p. m. has been advocated by some department-store managers, with the idea that both fuel and labor would be saved thereby. Mr. Storrow points out that this appears to be misapprehension, saying: "It may be a labor conservation measure, but in my judgment it will lead to the consumption of more fuel and not less. To take an hour off the store schedule at high noon, when the minimum of electric light is needed, will not save as much as if the hours were shortened, as was done last winter and may be necessary next winter."

Engineers Needed for Construction Work.—The construction division of the army is believed in Washington to be the largest organization of its kind in the history of the world. The approximate value of construction projects undertaken by this branch of the government since the United States entered the war is $1,000,000,000. The figures representing the material used and the men employed are staggering; 250,000 workmen have been under the control of the division at one time. Among the division's present urgent needs are fifty chiefs of survey party at $2,700 to $3,000 a year; fifty transitmen at $2,400 a year; twenty-five levelmen at $2,100 a year; 125 rodmen at $1,800 a year; 150 chainmen at $1,800 a year, and fifty topographic draftsmen at $2,100 a year. These positions are open to men only, except the drafting positions, which are open to both men and women. All of the positions are in the civil, not the military, service. Persons interested should apply to the United States Civil Service Commission, Washington, D. C., or to the secretary of the local board of civil service examiners at Boston, New York, Philadelphia, Atlanta, Cincinnati, Chicago, St. Paul, St. Louis, New Orleans, Seattle or San Francisco. Applicants will not be required to undergo a written examination, the examination being of the "non-assembled" type; that is, the ratings will be based upon education, training, experience and physical ability as shown by the applications and corroborative evidence. These positions offer an excellent opportunity for patriotic service, and the Civil Service Commission urges qualified persons to apply for appointment without delay.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Liability of Utility Regarding Private Line.—A public utility corporation furnishing energy for electric lights to an individual user who constructs, owns and maintains a connecting private line and all attached equipment, wholly free from the control or inspection of the corporation, cannot be held responsible for damages on account of deterioration of his private line, and consequent defects therein, resulting in injury to a trespasser who comes in contact with it on private premises, not even adjacent to any path in general use by the public, when the private line was not only properly constructed originally but safely connected with the line of the company generating the electricity, and there was no knowledge on the part of the company as to any subsequent deterioration of the private line, the Court of Appeals of Georgia held in Scott versus Rome Railway & Light Company (196 S. E. 569).

Remedy for Entry of Utility Without Consent.—A public service corporation, in order to acquire an indefeasible title to its easements or other property against the claims of all persons interested therein, should proceed in the manner prescribed by law, making all persons having a present or prospective interest therein parties to a condemnation or other proceeding by which they will be bound, the Supreme Court of South Carolina held (96 S. E. 725). A corporation having power to condemn lands for a public purpose which takes possession of land for such purpose without express or implied consent of owner becomes a trespasser. Where a corporation having power to condemn land for public purposes takes possession of land for such purpose without consent of owner, the corporation, although liable as trespasser, cannot be ejected as ordinary trespasser and may retain possession. Where a corporation having power to condemn land enters upon land without owner's consent, the amount to which owner is entitled upon corporation's remaining in possession of land is to be ascertained by statutory method of determining compensation for condemnation where compensation is not denied, and by a jury in an action in the Court of Common Pleas when compensation has been denied but case adjudicated in owner's favor. Where the owner of legal tital or of an estate in less than the fee is in possession of land at the time it is taken for public use, such owner is bound by the statute under which the land is taken and must apply for compensation in the manner and within the time therein prescribed.

Men of the Industry

Changes in Personnel and Position— Biographical Notes

H. E. Cox, superintendent of the steam-heating department of the Birmingham (Ala.) Railway, Light & Power Company, has resigned to enter the service of the Birmingham Steel Company.

Frederick G. Simpson, vice-president and general manager of the Kilbourne & Clark Manufacturing Company, Seattle, maker of wireless apparatus, has been called into active service and assigned to engineering duties with the rank of lieutenant commander, United States Naval Reserve.

John T. Mountain, assistant to the chief operating engineer of the Commonwealth Edison Company of Chicago, has been commissioned a captain in the combatant branch of the Engineer Corps of the United States Army. He has entered upon a course of training at Camp Humphreys, Va.

L. H. Kistler, for the last five years electrical engineer of the Northern California Power Company at Redding, Cal., has resigned to enter an officers' training camp at Washington, D. C. Mr. Kistler was tendered a banquet by officials of the company on the evening preceding his departure.

C. Nesbit Duffy has resigned as vice-president of the Manila (P. I.) Electric Railroad & Light Company to accept the position of vice-president of the Visayan Refining Company, Manila, P. I., one of the largest cocoanut-oil companies in the Philippine Islands Mr. Duffy is to take over his new duties on Nov. 1.

Arthur F. Allsop, electrical heating engineer for the Commonwealth Edison Company, Chicago, has accepted an appointment with the United States Army, Ordnance Department, as a chief army inspector of ordnance. Mr. Allsop had been in the employ of the Commonwealth Edison Company for seven years.

J. C. Rockwell, the present general manager of the Manila (P. I.) Electric Railroad & Light Company, following the resignation of C. N. Duffy as vice-president, is being placed in full charge of the affairs of that company in Manila by the J. G. White Management Corporation, New York, the operating manager of the property.

M. O. DellPlain has been transferred from the Syracuse (N. Y.) Lighting Company, where he was sales manager, to the Northern Indiana Gas & Electric Company, Hammond, Ind., where he has taken up the duties of vice-president and general manager. Both of these properties are operated by the United Gas Improvement Company.

L. J. Hirt, vice-president of the Pearson Engineering Corporation, has resigned from the United Gas & Electric Engineering Corporation as chief engineer, which position he has held for about a year and a half, owing to the pressure of his duties with the Pearson interests. Mr. Hirt has been connected with the Pearson Engineering Corporation since 1889.

C. S. Ruffner, vice-president and general manager of the Union Electric Light & Power Company, St. Louis, Mo., and a member of the board of managers of the American Institute of Electrical Engineers, who underwent an operation for appendicitis the latter part of August, is being welcomed by his friends and associates upon his recovery and return to his duties.

Frank H. Brooks, formerly manager of the Lincoln (Neb.) Traction Company, member of the firm of Mid-West Electric Company of Omaha, Neb., and general manager of several Iowa public utilities, has recently been appointed general manager in charge of operation of the Continental Gas & Electric Corporation's properties in Iowa and Nebraska, with headquarters at Omaha, Neb.

James B. Harvey, who for a number of years has been general manager of the Public Service Company, York, Neb., has recently been elected vice-president of the Continental Gas & Electric Corporation and placed in active charge of the company's properties in Iowa and Nebraska, with headquarters in Omaha, Neb. Mr. Harvey is a graduate of the University of Nebraska and has for a number of years taken an active part in the growth of the electric lighting, railway and transmission industries of that State.

A. C. King, formerly engaged in consulting engineering practice in Chicago, has been commissioned as major in the Quartermaster's Corps in charge of the electrical section of the construction division. Prior to taking up consulting engineering in the spring of 1916, Mr. King was for three years deputy commissioner of gas and electricity for the city of Chicago. He was graduated from the University of Wisconsin in 1901 and immediately afterward became connected with the Northern Electric Company at Madison, Wis. There he rose to the position of assistant chief engineer, resigning in 1907, when the company was taken over by the General Electric Company, from which time until 1911 he was engaged in consulting engineering work. He later became associated with Ray Palmer, who at that time was engaged in making an electrolysis survey of the city of Chicago. During the period as deputy commissioner he was in charge of the city's investigations of the rates of the Commonwealth Edison Company, the city's valuation of the Automatic Telephone Company and of a valuation and report on electric and gas rates in the city of Cincinnati.

E. N. Hyde has resigned as general supplies sales manager of the Northern Electric Company of Montreal, Canada, and is returning to Philadelphia, where after a short rest he expects to go into business. Prior to going to Canada Mr. Hyde was associated with the Frank H. Stewart Electric Company. Mr. Hyde has been very prominent in the jobbing branch of the industry for many years, and his many friends will be glad to know of his return to the States. While in Canada Mr. Hyde did much to advance the standard of electric lighting.

A. R. Fairchild, electrical and mechanical engineer with the Electric Bond & Share Company, New York City, resigned Oct. 1 with the intention, it is understood, of going into consulting engineering work in New York City. Mr. Fairchild was graduated in electrical engineering from the University of Minnesota in 1907. For six years he was engaged in transmission-line and power-plant design and construction in the West. He then became electrical engineer in charge of work for W. V. N. Powelson, consulting engineer, New York, and in 1914 went to St. Louis, Mo., where he was assistant electrical engineer with the Union Electric Light & Power Company. In 1916 he resigned to become superintendent of distribution and construction for the Light & Development Company, St. Louis, and in the following year went to Bluefield, W. Va., as assistant superintendent of the engineering and construction department of the Appalachian Power Company. Later he went to New York with the Electric Bond & Share Company, where he was engaged until he resigned, designing and purchasing for construction of high-tension work.

Donald McNicol, during the past nine years assistant engineer of the Postal Telegraph-Cable Company, New York, and well known as an author and writer, on Oct. 21 assumed the editorial management of the *Telegraph and Telephone Age*, to fill the position made vacant by the death of Thomas R. Taltavall. Mr. McNicol has been intimately identified with the telegraph, telephone and railroad interests in the United States for the past twenty-two years. He began his career as a telegrapher in Canada and has had a wide experience in all branches of the service. He has been a copious writer and he brings to the *Telegraph and Telephone Age* valuable experience which will find abundant opportunity for application in his new position. He is a fellow of the American Institute of Electrical Engineers and takes an active part in its deliberations, now serving as chairman of the Institute's committee on telegraphy and telephony. Besides, he is a member of the Institute of Radio Engineers and of the Telephone Pioneers of America, and for many years has kept in close touch with the many phases of telegraph, telephone and radio development in foreign countries as well as America.

John F. Wessel, who about a year and a half ago was elected vice-president of the United Gas & Electric Engineering Corporation, has just been appointed chief engineer of the corporation in addition, succeeding L. J. Hirt, who has resigned. Mr. Wessel is a graduate of the Massachusetts Institute of Technology and for many years has been identified with lighting and railway interests. He was general manager of the Mahoning & Shenango Railway & Light Company of Youngstown, Ohio, prior to coming to New York toward the end of 1913.

John R. Anderson, chief engineer of the Milwaukee Electric Railway & Light Company for the last six years, will become a consulting engineer for the naval overseas transportation service in New York. Secretary of the Navy Daniels offered Mr. Anderson the rank of lieutenant-commander in the navy as he had been a naval volunteer during the Spanish-American War. This offer, however, was refused, since Mr. Anderson believes he can do better work as a civilian. His appointment is for the duration of the war, but he will not sever his connection with the Milwaukee Electric Railway & Light Company definitely. He is retained in supervisory control of the company's engineering work.

Obituary

Allan C. Choate, purchasing agent of the Eastern Pennsylvania Railways Company, died of pneumonia on Oct. 13, in Pottsville, Pa. He was a son of Joseph K. Choate, vice-president of the J. G. White Management Corporation, New York, N. Y.

William Allis, chairman of the board of directors of the Allis-Chalmers Company, Milwaukee, Wis., died on Oct. 10, at the age of sixty-nine years. Mr. Allis succeeded his father, the late E. P. Allis, as president of the E. P. Allis Company and continued in that position until the consolidation which resulted in the Allis-Chalmers Company, of which he became chairman of the board.

Frank I. Parker of the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., died at his home in Milwaukee on Oct. 18, at the age of thirty-six years. His death was due to pneumonia following Spanish influenza. Mr. Parker was graduated from the University of Wisconsin in June, 1906, and in July became engineer in charge of production in the magnet and clutch department of the Cutler-Hammer company. His early work was with lifting magnets made by this company, and he was responsible for many of the features of these magnets as well as for the design of several of the company's magnet and motor-operated brakes. After 1911 Mr. Parker had charge of the sales service work on the clutch department products. He was a member of the American Institute of Electrical Engineers.

H. L. Gannett, who died a short time ago, was for years the inspector of safety and fire prevention for the Commonwealth Edison Company of Chicago. Mr. Gannett was with the Commonwealth company and its predecessor company for thirty-two years. He started as a repair man and advanced to the position of repair foreman and assistant superintendent of construction and in 1894 was placed in charge of the repair department. After the company first began organizing safety work he devoted most of his time to it and achieved such success that in 1914 the company was awarded a gold medal by the American Museum of Safety for the work it had done in safeguarding its employees. Mr. Gannett was active in the Chicago Safety Council, of which he was president during the years 1916 and 1917.

Lieut. Charles R. Seed, U. S. N. R., superintendent of power, Worcester (Mass.) Electric Light Company, died recently at Worcester from pneumonia. Lieutenant Seed was widely known and liked among central-station circles in New England. He was born at Lawrence, Mass., forty-three years ago, and after a course in engineering on the Massachusetts nautical training schoolship Enterprise he spent seven years as an engineer in transatlantic service. He then was employed as a stationary engineer in industrial concerns at Utica, N. Y., and Blackstone, Mass., afterward going to Portsmouth, N. H., as chief engineer of the Rockingham County Light & Power Company. In 1911 he became chief engineer of the Webster Street plant of the Worcester company and soon was made superintendent of power. During the Spanish-American War he served as junior engineer aboard the U. S. S. St. Louis. When war was declared by the United States against Germany he immediately offered his services and was soon ordered to report at the Boston Navy Yard, having been commissioned as ensign. The Worcester company gave him a leave of absence for the period of the war and had hoped to have him resume his former post at its close. After serving for a short time along the coast of France, he was promoted to lieutenant and was on patrol duty for nearly a year. In June, 1918, Lieutenant Seed returned to the United States and was assigned for duty in the Fore River shipyards at Quincy, Mass.

Willard E. Case, widely known as a student of electrical science, particularly electrochemistry, died at Auburn, N. Y., on Oct. 27 from Spanish influenza. Mr. Case was born in Auburn on Feb. 19, 1857, and on his mother's side was descended from John Fitch, a pioneer in steam navigation. Mr. Case studied in public schools and under private tutors and subsequently was graduated from Hamilton College Law School. His tastes, however, ran more to science than to the law, and in 1886, when but twenty-nine years old, he read a paper before the Royal Society of London on "A New Means of Converting Heat Energy into Electrical Energy," which brought him into prominence. In 1897 he read a valuable paper before the New York Electrical Society on "Electricity from Carbon Without Heat." His laboratories at Auburn, among the finest in the country, are now being used by a force of electrochemists in government work. Mr. Case had been especially interested in the conservation of the power of the sun rays and the transmission of black-and-white photography by wire. He was a member of many scientific organizations, including the Faraday Society and Royal Arts Society of London, the American Electrochemical Society, the American Institute of Electrical Engineers and the New York Electrical Society. He was particularly interested in the latter organization and in October of last year made what was said to have been the largest endowment in years to the New York Electrical Society, to be known as the Case Fund.

William Main, formerly professor of chemistry in the University of South Carolina and one of the pioneers of the electrical industry, died at his home in Piermont, N. Y., on Oct. 18 in his seventy-fourth year. He was graduated from the University of Pennsylvania and later from the Polytechnic College of Pennsylvania. His earlier years were devoted to the mining industry. Later Professor Main turned his attention to electricity and invented and developed the high-voltage lead-zinc storage battery. As inventor and engineer of the River & Rail Electric Company he applied the storage battery to the propulsion of cars and boats and developed the batteries, motors, transmission gearing and control apparatus of the street cars built by that company. He was also at one time connected with the Consolidated Electric Light Company, and as its superintendent and engineer was particularly interested in standardizing the methods of lamp-filament manufacture and treatment and the methods of bulb exhaustion. For many years he had resided in or near New York City and had acted as a consulting engineer and chemist. His sound knowledge and power of clear expression caused him to be frequently called as an expert in litigations, and he was connected with many historical cases, including the protracted litigation over the Tesla polyphase motor patents, the insulated cable cases and the tungsten-filament lamp case. A veteran artillerist of the Civil War, he had devoted his time since the entry of the United States into the present war to the problem of accurate sighting of anti-submarine guns for aeroplanes and to chemical problems growing out of the war. He was a charter member of the American Society of Mechanical Engineers and of the American Electrochemical Society, and a member of the American Chemical Society, the Society of Chemical Industry of Great Britain and various other scientific and literary bodies.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

HOW PRIORITIES ARE WORKING ON CONDUIT

Suggestions Made by Prominent Manufacturing Concern to Its Distributers Outline Condition Under Which Supplies Can Be Obtained

Priority regulations are causing no end of trouble both to manufacturers and the trade. Jobbers are especially confused when they find that, although they have a preference rating, still they are not able to get material for stock in many lines. Especially is this true of conduit, and in order to clear up questions which seem to be in the minds of some of its distributers, the American Conduit Manufacturing Company, New Kensington, Pa., has made the following suggestions to its jobbers:

"1. Make a careful study of Circular No. 23, Priorities Division, War Industries Board, addressed to all electrical manufacturers and resale distributers of electrical equipment, apparatus, appliances and supplies. The pledge given in this circular and the conditions recited supersede the pledge and the various conditions which we have previously submitted to you.

"2. When the conditions of Circular No. 23 have been complied with, electrical jobbers are automatically rated B-4, which means that the manufacturers are free to ship to jobbers' stocks, provided that they can do so without interfering with orders taking a higher priority rating, such as A orders or B-1 and B-2 orders.

"3. We have a large tonnage of orders on our books at the present time which are regularly established as being of a higher priority than B-4.

"4. So long as this condition continues jobbers' stock orders will not be reached. However, if your orders are for direct shipment to essential work and supported by affidavit of the user or the indorsement of a government officer, in accordance with the provisions of Circular No. 4, Priorities Division, War Industries Board, they will be given the attention warranted by their relative importance.

"5. In order for us to maintain our standing with the War Industries Board it is necessary for us to call upon you each month for a report showing the disposition of conduit from your stock and under the present conditions. These reports should show a very high percentage of class A business. Certainly, in our opinion, very little, if any, class C business should be shown. At times it will be possible to make limited stock shipments, but the jobber who gets the shipment will be the one whose report shows that he is serving class A."

INSULATING FABRICS AND MATERIALS RAPIDLY ADVANCING

Raw Materials Scarce Owing Largely to Difficulty in Obtaining Supplies from Foreign Countries —War Demand Has Increased

Insulating materials of nearly every kind have in the past year advanced in price from 10 to 50 per cent and in some few cases are now nearly impossible to obtain. Raw materials, coupled with the high price of labor, have been the chief factors in the higher prices. Tremendous government orders for immediate war needs have swept the market nearly bare of stocks. Outside of government needs deliveries in nearly all instances are slow, ranging from two weeks to an extreme of six months in some cases. The following is a list of the more important materials used and the market condition:

Cotton sleeving (pure) is almost impossible to obtain, and deliveries are six months behind. Cotton tape can be had in standard sizes only, ½ in. to 2 in. Deliveries are two months behind, and the price has advanced 50 per cent in the past year. Paints and varnishes for insulating purposes are very short in supply owing to lack of gums. The price has advanced about 50 per cent in the past three months.

The market in friction tapes is very tight on account of the scarcity of cotton sheeting. There are no supplies on hand and the price has advanced 10 per cent in the past four months. The fiber-board situation is stationary and deliveries are slow. Linen cord is practically out of the market. Prices have advanced 50 per cent in the last four months. There is practically no pure flax to be had, and prices have gone 50 per cent higher in the last four months.

Supplies of imported mica on hand are limited, and the demand is good. Prices are variable. Supplies of cut electric mica are plentiful, with no recent price change. The demand for mica products is excellent, but the supplies are low and deliveries poor. Asbestos tape is practically out of the market. Asbestos paper is rapidly taking the place of asbestos tape, and it is stated will probably supersede it altogether.

Varnished-tubing demand is good, and supplies on hand are fair. Prices have not advanced recently. The demand for varnished cambric is great, and supplies on hand for immediate delivery are scarce. Export demand is increasing. Prices have not changed recently. On account of the scarcity of raw silk, supplies of varnished silk on hand are low. The demand is very brisk and prices have not changed since July. Supplies of varnished paper are plentiful, and it is in good demand.

High-melting-point waxes are out of the market entirely. Low-melting-point waxes are in plentiful supply.

MANUFACTURERS IN STRATEGIC POSITION TO MEET PEACE

Electrical Industry in Readiness to Return to Production to Meet Commercial Demand When War Orders Shall Cease

While many industries on the conclusion of peace will be greatly handicapped in getting back again into stride in their normal production, it is gratifying to see the ease with which the electrical manufacturing industry generally will be able to take up commercial demands immediately government demands shall stop.

In a great many lines, and especially those having little or no direct war value, whole plants, including labor and equipment, have been turned over to making products absolutely foreign to their normal production. Guns, rifles, shells, gas masks and other war requisites are being made in quantities in plants formerly turning out commercial materials of a far different nature.

The government has urged the concerns making less essential products to produce munitions of one kind or another. In fact, it is the only way in which a good many plants could continue to operate. Furthermore, when the war broke out in 1914 some plants began to contract to supply munitions to Great Britain, Russia and France in order to keep their plants going. Since that time business conditions have changed, but some manufacturers found it easier to continue in this work than to change back to their normal output.

In all of this work there will be found certain electrical manufacturing plants. Some have been doing it for three years, others only a few months as they realized the necessity for continuing in a very curtailed production of commercial merchandise. There was a time when electrical manufacturers were well represented in the list of makers of munitions. Generally speaking, however, electrical manufacturers are working at capacity on their normal product, except that it is for war work. Turbine manufacturers are rushed to fill the shipbuilding program. Motor manufacturers for a long time have not been able fully to supply the essential demand. Battery manufacturers are likewise filled up with war orders for batteries. Wire manufacturers have more government orders for wire than can be turned out in the desired time.

It would be possible to continue the list with still other branches of the industry which are wholly engaged in turning out their normal product for use in war work of one kind and another.

The natural result is that as soon as the war demand ceases and commercial demand begins the electrical industry for the most part will be in a position to turn out the goods without having to make extensive alterations in equipment or retrain an army of employees.

Indications are that when peace is restored the demand for electrical products will be of considerable proportions. Low stocks, unessential work and the reduction in building have held off a lot of business that apparently will be quick to be placed when goods can be had.

METAL MARKET SITUATION

Announcement that Present Price of Copper Is to Continue for Remainder of Current Year

The price-fixing committee of the War Industries Board has agreed by telegraph, instead of by conference, with the copper producers to continue the price of copper at 26 cents for the months of November and December. The market is very quiet with no new features. The influenza epidemic is affecting the output of both smelters and refineries, and it is estimated that it is reducing the current output of copper about 20 per cent.

Effective Oct. 20, all outstanding licenses for the importation by ocean shipment of pig tin, tin ore and tin concentrates, or any chemical extracted therefrom, have been revoked. Hereafter no licenses will be issued for the importation of these commodities except to cover shipments consigned to the United Steel Products Company, which is handling the tin situation in the United States.

NEW YORK METAL MARKET PRICES

	Oct. 22	Oct. 29
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26 00
Casting	Govt. price 26 00	Govt. price 26.00
Wire base	28 75	28 75
Lead, trust price	8 05	8 05
Antimony	13 37½	12 75
Nickel, ingot	40 00	40 00
Sheet zinc, f.o.b. smelter	15 00	15.00
Spelter, spot	9.20	9.10
Tin, Chinese *	No quotations	77 00 to 77 50
Aluminum, 98 to 99 per cent	Govt. price †33.10	Govt. price †33 10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	23 00 to 23.50	23.00 to 23.50
Brass, heavy	13 50 to 14 00	13.50 to 14 00
Brass, light	11.00 to 11 25	11 00 to 11 25
Lead, heavy	7 50 to 7 75	7 50 to 7 75
Zinc, old scrap	6 00 to 6 25	6 25 to 6.50

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* No Straits offering. † In 50-ton lots or more; carload, 33 10 cents per lb.; 0-ton to 14-ton lots, 33 20 cents per lb

THE WEEK
IN TRADE

CONDITIONS are apparently the same as they have been. Some local stocks have been momentarily repaired by shipments of orders long overdue. Shortages in other lines than those spoken of last week are showing up everywhere, the most significant being that in heater cord. Unless this situation is bettered shortly some local distributers may find it difficult to dispose of heating appliances.

Prices are still very steady. It is now almost seven weeks since prices advanced with any regularity.

The influenza epidemic is apparently rapidly coming under the control of the health authorities. The full effect, however, should be felt some weeks later, when the decrease in output will serve to prevent diminished stocks from being replenished as much as they might otherwise have been. The output of brass, for instance, fell off, it is estimated by good authority, 35 per cent during the epidemic. Copper output was reduced some 20 per cent. Such things will not necessarily be felt by the industry as a whole immediately, but the inevitable result will be longer deliveries.

NEW YORK

Reports from all branches of the electrical trade in the past week indicate that business is showing no reduction. Demand in almost all lines is heavy, and the manufacturers are forced to the limit to fill present and future orders on hand. The Spanish influenza is still a very serious factor, and working forces are cut down all the way from 20 to 60 per cent, while total shut-downs are not at all uncommon.

Stocks on hand in nearly all lines are exceedingly low and some products are next to impossible to get. Prices during the past week have practically remained stationary, and the early peace talk during the first weeks of the month has apparently in no way had any effect on business either with the manufacturer or the jobber.

LAMPS.—The demand is increasing and the market is in fair shape as to supplies and shipments.

LINE TOOLS.—Announcement was made this week that, effective Sept. 15, climbers' and linemen's tools advanced about 10 per cent. The advance also includes tool bags, digging bars and cable reels. Supplies on hand are only fair and the demand much heavier.

WASHING MACHINES.—These products are still showing marked popularity and the output cannot keep up with the sales. One of the largest manufacturers is eliminating some of the more expensive machines and is prepared to supply three or four of the household sizes only. Prices have not changed recently and stocks on hand are low.

FUSES.—The demand for fuses continues to be very heavy. As far as can be learned the supply of stocks on hand is only fair.

CABLE APPLIANCES.—Stocks on hand of all cable appliances are good and shipments prompt. There have been no price changes reported since June.

HEATER CORD.—A very serious situation is present in the heater cord market. Manufacturers have been called upon to turn their machinery to other more warlike purposes, and there is practically no heater cord in the market. One large appliance-manufacturing concern has sent out a notice to his customers asking that every effort be made to conserve old cord wherever possible and saying that it cannot supply more than six complete cords to any one customer.

FARM-LIGHTING PLANTS.—The Main Electris Manufacturing Company, Pittsburgh, Pa., has advanced the price of its product, effective Nov. 1. The size formerly at $125 is now listed at $140.

MOTORS.—Motors of all sizes are still in great demand. Stocks on hand are very low and shipments behind. It is practically necessary to have a priority order before a motor of some sizes can be obtained.

CIRCUIT BREAKERS.—Oil-switch and circuit-breaker business is very brisk. Supplies on hand are limited and shipments slow. Prices have not changed recently.

LINE MATERIAL.—Business is very quiet. Stocks on hand are good and shipments prompt. No recent price changes have taken place.

BOSTON

Business continues good, although somewhat below the level of a few weeks ago in volume. Stocks are running lower, but war needs are still being met with efficiency in most lines. Prices show little change, with the exception of an advance of 20 per cent in alkaline batteries, effective Oct. 16. Collections are still running a bit slow. The influenza epidemic appears to be subsiding rapidly in this district, and factory and mercantile operations are being resumed on the former scale. The labor market is seething with unrest. The United States Housing Corporation has filed plans with the inspector of buildings at Quincy, Mass., for the construction of 254 houses, to cost $1,277,500, for shipyard workers.

Deliveries are running about the same as last week. The market is short of electric radiators and washers, and dealers in appliances are in an uncertain frame of mind regarding future business. The announcement of the War Industries Board that the 1919 fan production will be curtailed to 40 per cent of the 1918 figures and that only 75 per cent of this year's vacuum cleaner production will be allowed next year is causing speculation as to the size of stocks which should be carried into the coming year and the extent to which such devices should be locally advertised. The movement to close mercantile establishments during the hours of 12 to 1 as a labor conservation measure is not being favorably received hereabouts, as yet.

MOTORS.—Stocks are fairly good except in the larger sizes. Prices show little change. The demand is somewhat below that of a year ago at this time. Some difficulty is reported in obtaining motors promptly for industrial electric truck applications. Cutting down of production because of the epidemic and labor troubles is the primary cause of a shortage.

CIRCUIT BREAKERS.—Business is very brisk, with 98 per cent government or allied war-plant demand in representative cases. Prices have remained steady since July. The employment of women in factories is increasing and with good results. No accumulation of factory stocks is possible now on any large scale. Raw material is in fairly good supply, when the demand is backed by the necessary priorities.

LAMPS.—The factories are very busy and output is promptly absorbed. Reserve stocks may be said to be in pretty fair shape.

WIRE—The shortage of No. 14 wire continues, but it is possible to obtain it in reasonable quantities for essential work. While stocks are low, one Boston jobber is known to have 500,000 ft. held for genuine government or related demands. Strict pledging is insisted upon in the moving of such stocks by gilt-edged houses.

ELECTRIC RANGES.—One Boston jobber received a carload of ranges a few days since, but the market is dull, and little pushing of this business can be seen at this time.

INDUSTRIAL ELECTRIC TRUCKS.—Government and related business rules the situation. Close watch is being exercised over the destination of all materials used in truck applications. Prices will show an advance of about $100 on quotations in the immediate future where a recent battery price increase affects bids. Deliveries range now from about two weeks upward, depending on the type of truck ordered. Some difficulty in obtaining motors is reported temporarily.

FIRE ALARM TELEGRAPH EQUIPMENT.—Business is very active in supplying governmental and industrial plants with improved protection apparatus. An order of 1000 pen registers has recently been placed for overseas military service. Municipal business is dull, but ought to be better in view of the importance of better protection and the favorable attitude of the government toward fire-alarm signal apparatus sales and applications. There is a feeling in manufacturing circles that too many municipalities are conducting a short-sighted policy this year in withholding expenditures for fire-alarm apparatus which are justified by the increased risks existing. In spite of the fact that manufacturing costs have increased in many cases from 100 to 300 per cent, the increase in price of apparatus has not been over 20 per cent in standard equipment. Labor conditions are reasonably steady now and the companies are in good shape to handle orders.

STREET-LIGHTING EQUIPMENT.—Municipal business is quiet, but cantonment and housing territory demands are very active.

CHICAGO

The business of the week has been especially brisk, in spite of the continued inroads on labor which are made by Spanish influenza. One electrical manufacturer employing more than 1000 persons reported 19 per cent of them absent on Wednesday. Government contracts and group residential building are again in evidence. Plans have been made by Harry J. Kusel & Company for constructing in Chicago eighty bungalows to cost $400,000. There have been few changes in commodity or product prices.

COPPER WIRE.—The situation in small sizes is not so difficult as was expected by the jobbers. It appears that the severe tightening which occurred a few weeks ago has been somewhat reduced now that the government is supplying wire mills with larger quantities of raw copper. Some shipments of smaller sizes were received this week.

ELECTRIC RANGES.—The manufacturers have stocks of many styles of ranges in Chicago and can accept orders for a considerable number. All of these styles will be offered for sale until present stocks are depleted.

SECOND-HAND MACHINERY.—Purchasers of second-hand machines apparently do not yet understand how to do business under the pledge system. This fact has caused a slowing up in orders for the smaller classes of machines. This does not mean that business is bad, however, for there is still plenty of business in large machines and some concerns have orders for two months ahead on their books. The volume of repair work is the greatest ever known.

TELEPHONE SUPPLIES.—Prices on bridle rings and similar small items have been increased slightly.

ELECTRIC HEATERS.—Household-type air heaters are in brisk demand with the supply limited. One manufacturer is refusing orders. Another manufacturer expects to put a new stock on the market next week.

MOTORS.—Manufacturers are still loaded to the limit with orders. Nevertheless, enough time is being spared here and there to get out new bulletins in foreign languages for use on present and future export trade.

METERS.—With the future of the farm-lighting plant in the hands of the War Industries Board, meter manufacturers who have been making both low-voltage and industrial-plant equipment are making special efforts to get ready to switch to the latter line exclusively if necessary.

HOUSEHOLD REFRIGERATORS.—A nationally known wholesale electrical distributer has contracted with a Middle Western manufacturer for a line of household electric refrigerators. These will be announced shortly.

PLATINUM CONTACT POINTS.—That the platinum contact point situation is not at all hopeless on account of shortage is evident from the fact that a Chicago firm is taking steps to place a line of this material through the electrical trade.

CEDAR POLES.—The producers claim that very few poles are being bought.

ATLANTA

Substantial rains fell this week, covering a large area of the Southeast, which has put the water-power companies in good shape for a while at least. Power curtailment by the War Industries Board has been very drastic during the past few weeks, in order to allow essential war plants to operate at capacity.

CONDUIT.—The latent demand for both white and black rigid awaits expansion as soon as restrictions are lifted. Manufacturers state that there are large quantities in factory stock and in process of manufacture, but this can only be released by the presentation of proper priority on account of big shipments being made to shipbuilding centers and government demand, which has shown a healthy increase in the last six months. Southeastern stocks are low and are estimated to be only 25 per cent of normal. Prices show no change. Warehouse shipments are up two to four points.

MOTORS.—During September a very good business was transacted in capacities up to 100 hp., but sales this month so far are somewhat off. Priority affidavits tend to retard sales.

PANELBOARDS.—Factory facilities have improved, but the call for these has fallen off following the speculative building situation. Shipments can now be made in two to three weeks.

STAMPED STEEL BOXES.—The volume of sales through commercial channels has sagged considerably but has been offset to some extent by heavy requirements from shipyards.

FLEXIBLE STEEL CABLE.—This and flexible conduit are moving freely, owing to the fact that the restrictions are less drastic than for rigid conduit. Jobbers state that the demand has increased sharply of late. Prices remain firm, ranging approximately 5 per cent above rigid conduit. So far there are ample stocks to handle all requirements.

ELECTRIC HOISTS.—The scarcity of labor has directed attention to this type of labor-saving device, and manufacturers report an increasing number of inquiries from all classes of industrials. Sales for government account are holding up well, and it is expected that this condition will exist for some time. Shipments for ordinary channels run from two to six months. Shipyards and lumber plants can secure equipment in about half this time. There has been no change in price during the past two months.

SEATTLE—PORTLAND

Seattle jobbers particularly report a heavy volume of sales the past week. Of note were large orders placed by the Norway Pacific Shipbuilding Company, Everett, for heavy power apparatus and electrical equipment for its plant nearing completion. Siems-Carey interests engaged in lumber logging and railroad building in the Olympia peninsula district recently placed heavy orders, as did the Standifer shipyard, Vancouver, Wash. The volume of sales to shipyards in Seattle also showed a decided increase over the past several weeks. Large Seattle jobbers assert the Christmas trade will be confined almost exclusively to those household devices which are still on the essential list. Even sales on these are not expected to approach last year's volume. Ordering for Christmas tree outfits and electrical novelties is very light and jobbers do not expect deliveries. The labor situation shows little if any improvement. Jobbers report that shortages heretofore reported still obtain. Rubber-covered wire in large sizes is hard to get, and smaller sizes are practically off the market. The Portland territory reports a temporary shortage in stocks of 50-watt and 100-watt types "Mazda C" lamps, although shipments are on the way. Stocks of miniature lamps are slowly improving. Other sizes are in good shape.

Orders were placed during the week for an aggregate of over 1500-kw. capacity in transformers for the new steel rolling mill of the Pacific Coast Steel Company. The Portland Coast Power Company, Tillamook, Ore., is working on a new 20-mile, 6600-volt transmission line from Tillamook to Brighton.

The rainfall of the past three weeks has materially improved water-power conditions, but much more is urgently needed at the present time to relieve conditions at steam plants. A permit has been received from the War Industries Board by the Northwest Trust Company to erect 100 homes for war workers in the peninsula district, Portland, costing from $1,200 to $1,700 each. The Spanish influenza epidemic in the Northwest is materially affecting the electrical industry, especially in Portland. Not only are many employees of various concerns suffering, but owing to drastic closing orders of the Board of Health prohibiting all public gatherings, earnings of public utilities have been reduced. Closing of churches, schools, theaters and similar places has made an appreciable decrease in lighting revenues.

The volume of sales of some farm-lighting outfits during the past month was heavy, especially in eastern Washington, the Inland Empire section and eastern Oregon. Stocks, in spite of heavy demand, are in fair shape. Demonstrations at county fairs are constantly bearing fruit. Washing machines are selling well. Stocks are practically nil and shipments extremely hard to obtain. The movement which has been strong for months shows no signs of declining. Collections are excellent and expected to continue to be so.

SAN FRANCISCO

Inasmuch as all unessential construction is being eliminated, it is natural that Pacific Coast business should be affected. The United States Navy representative sent to look over the field has decided to discontinue the projected Liberty shipbuilding plant near Oakland on the ground that it is difficult to secure sufficient steel now for existing plants. The industrial housing work at Clyde has been cut down from 350 to 103 cottages, which incidentally will be wired for, but not equipped with, electric ranges. On the other hand, the Mare Island Navy Yard, a permanent government plant, will be equipped with 210 one-and-a-half-story frame dwellings. In other lines of government activity, especially the air service, additional activity is noted. New hangers for San Diego, enlarged airplane factories near Sacramento and an additional hospital at the Whipple Barracks in Arizona are recorded for immediate construction. Private construction is necessarily small. As an indication of September building, San Francisco building permits were 242 in number and aggregated $757,000; Oakland permits for the same period, 333, amounting to $564,000, and those of Los Angeles 520, aggregating $724,000.

CREDITS AND COLLECTIONS.—Conditions were better in September than in the two previous months, possibly because 1918 crop money was placed in circulation.

TRANSFORMERS.—Very few sales are reported, as practically no new extensions are being made. The few tying-in lines are designed as through connections and not as feeders to the territory through which they run, at least at the present time. As work on these lines proceeds considerable pole-line hardware business is anticipated.

WASHING MACHINES.—The new prices, averaging $130 for the family machine, have not influenced business, which has been excellent. But the chief detriment to an increase of business over last year's showing has been the lack of stock. Several jobbers report big shipments on orders placed a long time ago, and their salesmen are again soliciting business.

FIBER.—Stocks are fair and demand is excellent. It is reported that a new factory is to be established at Kingman, Ariz., where fiber will be manufactured from Yucca and the Spanish bayonet plants. This is an innovation whose progress is followed with considerable interest.

LAMPS.—Local lamp stocks are good. The demand is steady, and so far few orders for winter requirements have been received. The Oakland lamp factory has informed its customers that only a percentage of orders covering frosted lamps can be filled by it, owing to its inability to secure necessary apparatus, and it furthermore requests its customers to do all possible to cut down the demand for frosted lamps.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B & S. Size	List per 1000 Ft.
No. 14 solid	$61 00
No. 12 solid	71 00
No. 10 solid	90 00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95 00
No. 8 stranded	115 00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266 00
No. 1 stranded	315 00

Twin-Conductor

No. 14 solid	104 00
No. 12 solid	135 00
No. 10 solid	185 00
No. 8 stranded	235 00
No. 6 stranded	370 00
No. 4 stranded	575 00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

DISCOUNT CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20% to $73 20
Coil to 1000 ft	List

	No. 12 Solid
Less than coil	+20% to $85 20
Coil to 1000 ft	List

Twin-Conductor

	No. 14 Solid
Less than coil	$115.00
Coil to 1000 ft	100.00

	No. 12 Solid
Less than coil	+20% to $162.00
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to 12%
1/5 to std. pkg	+5% to 20%
Std. pkg	18% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 45—$0.46	$0 45—$0.47
2 to 50	.40	40— 41
50 to barrel	.35— .36	36 .37
Barrel lots	.32— .329	.33— .339

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40 to $0.45	$0.40 to $0.45
12 to 50	.35 to .39	.35 to .39
50 to barrel	.319 to .362	.329 to .382
Barrel lots	.289 to .332	.299 to .342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5 00
⅜	250	7 50
½	100	10 00
¾	50	13 00
1	50	21 00
1¼	50	26.00
1½	25–50	35 00
2	25–50	45 00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single.trip.	$75 00	$63.75— 69 75
⅜-in. double strip	75 00— 82 50	72.00— 75 00
½-in. single strip	100 00	85.00— 93.00
½-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75 00	$63 75 to $64 25
⅜-in. double strip	78.25 to $90 00	71.25 to 75 00
½-in. single strip	100.00	75 00 to 85.00
½-in. double strip	105.00 to 120 00	93.00 to 100 00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0 05½	1	$0.25
¼	06	1¼	.33
⅜	09	1½	.40
½	12	1¾	.47
⅝	15	2	.55
¾	18	2¼	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$25 00-51.70	$24 00-35 20	$23.00-30 25
¼-in.—	30.00-56.40	28.00-38.40	26.00-33.00

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$44 00-60 00	$30.00-33.00	$26 50-29 15
¼-in.—	48 00-65.00	33.50-36.00	29.00-31.80

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
¼	$0.08½
⅜	.08½
½	08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0 05	$0 19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1 10
2½	.40	1 80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	7% to 7 1%	9% to 9.1%
2500 to 5000 lb.	10% to 10 1%	12% to 12 1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+5.5% to 3.5%	+3.5% to +1.5%
2500 to 5000 lb.	+2.5% to +5%	+5% to 1%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$6.00 to $7 00
Discount	20% to 30%

CHICAGO

List price	$6 00 to $7 00
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp	100	$0 25
35-amp. to 60-amp	100	.35
65-amp. to 100-amp	50	90
110-amp. to 200-amp	25	2 00
225-amp. to 400-amp	25	3 60
450-amp. to 600-amp	10	5 50
600-Volt		
3-amp. to 30-amp	100	$0 40
35-amp. to 60-amp	100	60
65-amp. to 100-amp	50	1 50
110-amp. to 200-amp	25	2 50
225-amp. to 400-amp	25	5 50
450-amp. to 600-amp	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41% to 45%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30% to 31%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6.00 to $9 37
1/5 to std. pkg	5.25 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8.00
1/5 to std. pkg	7 00

Standard packages, 500. List, each, $0.07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

Regular, Clear:	Std Pkg.	List, Each
10 to 40-watt—B	100	$0 35
60-watt—B	100	40
100-watt—B	24	85
75-watt—C	50	70
100-watt—C	24	1 10
200-watt—C	24	2 20
300-watt—C	24	3 25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4⅜-in., Frosted:		
100-watt—G 35	24	1 15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30 47—$40.77
Coil to 1000 ft	27 42— 30.22

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$38.00
Coil to 1000 ft	28.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24.00

CHICAGO

Net per 100	$21.75 to $30 00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30 00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30 00
103—C.A., 9, 4R, B 1½	25 00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%	20%
$10.00 to $50.00 list	36%	31%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20%	10%
$10.00 to $50.00 list	30%	20%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	5%
1/5 to std. pkg	15%
Std. pkg	25%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$21.00 to $34 00
1/5 to std. pkg	17 85 to 28 90

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$16 80–24 15
1/5 to std. pkg	15 80–21.00

Standard package, 2200. List per 1000, $20.00–21 00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500 5½ N C.	Std. Pkg. 4000 —Solid Nail-it—N.C.
Less than 1/5 std. pkg	$16 00 to $22 00	$32 00
1/5 to std pkg	13 60 to 18 70	27 20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500. 5½ N C.	Std. Pkg. 4000 —Solid Nail-it—N.C.
Less than 1/5 std. pkg	$11 70–$24 00	$33 85–$36 80
1/5 to std pkg	10.15– 20 00	26 60 32 00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0 33
½-in. cap keyless socket	500	30
½-in. cap pull socket	250	60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std pkg	List
1/5 std. pkg	10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0 80
60-amp. S. P. S. T	1 20
100-amp. S. P. S. T	2 25
200-amp. S. P. S. T	3 48
300-amp. S. P. S. T	5 34
30-amp. D. P. S. T	1 20
60-amp. D. P. S. T	1 78
100-amp. D. P. S. T	3 38
200-amp. D. P. S. T	5 20
300-amp. D. P. S. T	8 00
30-amp. 3 P. S. T	1 80
60-amp. 3 P. S. T	2 68
100-amp. 3 P. S. T	5 08
200-amp. 3 P. S. T	7 80
300-amp. 3 P. S. T	12 00
Low Grade:	
30-amp. S. P. S. T	$0 42
60-amp. S. P. S. T	74
100-amp. S. P. S. T	1 50
200-amp. S. P. S. T	2 70
30-amp. D. P. S. T	68
60-amp. D. P. S. T	1 22
100-amp. D. P. S. T	2 50
200-amp. D. P. S. T	4 50
30-amp. 3 P. S. T	1 02
60-amp. 3 P. S. T	1 84
100-amp. 3 P. S. T	3 76
200-amp. 3 P. S. T	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15% to +10%
$10 to $25 list	+10% to 2%
$25 to $50 list	2% to 5%
	Low Grade
Less than $10 list	+5% to list
$10 to $25 list	List to 8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 15%
$10 to $25 list	List to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15% to 16%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0 28
5-amp. single-pole, ind	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0 45
10-amp. three-way	50	70
10-amp. double-pole	50	70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to 10%
1/5 to std. pkg	+5% to 16⅔%
Std. pkg	18% to 25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 30%	Net to 30%
$2.00 to $10.00 list	10% to 35%	5% to 40%
$10.00 to $50.00 list	20% to 37%	10% to 52%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 50%

TOASTERS, UPRIGHT

NEW YORK

List price	$6 00 to 6 50
Discount	20% to 30%

CHICAGO

List price	$6 00 to $6 50
Discount	20% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0 51–$0 66
No. 18, full spools	.49– 56

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0 65 to $0 72
No. 18, full spools	.595 to .65

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$20 00–$25 00	$15.00–$17 00	$15 00–$15 75
12	23 58– 27 09	21.62– 29 09	17 68– 23 22
10	30 20– 37 80	27.45– 32 40	23 47– 32 40
8	42 74– 53 34	38 85– 45 72	33.21– 45 72
6	61.50– 84 42	55.35– 72 36	52.58– 55.48

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$25 00	$18 00–$25 00	$15 50
12	$29 46– 31 44	29 46– 31 44	$25 54– 31 44
10	41 10– 43 84	41 10– 43 84	34 62– 38 36
8	57 00– 61 76	57 90– 61 76	50 18– 54 04
6	85 31– 97 68	85.31– 85 47	72 21– 85 47

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4 0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$39 75 to $44 00
25 to 50 lb	39 75 to 42.00
50 to 100 lb	38 75 to 40 00

CHICAGO

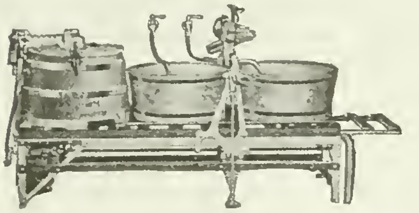
	Per 100 Lb. Net
Less than 25 lb	$41.00 to $41.76
25 to 50 lb	39.75 to 40.76
50 to 100 lb	38 75 to 39.76

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Platform-Type Electric Washer

Convenience is claimed as the chief feature of the platform washer now being put out by the Voss Brothers Manufacturing Company, Davenport, Iowa. This machine, which is known as "E-12," has a peg-type dasher. It not only does the washing but takes care of rinsing, wringing and draining as well, without the necessity of lifting the tubs either during the washing or after it is finished. The sliding wringer attachment and the drain from the tub make this heavy labor unnecessary, according to the makers.


LIFTING TUBS ELIMINATED BY SLIDING-WRINGER ATTACHMENT AND DRAINS

The sliding-wringer feature serves to make it possible to operate the wringer in either direction from any place on the bench. Double control gives the user convenience, speed and safety in operation. The hand lever placed conveniently at the top of the side frame enables the operator to start, stop or reverse the wringer by hand alone. A foot attachment is also provided which permits the operator to use both hands in rinsing the clothes and in feeding the wringer, starting and stopping the wringer at will by application of slight pressure on the foot treadle.

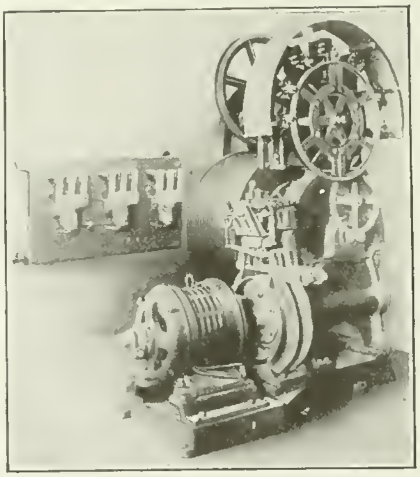
Simple Control for Squirrel-Cage Elevator Motors

An elevator control to be used with squirrel-cage motors in sizes up to and including 20 hp. at car speeds not exceeding 150 ft. (45.7 m.) per minute has been designed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., for both freight and passenger service. The equipment of this elevator control, type E, is extremely simple, consisting of a small control panel mounted on the wall somewhere near the motor, a car switch by means of which the operator controls the movement of the elevator cars and such elevator safety devices as may be desired. A line contactor and two mechanically interlocked directional contactors are mounted on a black marine-finished slate base. The motor, being started with full-line voltage, requires no secondary or accelerating contactors.

The equipment is simple in construction and quiet in operation. All parts are easily accessible for inspection or repairs. The contacts are graphite to graphite of the butt type (no sliding contacts used) and are interchangeable for the various contactors. The same contacts may be used for alternating-current and direct-current type E controllers for both car-switch and push-button operation.

The car switch closes the line contactor and one of the directional contactors and thus starts the car in the desired direction.

Westinghouse type E brake magnets are recommended for use with this equipment. When the operator by means of the car switch closes the circuit through the contactors a shunt circuit energizes the brake magnet and releases the brake. If the car switch is returned to the "off" position or if any of the safety devices operate, the control circuit is opened, the brake magnet is de-energized and the brakes are immediately applied.


CAR-SWITCH ELEVATOR ALTERNATING-CURRENT CONTROL

The safety devices most commonly used are the emergency switch to be used by the operator in case of accident to the car switch; machine-limit and hatchway-limit switches, which operate automatically to prevent accidents from over-travel should the operator for any reason fail to release the car switch, and door interlocks, which prevent the starting of the car until the door is properly closed.

The car-switch elevator control (type E) is used with alternating-current squirrel-cage motors of 20 hp., 220, 440 and 550 volts, 25-cycle and 60-cycle, two-phase and three-phase types.

Reflector-Type Fixture

As an addition to its line of "Standard-Lite" units the Standard Brass & Bronze Manufacturing Company, 636 Penn Avenue, Pittsburgh, Pa., has developed a new unit for 100-watt type C lamps, which it designates as its No. 6104 unit. The reflector diameter is 18 in. (45 cm.) and the bowl diameter 10 in. (25 cm.). The fixture is designed for efficiency and economy and is of a type especially adapted for stores, offices, schools, churches, libraries, banks and other public buildings.

High-Current Pull Switch

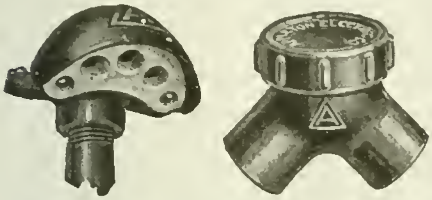
For use with conduit wiring a pull switch has recently been placed on the market by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis. It has a one-piece white-glazed porcelain base which entirely covers a standard 3¼-in. (7.1-cm.) outlet box. Two screws furnished with the box are used to attach the switch. The shell lock for fastening the shell to the base is the same as those used on all Cutler-Hammer push sockets as well as on other types of this firm's pull switches.

The mechanism used consists of two pieces of porcelain fastened together and containing a rotary switch movement operating on a steel shaft. There are two holes in the halves of porcelain arranged to permit feeding the supply wires through them. This prevents vibration and operation of the switch from loosening of the contact screws. Having a capacity rating of 6 amp. at 125 volts instead of the usual 3 amp. at the same voltage, the switch is said to be of particular value for controlling large groups of lamps or high-wattage lamps.

PULL SWITCHES USEFUL IN CONDUIT WIRING

Interchangeable Service Entrance Fittings

The Appleton Electric Company of Chicago has designed two entrance fittings, one for service entrance and the other for outside conduit installation. The first has been designed to meet the demand for a small, light and durable entrance. The same parts are used for ½, ¾ and 1-in. (1.3, 1.9 and 2.5-cm.) fittings, excepting the hub, a separate hub being required for each size. Interchangeability is one of the features of this fitting, the top cover and also the porcelain covers being interchangeable on all sizes. The top cover is removable, allowing for a straight pull of the wires, and connections may be made without difficulty. This fitting may be used either on vertical or horizontal conduit.


CONNECTIONS TO THESE FITTINGS MAY BE MADE EASILY

The second fitting for outside conduit installation is a neat, short right-angle fitting. This fitting is perfectly smooth on the interior, and the corners are rounded so as to prevent any injury to wires. The cap is well finished so that it will sit right on the fitting, and the result is a weatherproof entrance. Black enamel and galvanized are the standard finishes for the above fittings.

Powerful Mine Locomotive

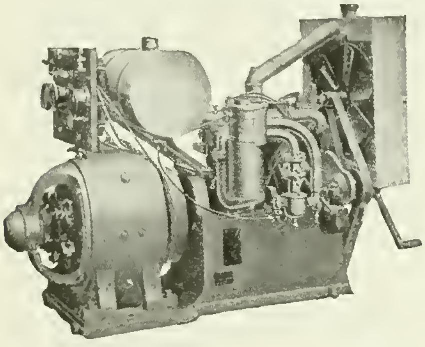
An important need of present times is the replacement of mule teams in mining work by electric locomotives. This releases the drivers for other important work in the industry. A powerful electric locomotive of the Baldwin-Westinghouse type is furnished by the Westinghouse Electric & Manufacturing Company, East Pittsburgh. The frame is of especially heavy and rugged construction and is driven by traction motors of the interpole type. The electrical equipment is much like that found on trolley cars with magnetic blow-out controllers, fuse and circuit breakers of the car type. Two incandescent headlights are provided in heavy iron casings with iron bars protecting the glass. Trolleys are provided to give adjustable contact pressure and also for adaptation to a variation in the height of the trolley wire. This is essential when the locomotive operates through passageways of limited head room.

REPLACES MANY MULE-AND-MAN TEAMS

Private Electric Lighting Plants

Two general styles of gasoline-engine-driven electric lighting plants are being manufactured by the Langstadt-Meyer Company, Appleton, Wis. One type consists of a gasoline engine belted to a generator designed to supply energy to installations on farms, in summer homes, resorts, country stores, public buildings, garages, etc., in conjunction with an electric storage battery. Of this type three sizes are made, namely, a 40-light to 60-light size, an 80-light to 100-light size and an 80-light to 110-light size. The engine used is a 3-hp., four-cycle single-cylinder machine, and the battery is of the Faure type. The outfit is sold complete with engine, generator, battery, switchboard, gasoline and water tanks.

The other type of plant consists of a direct-connected four-cylinder gasoline engine and a 5-kw. electric generator. It is designed, the manufacturers say, to supply electric light and power at low cost of operation and maintenance wherever central-station service is not available or where a self-contained portable unit is required. These machines are offered to supply demand for a high grade, simple, compact, reliable, medium-weight, low-speed unit. The outfit is intended for continuous operation, and for this reason no storage battery is sold with the standard set.

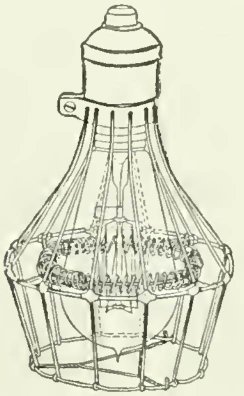

DIRECT-CONNECTED PLANT IN ONE COMPACT UNIT

Linemen's Straps and Belts

For use by linemen T. J. Cope of 1620 Chancellor Street, Philadelphia, is marketing a line of leather belts and straps. A belt of black harness leather, 2¼ in. (5.7 cm.) in width, has two heavy "D" rings, six loops for tools and a strong buckle, and may be obtained in five sizes. A safety strap 1¾ in. (4.5 cm.) wide and 6 ft. (1.8 m.) long is provided with an extra strong snap at each end, while a combined safety vise or jack strap 1¼ in. (3.2 cm.) by 5½ ft. (1.7 m.) is made of selected harness leather and may be had with or without snaps. Climbers' straps are also being made, a set consisting of two upper and two lower straps with pads 4 in. by 4 in. (10.2 cm. by 10.2 cm.).

Wire Guard for Lamp Protection

For protecting lamps from breakage and unauthorized removal, W. N. Matthews & Brother, Inc., of St. Louis, Mo., are marketing the "Holdfast" lamp guard shown in the accompanying illustration. The manufacturer says that the guard transfers shocks, jars and vibrations to the lamp socket, and these are then dissipated by the lamp cord. The framework of the guard consists of two rings, one around the widest portion of the bulb and the other above the lamp tip, which are connected to the clamping and locking collar on the socket by a number of vertical bars. The lamp is protected from blows and jars by these rings and the bars, while a spring cushion, which is the only part of the device touching the bulb, will absorb shocks and vibrations that tend to break the lamp at its neck. Both the lock on the collar and the trap lock at the lamp's point are said effectually to prevent the theft of lamps. The guard has a 1-in. (2½-cm.) clearance and can be stood on the end ring without the useful downward rays of light from the lamp being obstructed.


PREVENTS THEFT AND BREAKAGE

Crosses for Christmas Trees

A line of miniature incandescent lamps for use on Christmas trees and for other decorative purposes is being offered to the trade by the A. C. Mannweiler Company, Inc., of Fort Wayne, Ind. The lights may be obtained in red, white and blue, as well as in other colors, and are said to be both safe and durable. A new design in the form of a cross is illustrated.

APPROPRIATE FOR CHRISTMAS TREES

Trade Notes

RIGHT OF COMMERCIAL TRAVELERS IN SOUTH AMERICA.—A treaty designed to protect rights of commercial travelers has been ratified between the United States and Uruguay. The treaty limits right to license or tax commercial travelers to the federal government of each country and provides a uniform plan for certification of samples. Negotiations are in progress for similar treaties with other Latin-American countries

INDEPENDENT LAMP MANUFACTURERS ACQUIRE INTEREST IN LARGE BULB PLANT.—The Independent Lamp & Wire Company, New York City, and the Novelty Incandescent Lamp Company, Emporium, Pa., have acquired an interest in the Rochester Bulb Company, formerly the Rochester Tumbler Company, Rochester, Pa., which commenced to manufacture bulbs two years and a half ago and has now devoted its entire plant to the making of bulbs only. Five hundred people are employed, and the daily output is 100,000 bulbs with every probability of further increase. Officers of the company are: President, B. G. Erskine; treasurer, A. P. Saas, who is also treasurer of the Independent Lamp & Wire Company; vice-president and manager of the plant, Charles Runyon, and vice-president, M. L. Hofheimer, who is also vice-president of the Independent Lamp & Wire Company. Management of the factory will be retained by Charles Runyon, who was formerly president of the Rochester Tumbler Company and is very well known throughout the glass trade. General offices of the company will be at 1737 Broadway, New York City.

SEVENTEENTH ANNIVERSARY OF HYGRADE LAMP COMPANY.—The Hygrade Lamp Company, Salem, Mass., is commemorating the seventeenth anniversary of its establishment by issuing a special number of the *Hygrade Triangle*, the company's publication for employees. An interesting account of the growth of the concern is included, with many personal reminiscences from those who have led and have been closely identified with its work since the early days of the organization. The floor space has incerased from 5400 sq.ft. to about 60,000 sq.ft. and the invested capital from $3,500 to $500,000 since 1901. The company started business with one bookkeeper and now has an office force of fourteen members and a total payroll of about 360 employees. The enterprise started in Middleton, Mass., and was soon moved to Danvers, F. A Poor, now treasurer and general manager, and Matthew Merritt being the organizers of the concern. In the early days it was known as the Bay State Lamp Company, and refilling was the principal business handled. In 1909 Mr. Poor took up the manufacture of carbon lamps under the present company name, and two years later, with Walter E. Poor, now assistant general manager, in charge of the development, the manufacture of tungsten lamps was begun. The low-voltage tungsten sign lamp was first put in production on account of the ease of manufacturing the short V-filament lamp and the ease of reaching a market for this product. In the fall of 1912 the manufacture of regular 25-watt to 60-watt tungsten lamps was begun. Up to the beginning of the war the company obtained practically all its bulbs and filament wire from Australia. In 1913 the refilling of lamps was discontinued entirely, and the outbreak of the war found the company making but one-third carbon lamps in its output. Two years later the company began making wire-drawn filaments on its own account, and the lamps resulting gave better service than those made with foreign wire. In 1916 the company moved into its new factory at Salem. The plan of distributing Hygrade lamps through jobbers was started about this time, and in 1917 a license agreement under the Just and Hannaman patent was signed with the General Electric Company. In 1917 the company attained a production rate of 13,000 lamps per day, 7 per cent of which were of the gas-filled type. By the summer of that year it became necessary to increase the floor space and a two-story brick storehouse was erected which added about 50 per cent to the plant area. The organization is well represented in the army and navy, and the employees exceeded their quota of $21,000 by $5,150 in the fourth Liberty loan, the total subscriptions, with that of the company, aggregating $41,150. E. J. Poor, president and sales manager, and J. H. Poor, director, are also receiving congratulations on the company's anniversary.

EXPORT LICENSE PROCEDURE FOR SAMPLES.—The War Trade Board announces in a new ruling (W. T. B. R. 280) the regulations governing the exportation of samples of no commercial value to be used in the solicitation of orders.

GOVERNMENT ORDERS AND CONTRACTS.—The hardware and metals division of the Quartermaster General's Department is calling for bids on or before Nov. 5 on sixty 2-qt. electric glue pots, tinned inside, complete with cord and attachment plug for use on 220 volts, American Electric Company or equal.

RETURN OF MATERIALS FOR REPAIRS OR CREDIT.—The Westinghouse Electric & Manufacturing Company, New York office, is notifying customers that strict compliance with certain rules relative to the return of materials for credit and repairs will assist greatly in avoiding unnecessary delay and confusion. Customers in the New York district are urged under no condition to return any material whatever until they have first secured proper shipping instructions from the New York office and then not to neglect to mention class and style of material when entering request. This action, it is pointed out, is made necessary because of the return in many instances of material intended for the New York service department to the East Pittsburgh, Newark or Mansfield works while other material intended for the works has gone to the service department or to the New York office. In the future the company will assume no responsibility unless these conditions are complied with.

WIRE DELIVERIES BY AËROPLANE.—Speed of delivery since this war began has been one of the chief virtues of an electrical jobbing house, and the Richmond (Va.,) branch of the Western Electric Company has set a new record in that respect by delivering some wire by aëroplane. The government furnished the aëroplane, to be sure, but to the Richmond house belongs the credit for devising the plan. Here is the story as told by J. B. Odell, manager of the Richmond branch, in a message sent at the very moment that the aëroplane was delivering the goods: "Richmond has, I believe, the distinction of being the first Western Electric house to deliver its goods by aëroplane. The supply officer at Langley Field (aviation experimental station), Hampton, Va., about 100 miles away, called up this morning and stated that they were in great need of some weatherproof wire. Of course we had it in stock, and they asked us how quickly we could get it to them. We suggested express, which would have delivered the goods at Hampton to-morrow morning, but that was not quick enough for the government's needs. We then proposed that they give us the use of an aëroplane, as affording the quickest possible means of getting the goods to Hampton. Speaking literally, they took us up, and they will have the wire down there within three or four hours after they called us."

THE NATIONAL TUBE COMPANY of Pittsburgh, Pa., continues to add to its property holdings in the neighborhood of its works at Dravosburg. Following its purchase of thirty acres, it has now acquired seventeen acres more from the Pittsburgh Coal Company, as well as thirty lots on Washington Road. The company's purchases now aggregate fifty-one acres.

THE WALTER A. ZELNICKER SUPPLY COMPANY announces the appointment of R. H. Wilson as assistant to the president, with office at St. Louis. Mr. Wilson, who has been with the company for years, latterly as Houston representative, is succeeded there by B. O. Griffin, for the past twenty years storekeeper and assistant general manager of the International & Great Northern Railroad and more recently assistant to president of the St. Louis Southwestern Railroad in charge of purchases.

THE ALLIS-CHALMERS MANUFACTURING COMPANY, Milwaukee, Wis., has been making strenuous efforts to meet the war need for centrifugal pumps and has just recently caught up with the increased volume of business. As a result it now has a number of type "S" centrifugal pumps in sizes from 2 in. to 20 in. completed and ready for prompt government or other priority orders. The smaller sizes are in more plentiful supply. From six to twenty-five days, according to size of pump, are required for shipment, this time being the time necessary for making suitable common-base plates for mounting pumps and Allis-Chalmers motors. The company further states that it has a reasonable supply of motors in stock suitable for a portion of these pumps.

Trade Publications

FUSES.—Data and oscillographic tests of the "S. & C" carbon-tetrachloride fuses are given, with illustrations of their applications to inside and outdoor service, in a leaflet prepared by the Delta-Star Electric Company of Chicago.

INCLOSED SWITCHES.—Illustrating and describing the Trumball Electric Manufacturing Company's line of externally operated safety switches, the Julius Andrae Sons Company of Milwaukee is distributing an eight-page catalog known as revised circular No. 37.

HOUSEHOLD MOTOR.—The Hamilton-Beach Manufacturing Company, Racine, Wis., is distributing to retailers a circular reproducing two Hamilton-Beach "Home" motor advertisements that are being run in two national women's magazines and containing a card for procuring selling helps.

BELT FASTENERS.—The subject of belt joining is treated in a humorous way by the Crescent Belt Fastener Company of 381 Fourth Avenue, New York City, which has prepared a twenty-four-page booklet entitled "Gone Again," pointing out the advantages of "Crescent" belt fasteners in a "movie" drama. Copies may be had upon application.

LIGHT AND POWER PLANTS.—Its line of "Perfection" automatic and semiautomatic light and power plants for use on farms is fully described in a twenty-four-page booklet from the Perfection Storage Battery Company, Fortieth Street and Rhodes Avenue, Chicago. Information is also given about its "Jupiter" belt-driven plants and the lighting fixtures and appliances sold by the company.

ATTACHING CAP.—"C-H Standard Attaching Devices" is the title of a two-color envelope folder being distributed by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. The "Standard" attaching cap illustrated and described therein fits twenty-one of the various attaching devices of this company, as well as the standard plugs and receptacles of five other makers. Prices and listings of the complete line of attaching devices are also given.

New Incorporations

THE PITTSBURGH (PA.) GENERATOR COMPANY has been chartered with a capital stock of $50,000 to manufacture generators, etc. The incorporators are: F. Giles, M. M. Clancy and J. J. Kennedy.

THE METAL TOP BATTERY COMPANY of Oakland, Cal., has been incorporated with a capital stock of $50,000 to manufacture batteries. The incorporators are: D. R. Young, Henry Milan and George L. Tarver.

THE ATLANTIC & PACIFIC POWER COMPANY of Augusta, Me., has been incorporated with a capital stock of $900,000 to develop and deal in water powers, especially tides, currents and waves of the ocean, etc., to generate electricity.

THE ELECTRIC KITCHENET COMPANY, Dover, Del., has been incorporated with a capital stock of $500,000 to manufacture electrical specialties. The incorporators are: M. L. Rogers, L. A. Irwin and W. G. Steigler, of Wilmington, Del.

THE HOT FLO UTILITIES COMPANY of New York, N. Y., has been incorporated by S. O. Simons, H. Frantzen and H. Remington, 302 West 102d Street, New York City. The company is capitalized at $50,000 and proposes to manufacture electrical supplies, etc.

THE STANDARD APPLIANCE COMPANY OF AMERICA of New York, N. Y., has been incorporated by E. Goodman, J. L. Volz and N. Shaw, 32 Cooper Square, New York, N. Y. The company is capitalized at $95,000 and proposes to manufacture general telephone apparatus.

THE PROCESS ENGINEERS of New York, N. Y., has been incorporated by J. A. Kellogg, H. J. Alheim and E. Ackley, 15 Broad Street, New York City.. The company is capitalized at $200 000 and proposes to do a general chemical, electrical, consulting and contracting engineering business.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

WINN, ME.—The local electric light plant, owned by Robert Carll and Henry Whitney, was recently destroyed by fire.

NASHUA, N. H.—The Board of Aldermen has granted the Connecticut River Power Company of Worcester permission to extend its electric transmission line into Nashua to supply electricity to certain industries here.

WORCESTER, MASS.—Plans have been prepared for the erection of a new boiler house, 50 ft. by 70 ft., at the works of the Rockwood Sprinkler Company, 56 Harlow Street.

EAST NORWALK, CONN.—The voters of the Third Taxing District have authorized the Commissioners of the district to enter into a contract with the Connecticut Light & Power Company to furnish electricity for operating the local system for a period of ten years; also to purchase the distributing equipment of the Connecticut company and connect it with the lines of the district. The municipal electric generating plant will be closed down and the machinery sold.

GROTON, CONN.—The taxpayers have authorized the Board of Water and Light Commissioners to enter into a contract with the Shore Line Electric Railway Company, 362 Main Street, Norwich, for electricity to operate the municipal electric light system. Energy will be secured from the Montville power plant of the Eastern Connecticut Company. The cost of installing the new system, including transformers, wiring, insulation, etc., is estimated at $20,000.

NEW LONDON, CONN.—Contract has been awarded by the Navy Department, Washington, D. C., to James Miles & Son of Worcester, Mass., for the erection of two sub-charging stations at the local government site, to cost about $16,837.

Middle Atlantic States

ALBION, N. Y.—Bids will be received by John L. Reilly, acting president board of managers of the Western House of Refuge, Albion, N. Y., until Nov. 12 for electric work and rewiring four cottages at the Western House of Refuge for Women at Albion. Plans and specifications may be consulted at the above institution, at the New York office of the Department of Architecture, Room 1715, Tribune Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

AMSTERDAM, N. Y.—The Schenectady (N. Y.) Illuminating Company has petitioned the Public Service Commission for permission to erect an electric plant in Amsterdam.

BUFFALO, N. Y.—Contract has been awarded by the Republic Carbon Company to the Lackawanna Bridge Company, Bell and Abbey Streets, Buffalo, for the construction of four new factory buildings at its works.

LA SALLE, N. Y.—Plans have been filed by the La Salle Electric Corporation for the construction of a new transformer station, 25 ft. by 35 ft., to cost about $10,000. Contract for the building has been awarded to Fred Brooke of La Salle.

LYONS, N. Y.—The local electric plant of the Niagara, Lockport & Ontario Power Company was damaged by fire on Oct. 20, causing a loss of about $200,000.

NEW YORK, N. Y.—Plans have been prepared for the erection of a new boiler house, 30 ft. by 30 ft. by 30 ft., at the Roosevelt Hospital, Ninth Avenue and Fifty-ninth Street.

NEW YORK, N. Y.—Work has begun in connection with the remodeling of the Grand Central Palace, Lexington Avenue and Forty-sixth Street, recently taken over by the government, to be known as the Debarkation Hospital No. 5. Considerable electrical equipment will be required for the proposed improvements.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 11 for construction of electric shop and light machinery at the local navy yard, under Specification 3551, to cost about $800,000.

NIAGARA FALLS, N. Y.—Plans have been prepared by the Acheson Graphite Company, Buffalo Avenue and Portage Street, for the erection of three new factory buildings on the River Road, Tonawanda, 40 ft. by 40 ft., 65 ft. by 100 ft. and 40 ft. by 80 ft. respectively. Contract has been awarded to the J. W. Cowper Company, Fidelity Bank Building, Buffalo.

OGDENSBURG, N. Y.—Plans are under consideration by the Ogdenburg Power & Light Company for the erection of a new office building on Ford Street near Catherine Street, to cost about $10,000. Williams & Johnston, 40 Ford Street, are architects.

TONAWANDA, N. Y.—The Pierce-Arrow Motor Car Company has awarded contract for the construction of a new boiler plant in connection with its proposed new works on the River Road to the J. W. Cowper Company, Fidelity Building, Buffalo, N. Y.

BLOOMFIELD, N. J.—Contract has been awarded by the Sprague Works of the General Electric Company to the Salmond Brothers Company, 526 Elm Street, Arlington, for the erection of its proposed new pattern shop, to cost about $50,000.

JERSEY CITY, N. J.—Plans are being prepared by the Continental Can Company, 111 West Washington Street, Chicago, Ill., for the construction of three and four buildings between Fifteenth and Sixteenth Streets, to cost about $500,000.

PENNS GROVE, N. J.—The Salem & Penns Grove Traction Company, it is reported, will build an extension to Pedrickton to connect with the Camden, Gloucester & Woodbury Railway, passing through Bridgeport, Paulsboro and Gibbstown.

TRENTON, N. J.—Work has begun by the Trenton & Mercer County Traction Company on the installation of new conduits in Lincoln Avenue, this being one of the steps in the elimination of electrolysis damage in Trenton. E. E. Brownell has been engaged by the city officials to suggest ways and means for overcoming this difficulty.

ARDMORE, PA.—Bids will be received at the office of the Commissioners of Lower Merion Township, Ardmore, until Nov. 26, for furnishing and installing a 125-hp. electric motor and centrifugal pump for pumping sewage at the Mill Creek pumping station, together with all necessary foundations, wiring, etc. Robely A. Warner is superintendent.

EASTON, PA.—Notice has been filed by the Pennsylvania Utilities Company of Easton with the Public Service Commission of an issue of $115,000 in notes. Part of the proceeds, it is understood, will be used for extensions.

EAST PITTSBURGH, PA.—Plans have been prepared for the erection of a new three-story building, 65 ft. by 70 ft., at the local plant of the Westinghouse Electric & Manufacturing Company.

HARRIMAN, PA.—Arrangements have been completed for the erection of an electric power plant at the local works of the Merchants' Shipbuilding Corporation.

HARRISBURG, PA. — Arrangements have been completed by the City Council for the installation of the proposed new police and fire-alarm systems. Clark E. Diehl is city electrician.

NORTHEAST, PA.—The installation of an electric light plant is reported to be under consideration by the Borough Council.

PHILADELPHIA, PA.—Contract has been awarded by the Philadelphia Electric Storage Battery Company to F. P. E. Aubel, 2503 Germantown Avenue, for the erection of two two-story buildings, about 49 ft. by 118 ft. and 30 ft. by 40 ft., respectively, at Ontario and C Streets.

SHARON, PA.—Arrangements have been completed by the Savage Arms Corporation, 50 Church Street, New York, N. Y., for the construction of a new power plant, 88 ft. by 88 ft., at its local works. Contract has been awarded to the Stone & Webster Engineering Corporation, 120 Broadway, New York, N. Y.

THROOP, PA.—The Price-Pancoast Coal Company, Board of Trade Building, is planning to erect a new electric plant at its works. The proposed building will be about 80 ft. by 100 ft. and will cost about $75,000.

WEST NANTICOKE, PA.—Plans are being considered by Stapler & Boll, Mears Building, Scranton, for the construction of a coal breaker and stripping plant at West Nanticoke, to cost about $100,000. Frank B. Davenport, Coal Exchange Building, Wilkes-Barre, is engineer.

BALTIMORE, MD.—The United Railways & Electric Company is contemplating building an extension of its Sparrows Point line to the yards of the Bethlehem Shipbuilding Corporation.

BALTIMORE, MD.—Contract has been awarded by the Central Chemical Company for the erection of a new building at Race and Winder Streets, to cost about $155,000, to Westinghouse, Church, Kerr & Company, 37 Wall Street, New York, N. Y.

CHARLESTON, W. VA.—Improvements are contemplated to the electric power plant and waterworks system of the West Virginia Water & Electric Company, including the construction of pumping station and intake from river, the installation of two electrically driven centrifugal pumps of 18,000,000 gal. daily capacity, reinforced concrete reservoir of 2,000,000 gal. capacity, addition to filter plant, including buildings, pipe, etc. They have a contract with the government to supply electricity and water to the naval ordnance plant at South Charleston. The Charleston Concrete Construction Company is contractor. James H. Fuertes, 140 Nassau Street, New York, N. Y., is engineer.

FAIRMONT, W. VA.—Extensions and improvements involving an expenditure of about $2,000,000 will be made by the Railroad Administration at Grafton and Fairmont, covering the lines of the Baltimore & Ohio Railroad, the West Virginia Northern Railroad and the Monongahela River Railroad. The proposed work will include car-repair shops, engine houses, new turntables, etc., and also housing facilities for employees. Arthur W. Thompson, federal manager, and E. E. Hamilton, assistant manager, have charge of the work.

HUNTINGTON, W. VA.—The Consolidated Light, Heat & Power Company will begin work at once on the erection of a 33,000-volt transmission line from Ashland, Ky. to Ironton, Ohio, a distance of 5 miles. D. L. Evans, line superintendent, will have charge of the work. Work has begun on changing the equipment of the substations of the company in Huntington, W. Va ; Ashland, Ky., and Ironton, Ohio, five in all. W. E. Salber, electrical superintendent, will have charge of the installations.

ALEXANDRIA, VA.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., to the Fleischman Construction Company, New York, for the construction of the local naval torpedo assembly plant at Alexandria at $1,075,000. Considerable electrical equipment and five large electric elevators will be installed.

NORFOLK, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 4, under Specification 3377, for electric light and power system and steel storage building, to cost about $6,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Washington, D. C., until Nov. 8, under Proposal 1150, for enameled conduit, locknuts and bushings.

WASHINGTON, D. C.—The Department of Labor has awarded contract for 77 buildings at Lowell, Mass., to the J. G. Poland Company of Quincy, Mass., and another contract for 152 buildings at Niagara Falls, N. Y., to the George W. Syfles Construction Company of Chicago, Ill.

WASHINGTON, D. C.—Contract has been awarded by the United States Housing Corporation (on a fee basis) to Moss, Taylor & Crawford, 701 North Sixty-third Street, Philadelphia, Pa., for the erection of a group of 40 dormitory and administration buildings on block bounded by Twenty-first, Twenty-third, B and C Streets, to cost about $2,500,000. Waddy B. Wood, 816 Connecticut Avenue, Washington, is architect.

WASHINGTON, D. C.—A favorable decision has been reached by the War and Navy Departments for the establishment of a belt line in Washington, D. C., to relieve the electric railway congestion in the center of the city and to accommodate the federal government workers in West Potomac Park. The proposed line will be used by both the Capital Traction Company and the Washington Railway & Electric Company. The plan involves the laying of new tracks over a portion of the route. The government will either build them or guarantee the cost.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and stations supplies as follows: New London, Conn., Schedule 6656½, signaling searchlight parts. Cape May, N. J., Schedule 6658½, engine generators. Norfolk, Va., Schedule 6601½, six air compressors; Schedule 6663½, three motor-driven lathes. Charleston, S. C., Schedule 6673½, one electrically driven crane and parts. Philadelphia, Pa., Schedule 6695½, one locomotive and motor-generator. Hampton Roads Schedule 6701½, three conductor cable.

New York, N. Y., Schedule 6726½, one gasoline engine. Boston, Mass., Schedule 6730½, 50,000 ft. ignition wire. Navy Yard, Connecticut, Schedule 6731½, machine tools, including lathes, drills, grinders, tapping machine, hand press machines and induction motors. Puget Sound, Wash., Schedule 6732½, duplex and solid wire; Schedule 6733½, steel conduit. Mare Island, Cal., Schedule 6752½, 250 lb. phosphor wire. South Brooklyn, N. Y., Schedule 6782½, desk and bracket fans. Applications for proposal blanks should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval station supplies as follows: South Charleston, W. Va., Schedule 1975—five motor-driven, 12-in. geared-head lathes. Mare Island, Cal., Schedule 1979—six ventilating sets. San Francisco, Cal., Schedule 1976—miscellaneous lead-covered electric cable, 650 ft. portable armored cable. Washington, D. C., Schedule 1976—miscellaneous duplex standard copper wire. Various, Schedule 1992—miscellaneous soft lead wire in 5-lb. spools; Schedule 1991—miscellaneous flexible, flat, fish-steel wire, miscellaneous mild, iron or steel welding wire, miscellaneous soft iron or steel wire, miscellaneous tempered spring crucible steel wire, 8850 lb. steel deep-sea sounding wire; Schedule 1993—miscellaneous phosphor-bronze wire, miscellaneous hard spring brass wire, miscellaneous hard copper wire, 1-lb. spools. New Orleans, La., Schedule 1991—miscellaneous annealed black iron wire. Applications for proposal blanks should designate the schedule desired by number.

North Central States

BELLAIRE, OHIO.—The City Council has granted the Wheeling (W. Va.) Traction Company a franchise to operate cars within the city limits.

CLEVELAND, OHIO.—The Cleveland Illuminating Company has notified the Lakewood School Board that it will not extend its high-tension service to a new building on Bunts Road unless the board will pay the cost of installation, which is estimated at $12,000.

HAWESVILLE, KY.—The local electric plant and waterworks system, owned by Henderson Williams, has been purchased by John Quissenberry, at $11,000.

MATTOON, ILL.—The H. W. Clark Company, it is reported, is rebuilding its factory, which was destroyed by a tornado last year. The plant will be equipped with electrically driven machinery. The plant, it is understood, is nearly completed.

SADORUS, ILL.—The village of Sadorus has placed a contract with the United States Electric Company of Peoria for equipment for the installation of an electric lighting system, at $6,000. Electricity for operating the system will be supplied from the Pesotum plant (8 miles distant) of the Central Illinois Public Service Company of Mattoon.

SOUTH PEKIN, ILL.—Contract for extensions to the local power plant of the Northwestern Railroad, it is reported, has been awarded to the G. A. John Company.

DEERWOOD, MINN. — The Cuyuna Range Power Company is planning to move its headquarters to Ironton in the near future. The company is making connection to the town of Motley with its distribution system and has recently purchased the pole lines in Walker and will furnish electricity for lamps and motors in the later place.

DULUTH, MINN.—The McDougal-Duluth Company, Fifteenth Avenue, is contemplating an addition to its shipbuilding plant, to cost about $750,000.

JANESVILLE, MINN.—Contract will soon be awarded by the City Council for furnishing and installing a two-stroke pump directly connected to a 20-hp slip-ring motor, three-phase, 60-cycle, 220-volt, alternating-current, capable of delivering 200 gal. per minute against a total head of 200 ft.

ST. PAUL, MINN.—Preliminary plans are being prepared by the Toltz Engineering Company, engineers, Pioneer Building, for the construction of a two-story building, 200 ft. by 250 ft., at University and Fairview Avenues, for Griggs, Cooper & Company, Third Street and Broadway, to cost about $350,000.

KANSAS CITY, MO.—The Kansas City & Leeds Railroad Company is considering the construction of an electric interurban railway from Thirty-first Street and Hardesty Avenue to Leeds, Mo., and thence to the Municipal Farm. Later on the railway will be extended to Lees Summit. W. E. Winner, W. E. Collins, Howard Ross and others are reported interested in the project.

ST. CHARLES, MO.—Following an adverse ruling of the Public Service Commission, which denied the application of the American Light & Power Company of St. Charles for permission to collect a monthly surcharge of 50 cents, the company, as a matter of economy, will be compelled to dismantle and junk the local municipal electric plant, maintained for emergency purposes.

ST. LOUIS, MO.—The George F. Wyland Building Company is contemplating building a garage in connection with the construction of a new mercantile building, to cost about $132,000.

SLATER, MO.—An election will soon be held to vote on the proposal to issue $25,000 in bonds for improvements to the municipal electric light plant. The installation of new boilers is included in the proposed improvements.

SWEET SPRINGS, MO.—The Farmers' Elevator & Grain Company is contemplating rebuilding its building recently destroyed by fire.

DORRANCE, KAN.—An election will soon be held to submit the proposal to issue $10,000 in bonds for the purpose of establishing a municipal electric light plant in Dorrance.

EMPORIA, KAN.—The plant of the Empire Electric Manufacturing Company was recently destroyed by fire, causing a loss of about $75,000. The company manufactures electric lighting plants for farms, etc.

HUTCHINSON, KAN.—Contract has been awarded to the Cates Electric Company of Hutchinson for electric wiring in the new hospital building of the Sisters of Mercy. The cost of the building is estimated at $100,000.

Southern States

FORT McPHERSON, GA.—The War Department is planning to erect hospital buildings at Fort McPherson, to cost about $500,000. General R. C. Marshall, Jr., Construction Division, Seventh and B Streets, Washington, is in charge.

JACKSONVILLE, FLA.—The City Council, it is reported, will soon award contract for the installation of a reciprocating air compressor belted to a 50-hp., 2200-volt, 60-cycle induction motor, compressor to travel not more than 200 r.p.m. and deliver 350 cu. ft. per minute at 100 lb. pressure.

BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company is considering improvements to its plant.

HAZEN, ARK.—J. D. Cash is reported to have been granted a franchise to operate an electric light plant in Hazen.

LITTLE ROCK, ARK.—The City Council is considering a proposition submitted by the merchants of Little Rock, recommending enlarging the municipal electric light plant in order that it may furnish electrical service to commercial consumers. At present the plant supplies street-lighting service only.

NEW ORLEANS, LA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 12, for construction, complete, of three buildings for the United States Marine Hospital at New Orleans. Drawings and specifications may be obtained at the above office or from the custodian at New Orleans.

HARTSHORNE, OKLA.—An election will be called to vote on the proposal to grant a franchise to the Choctaw Power & Light Company of McAlester to construct and operate an electric light and power system in Hartshorne.

BRYAN, TEX.—Improvements to cost about $25,000 are reported to be under consideration by the Bryan Ice Company.

DALLAS, TEX.—The Texas Electric Railway Company of Dallas, it is reported, is contemplating the construction of an extension to the camp at Provident City, to cost approximately $25,000.

Pacific and Mountain States

BELLINGHAM, WASH.—The Morrison Mill Company is planning to replace its present generator with a turbo-generator of 1000 hp. capacity. The company has purchased electricity from the municipal electric plant for the past two years.

BURBANK, WASH.—The question of building a hydroelectric power plant at Five-Mile Rapids on Snake River in connection with the Burbank Irrigation project is reported to be under consideration. Electricity developed by the plant will be used to operate pumps for irrigation purposes and for lamps and motors for domestic and commercial use. The matter will be taken up with the Department of the Interior. F. J. Pingry is manager of the project.

EVERETT, WASH.—Work will soon begin on the construction of the power plant in connection with the new shipbuilding yards of the Norway Pacific Construction & Dry Dock Company in Everett.

SEATTLE, WASH.—The commissioners of King County have granted the Chicago, Milwaukee & St. Paul Railway Company a franchise to erect a high-tension electric transmission line from Snoqualmie Falls to Cedar Falls, and from Snoqualmie Falls through Preston, Issaquah and Renton to Renton Junction, for a period of thirty-eight years. The power will be used by the company in connection with equipping its main line from the crest of the Cascade Mountains to Seattle and Tacoma for electrical operation.

FLORENCE, ORE.—The Florence Mill, Power & Light Company, recently incorporated with a capital stock of $30,000, proposes to operate an electric plant in Florence.

BANNING, CAL.—Marcus Pluth of Los Angeles is interested in a project to establish a large cement plant at Whitewater. The plans of the promoters include developing the water power of Snow Creek and Whitewater River, to generate electricity, part of which will be utilized to operate the cement works. Under the present plans the waters of Snow Creek, after being released from the power plant, will be used for irrigation and domestic purposes in the Imperial Valley.

EUREKA, CAL.—The Western States Company, it is reported, has decided to erect an aerial transmission line across the bay to replace the submarine cable recently destroyed. At present electricity for the local service is being supplied by the electric generating plant of the Hammond Lumber Company.

MILLSAPS, CAL.—Application has been filed with the State Water Commission by Omer S. Avery of Millsaps for permission to appropriate 40 miners' inches of the waters of Heifer Creek, a tributary to Stony Creek, for power purposes. The cost of the proposed works is estimated at $10,000.

NOGALES, ARIZ.—Application has been filed with the State Corporation Commission by the Arizona Gas & Electric Company for permission to issue $100,000 in bonds, the proceeds to be used to pay a portion of the indebtedness incurred in the construction of its present plant and for an additional power unit, to cost about $30,000.

TORRINGTON, WYO.—At an election to be held Nov. 12 the proposal to issue $7,500 in bonds for the installation of an electric lighting system and $10,000 for extension to waterworks system will be submitted to the voters.

AULT, COL.—The Town Council has authorized an issue of $12,000 in bonds for the purpose of establishing a municipal electric light plant. It is proposed to purchase the distributing system of the Farmers' Electric & Power Company, which distributes electricity furnished by the Western Light & Power Company in Ault and vicinity.

JULESBURG, COL.—Improvements, it is reported, are contemplated to the municipal electric light plant, to cost about $70,000.

Canada

CALGARY, ALTA.—The City Council has decided to build a new electric railway. The proposed line will cross the city limits at Fiftieth Avenue and will extend across the prairie in almost a direct line to the new hospital site.

EDMONTON, ALTA.—The Department of Public Works is considering the erection of a hospital at Bowness, to cost about $400,000.

GREENWOOD, B. C.—Work will begin at once on the erection of the poles which are to carry the high-tension transmission line of the West Kootenay Light & Power Company from Greenwood to Princeton. The wire, it is expected, will not be strung until next spring.

PORT COQUITLAM, B. C.—The Western Power Company is planning to extend the electric lamps on the Pitt River Road, from the present terminus to the shipyards.

WINNIPEG, MAN.—The construction of a three-story factory and a one-story power house in Winnipeg, to cost about $60,000, is reported to be under consideration by William Kragh. James Chisholm & Son, 80 Great West Permanent Building, are architects.

ST. JOHN, N. B.—Tenders, it is understood, will soon be asked for electric wiring and for signal system, for power house and laundry for the general public hospital.

OJIBWAY, ONT.—Bids are being received by W. P. Perley for workmen's houses and welfare buildings for employees of the Canadian Steel Company. The cost is estimated at about $500,000.

WALKERVILLE, ONT.—The General Motors Company, Ltd., it is reported, contemplates the construction of a plant in Walkerville. The proposed site consists of 38 acres.

EYEBROW, SASK.—The installation of an electric light plant in Eyebrow, to cost about $60,000, is under consideration. Carlyle & Seeley are reported to be interested in the project.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until Nov. 13 for copper wire and cables, electrical supplies and fixtures, conduit, laboratory instruments, asbestos gaskets etc. Blanks and information relating to this circular (1234) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York; New Orleans and San Francisco.

Directory of Electrical Associations

Printed in the First Issue of Each Month

Alabama Light and Traction Association. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

American Association of Engineers. Secretary, A. H. Krom, 29 South La Salle St., Chicago, Ill.

American Electric Railway Association. Secretary, E. B. Burritt, 8 West Fortieth St., New York City.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

American Institute of Consulting Engineers, Inc. Secretary, F. A. Molitor, 35 Nassau St., New York City.

American Institute of Electrical Engineers. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

American Physical Society. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

American Society for Testing Materials. University of Pennsylvania, Philadelphia, Pa.

Arkansas Association of Public Utility Operators. Secretary, W. J. Tharp, Little Rock, Ark. Annual meeting, Fort Smith, Ark.

Associated Manufacturers of Electrical Supplies. General secretary, C. E. Dustin, 30 East 42d St., New York City.

Association of Edison Illuminating Companies. Secretary, H. T. Edgar, Stone & Webster, Boston, Mass.

Association of Iron and Steel Electrical Engineers. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

Association of Railway Electrical Engineers. Secretary-treasurer, Joseph A. Andreucetti, Chicago & North Western Railway, Chicago, Ill.

British Columbia Association of Electrical Contractors and Dealers. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C.

Canadian Electrical Association, affiliated with N. E. L. A. Secretary-treasurer, W. Volkman, Toronto Power Company, 12 Adelaide St. East, Toronto, Ont.

Colorado Electric Light, Power and Railway Association. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

Commercial Section, N. E. L. A. Secretary, Henry Harris, Pittsburgh, Pa.

Eastern New York Section, N. E. L. A. Assistant secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

Electrical Supply Jobbers' Association, Pacific Coast Division. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

Electrical Manufacturers' Club. Secretary, Shiras Morris, Hart & Hegeman, Hartford, Conn.

Electrical Supply Jobbers' Association. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

Electrical Trades Association of Canada. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

Electric Power Club, Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

Electric Vehicle Section of the N. E. L. A. Secretary, A. Jackson Marshall, 29 West 39th St., New York City.

Empire State Gas and Electric Association. Secretary, Charles H. B. Chapin, 29 West 39th St., New York City.

Florida Engineering Society. Secretary, J. R. Benton, Gainesville, Fla. Annual meeting, Jacksonville, Jan. 5, 1919.

Illinois State Electric Association. Secretary-treasurer, R. V. Prather, Springfield, Ill.

Illuminating Engineering Society. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston.

Indiana Electric Light Association. Secretary, Thomas Donohue, Lafayette, Ind.

Industrial Electric Heating Association. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

Institute of Radio Engineers. Secretary Alfred N. Goldsmith, College City of New York, New York.

International Association of Municipal Electricians. Secretary, C. R. George, Houston, Tex.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). General secretary, C le Maistre, 28 Victoria St., Westminster, London, S. W., England.

Iowa Section, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

Jovian Order. Jupiter (president), Henry J. F. Strickland, Dallas, Tex.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

Kansas Public Service Association. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

Michigan Section, N. E. L. A. Secretary, Herbert Silvester, Detroit Edison Co., Detroit, Mich.

Minnesota Electrical Association. Secretary, H. C. Hoffman, St. Paul Gas Light Co., St. Paul, Minn.

Mississippi Electric Association. Affiliated with the N. E. L. A. Secretary-treasurer, L. D. Gordon, Jackson Light & Traction Co., Jackson, Miss.

Missouri Association of Public Utilities. Secretary-treasurer, F. D. Beardslee, 721 Locust St., St. Louis, Mo.

National Association of Eletrcical Contractors and Dealers. Secretary, H. C. Brown, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin.

National Association of Electrical Inspectors. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass.

National Electric Light Association. Executive secretary, T. C. Martin, 33 West 39th St., New York City.

National Electrical Credit Association. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

National Fire Protection Association. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

Nebraska Section, N. E. L. A. Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

New England Electrical Credit Association. Secretary, Alton F. Tupper, 15 State St., Boston, Mass. Annual meeting, Boston, Mass.

New England Section, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

New Mexico Electrical Association. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M. Annual meeting, Albuquerque, N. M., Feb. 17-19, 1919.

New York Electrical Credit Association. Secretary, Franz Neilson, 120 Broadway, New York City.

New York Electrical Society. Secretary, George H. Guy, 29 West 39th St., New York City.

Northwest Electric Light and Power Association. Affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Society of Mechanical, Electrical and Steam Engineers. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

Oklahoma Gas, Electric and Street Railway Association. Secretary, L. W. W. Morrow, Norman, Okla.

Pacific Coast Section, N. E. L. A. Secretary, A. H. Halloran, 618 Mission St., San Francisco, Cal.

Pennsylvania Electric Association. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

Public Service Association of Virginia. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

Public Utilities Association of West Virginia. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

Radio Club of America. Secretary, T. J. Styles, 152 Beach St., Yonkers, N. Y.

Rocky Mountain Association of Municipal Electricians. President, Lawrence Stone, Denver, Col.

Society for Electrical Development, Inc. General manager, J. M. Wakeman, 29 West 39th St., New York City.

Society for the Promotion of Engineering Education. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

South Dakota Electrical Power Association. Secretary-treasurer, O. J. Gronsdahl, Hartford, S. D.

Southeastern Section, N. E. L. A. Secretary-treasurer, T. W. Peters, Columbus, Ga.

Southern California Electrical Contractors and Dealers' Association. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

Southwestern Electrical and Gas Association. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

Southwestern Society of Engineers. Secretary, C. E. Barglebaugh, 703 First National Bank Building, El Paso, Tex.

Toronto Electrical Contractors' Association. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

Tri-State Water and Light Association. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

Vermont Electrical Association. Secretary-treasurer, A. B. Marsden, Rutland, Vt.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill. Annual meeting, Chicago, Jan. 28-30, 1919.

Western Society of Engineers, Electrical Section. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill. Annual meeting, Chicago, January, 1919.

Wisconsin Electrical Association. Secretary, J. P. Pulliam, 1408 First National Bank Building, Milwaukee, Wis.

1,279,508. Storage Battery; Frederick Wright, Poughkeepsie, N. Y. App. filed Jan. 9, 1914. Electrodes substantially free from shedding and sulphating and particularly adapted for mounting close together.

1,279,591. Armature-Core Support; Amato N. Sammarone, Akron, Ohio. App. filed May 21, 1917. Secured together in such a manner that circulation of air is maintained, thereby cooling core.

1,279,593. Process of Producing Perhalates; Eugene P. Schoch and Rufus H. Pritchett, Austin, Tex. App. filed April 18, 1918. Anode composed essentially of carbon or silicon is used.

1,279,594. Combined Cam and Finger Adjustment Device for Timers and Distributers; Albert P. Shaw, Pittsfield, Mass. App. filed July 5, 1917. Readily permits angular adjustment of make-and-break cam used to open and close momentarily the primary circuit of induction coil or magneto electric machine.

1,279,618. Arc Lamp; James H. Wagenhorst, Akron, Ohio. App. filed Dec. 24, 1912. One coil or solenoid eliminated and replaced with spring mechanism which will carry approximately one-half of load imposed by carbon, carbon holder, dash-pot and solenoid.

1,279,631. Circuit Breaker; Louis Abeno, Meriden, Conn. App. filed March 29, 1917. Maintains parallelism of contacts, notwithstanding their adjustment for varying their separation as may be required for whatever purpose.

1,279,643. Field-Pole Construction; Arthur J. Brown, Milwaukee, Wis. App. filed Aug. 7, 1915. Means for securing winding in place on pole, involving utilization of flux-carrying parts of pole.

1,279,652. Electric Controlling System; Allen D. Cardwell, Brooklyn, N. Y. App. filed Sept. 5, 1914. Impulses cause isochronous operation of contact-closing means at transmitting and receiving stations.

1,279,653. Magnet Control; Allen D. Cardwell, New York, N. Y. App. filed Nov. 16, 1914. Various operations of electromagnet may be controlled with respect to time at which or during which these operations are performed.

1,279,666. Dynamo-Electric Machine; Rae W. Davis and Robert B. Williamson, Milwaukee, Wis. App. filed April 18, 1914. Means for protecting parts of dynamo-electric machines from dust and foreign matter and for maintaining such devices at comparatively low operating temperature.

1,279,681. Interlocking Relay; Oscar S. Field, Elizabeth, N. J. App. filed June 27, 1916. Means of interlocking two sides of relay in simplified manner.

1,279,738. Oven for Burning Out Invested Models; Theodore W. Maves, Minneapolis, Minn. App. filed April 24, 1918. Means for melting wax model of dental casting.

1,279,748. System of Control; Ray C. Newhouse, Wawatosa, Wis. App. filed May 9, 1912. Skip hoist, for hoisting stone, coal, ore, etc., is normally completely automatic in operation but may be manually controlled when desired.

1,279,750. Magneto-Electric Generator; Richard A. Oglesby, South Bend, Ind. App. filed Feb. 17, 1916. Simple and compact ignition device for single or multi-cylinder internal-combustion, engines.

1,279,763. Combined Control and Brake for Sewing Machines; Paul P. Ruhe, Hoboken, N. J. App. filed July 12, 1916. Electric motor and rheostat for regulating current are employed, and vertical treadle-operated shaft is arranged to control operation.

1,279,769. Energy-Translating Device; Reginald F. Smith, West Allis, Wis. App. filed May 22, 1915. To furnish energy with one or more substantially constant characteristics.

1,279,799. Switch; Halfdan A. Steen, Milwaukee, Wis. App. filed June 19, 1914. Improved operating mechanism and contact arrangement.

1,279,780. Circuit Controller; Halfdan A. Steen, Milwaukee, Wis. App. filed July 25, 1914. Active fixed and movable circuit-breaking parts can be readily removed from inclosing receptacle for inspection and repairs.

1,279,781. Circuit-Interrupting Apparatus; Halfdan A. Steen, Milwaukee, Wis. App. filed July 25, 1914. Shifting magnetic field is made use of in extinguishing arc formed between fixed and movable contacts.

Record of Electrical Patents

Notes on United States Patents

1,279,789. Incandescent Lamp; Frederick G. Talley, St. Louis, Mo. App. filed Jan. 31, 1917. Sudden vibration or movement of any of filament coils prevented, thus reducing danger of breakage of filament.

1,279,790. Motor Controller; Emanuel Tobiessen, West Allis, Wis. App. filed July 24, 1915. For induction motors; comprises coöperative primary and secondary control elements that accomplish desired control and at same time fully protect motor.

1,279,803. Light Support; George F. Watson, Rockland, Me. App. filed Sept. 29, 1917. Tension of spring coacting with movable members may be regulated upon relative movement of certain members comprised in stand.

1,279,807. Swing Joint for Lighting Fixtures; Ernest C. White, Westmount, Quebec, Canada. App. filed June 3, 1915. Invertible fixture in which source of light is movable with reflector and is maintained automatically in two extreme positions without aid of positive retaining devices.

1,279,808. Howler Circuits for Telephone Lines; Ray S. Wilbur, Jersey City, N. J. App. filed March 18, 1915. For connecting with any telephone line in which receiver has been inadvertently left from hook.

1,279,810. Retaining Wedge for Dynamo-Electric Machines; Robert B. Williamson, Milwaukee, Wis. App. filed Dec. 1, 1916. Of laminated magnetic material for securing windings in slots of machines.

1,279,811. Telephone-Exchange System; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed Dec. 8, 1916. If all connecting circuits of particular line group are busy, the initiation of a call in such group will automatically remove artificial busy condition of other positions.

1,279,812. Telephone-Exchange System; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed July 14, 1917. Relates to call-distributing system in which calling lines are extended to call-receiving units by means of automatic switching apparatus.

1,279,815. Electric Switch; Louis W. Wipperman, Buffalo, N. Y. App. filed Aug. 30, 1916. For use in connection with device for automatically turning on electric lights when unauthorized intruder enters building.

1,279,816. Ignition Apparatus; Lionel Wolffsohn, Hoboken, N. J. App. filed April 30, 1915. Adapted to automatically meet changing conditions of running for reducing undesirable sparking.

1,279,820. Illuminated Note Pad; Werner A. à Brassard, New York, N. Y. App. filed Aug. 27, 1917. For use in making night-time military observation.

1,279,823. Process and Apparatus for Causing Precipitation by Coalescence of Aqueous Particles Contained in the Atmosphere; John G. Balsillie, Melbourne, Victoria, Australia. App. filed June 22, 1916. Consists of electrical means for promoting formation of aqueous particles in the atmosphere and assisting the deposition of these particles.

1,279,840. Switchboard Apparatus and Circuits; Henry P. Clausen, Mount Vernon, N. Y. App. filed Aug. 1, 1916. System for establishing telephone connection between subscribers.

1,279,841. Telephone-Exchange System; Henry P. Clausen, Mount Vernon, N. Y. App. filed Dec. 29, 1916. Relates to systems in which automatic switches are used in establishing connections, either wholly or in part.

1,279,842. Telephone-Exchange System; Henry P. Clausen, Mount Vernon, N. Y. App. filed Oct. 29, 1917. To provide panel-type contact bank into which "slipped" multiple connections are built.

1,279,850. Wireless Apparatus and Method Therefor; William Dubilier, New York, N. Y. App. filed May 6, 1913. Relates to sending apparatus which will produce efficiently electrical oscillations suitable for use in wireless telegraphy, and method of producing such oscillations.

1,279,854. Automatic Electromagnetic Switch; Oscar E. Forsberg, Yonkers, N. Y. App. filed Dec. 8, 1916. Automatically returns to normal position when its restoring circuit is closed.

1,279,860. Electrolytic Process; William E. Greenawalt, Denver, Col. App. filed Feb. 24, 1914. For maintaining variable valent elements in impure electrolyte at their lowest valency and thus to a large extent increasing cathode efficiency.

1,279,867. Electrically Propelled Vehicle; Edmund H. Hewins, Sharon, Mass. App. filed Feb. 8, 1917. Controlling means whereby during certain operations of vehicle some power may be stored and subsequently used when additional power is required.

1,279,875. Telephone-Exchange System; Charles W. Keckler, Newark, N. J. App. filed Nov. 17, 1917. Relates to systems of central energy type employing connecting or link circuits provided with apparatus for automatically applying ringing current to called-for line upon connection being made therewith.

1,279,882. Signaling System; George W. Kuhn, Brooklyn, N. Y. App. filed March 29, 1915. Produces tone in receiver warning subscriber that it has been left off hook after proper length of time has elapsed.

1,279,887. Method of Operating Dynamo-Electric Machines; Hans Lippelt, Brooklyn, N. Y. App. filed Oct. 13, 1909. For effecting sparkless commutation of current in windings.

1,279,893. Selector Switch; James K. McQuarrie, Montclair, N. J. App. filed Sept. 5, 1916. Relates to type used in automatic and semi-automatic telephone systems.

1,279,894. Telephone Receiver; George E. Mather, East Orange, N. J. App. filed July 9, 1917. Relates to rapid adjustment of vibratory diaphragms.

1,279,905. Synchronizing System for Multiplex Telegraphs; Paul M. Rainey, West Hoboken, N. J. App. filed March 26, 1914. Relates particularly to system wherein at one station a distributer is rotated at practically constant speed and at any other station a similar distributer is kept in step with first, and variations either of acceleration or retardation are automatically corrected.

1,279,928. Three-Phase Electric Furnace and Method of Operating Same; Frederick T. Snyder, Oak Park, Ill. App. filed March 11, 1918. Three-phase current may be supplied directly to electric furnace having two carbon electrodes and a bottom contact without special transformers.

1,279,940. Weatherproof Socket; George B. Thomas, Bridgeport, Conn. App. filed March 28, 1918. Of two-piece base construction which insures complete inclosure of wiring connections.

1,279,941. Condenser and Process of Making the Same; Phillips Thomas, Edgewood Park, Pa. App. filed Nov. 7, 1916. Folding the edges of dielectric layers to compensate for thickness of metal foil, thus giving edges of completed condenser same thickness as central portions.

1,279,953. Storage Battery; Theodore A. Willard, Cleveland, Ohio. App. filed July 6, 1915. Means for sealing terminal posts in battery-jar cover to prevent creepage of acid or battery solution around posts to exterior of cover.

1,279,958. Switch for Electric Starters; Thomas Zimmerman, Niagara Falls, N. Y. App. filed Dec. 13, 1915. Manual starting switch which when moved to closed position will automatically retard spark and when pressure is removed will automatically move to open position and at same time adjust spark.

1,279,968. Inclosed Fuse; Harold G. Baxter, Wilkinsburg, Pa. App. filed Nov. 25, 1914. For renewable use and embodying means for visibly disclosing condition.

1,279,990. Method of Controlling and Apparatus for Producing Ionic Discharges; Daniel F. Comstock, Brookline, Mass. App. filed Nov. 14, 1916. Arc carrying a heavy current used to produce on one of a pair of electrodes a steady incandescent area out of alignment with other electrode.

Electrical World

The consolidation of Electrical World, Electrical Engineer *and* American Electrician

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Concerning Intersociety Memberships

ONE of the ways by which central-station people can learn about the electrochemical industry is by taking out memberships in the Electrochemical Society. That is what the Ohio Electric Light Association has done as a body. One well-qualified member will attend meetings, dissect reports and addresses and disseminate information to members of the Ohio association in general. He will become a valuable connecting link between the two industries. Too much approbation for its action in this matter cannot be accorded the Ohio Electric Light Association. It has shown an appreciation of the importance to the central station of the electrochemical field. It has grasped an open opportunity to get first-hand, uncolored information about its own relation to electrochemical concerns, and it has pointed the way to other groups of electrical men who desire more accurate knowledge of basic facts in this kindred industry. It is to be hoped that the example thus set will be followed by other associations and societies, not only in seeking facts about electrochemistry but also in other industries related to the electrical business.

A little less emphasis on man power, a little more emphasis on woman power would represent the facts as they are in the industry to-day. Some of the men who will return home after their patriotic work for humanity won't want their old jobs; they will expect and receive better jobs either with the old company or in another place. And the inexhaustible possibilities for upbuilding in the electrical industry will require more and more human power in order that they may be realized to the full. Women will be in industry in greater numerical strength than ever before.

Announcement to Readers

AFTER Jan. 1, 1919, the subscription price of the Electrical World will be five dollars a year, as announced in the colored insert in the preceding pages.

It is a difficult task for a journal to express its approval of its own ideals of service to an industry of which it is a part. Had not these ideals of service and their carrying out been recognized many times by our readers in their letters to the editors, such an expression might seem out of place. The Electrical World has always endeavored to be the journal with which others are compared. It has sought to be truly representative of the best engineering and business thought of the industry. In each critical period in the development of the industry it has sought to find the constructive plan that would lead the industry forward. All the time it has planned its articles and editorials to be practical and helpful to the men who were at work, whether as engineers, as central-station men, as manufacturers or as business men of the industry. The answer as to whether it has been of service is found in the fact that both at home and abroad the Electrical World has a position of leadership for which its editors feel a very real responsibility, and that its subscribers, found in all countries, are literally the "who's who" of the industry.

The cost of rendering this service has been increasing. Within the past few months costs have increased enormously. The postage cost alone of mailing the Electrical World to each subscriber plus the cost of the blank paper is now nearly double the present subscription price, and the zone system of postage will, unless it is repealed, increase the postage element in this cost 83 per cent for each of two succeeding years. Other costs have risen and are rising proportionately.

The Electrical World never had a greater opportunity for service to its subscribers. The whole industrial world is being remade. Cost what it may, this service must be continued, and the editors look forward to meeting these opportunities for service, knowing that they will not lack either the moral or the financial support of the industry.

The general effects of curtailment in building construction which have been felt by electrical contractors for some time are now beginning to make themselves known to electrical supply jobbers. Complaint is made that the turnover is not so rapid as it was, and profits are therefore not so great. The alternative, of course, is to increase prices or cut down expenses, with a natural inclination to do the former. However, raising prices does not always bring relief, and if electrical supply jobbers will trim their overhead in proportion to their lessening turnover, they will find themselves better able to cope with existing and after-war conditions.

Clean Men for the Work of the World

THE war is not over. Our industries have just contributed to a huge Liberty loan to help bring that war to a successful conclusion. We have invested our money in equipment for our soldiers. We are now asked to give our money for the upbuilding of the morale of that army. No war has ever been fought with an army so clean as the one America has sent to the

Old World. General Pershing has said that every hut adds ten men to a quota of one hundred.

The task of upholding the morale of the army should peace be declared to-morrow would be even greater than during the war. Under the inspiration of patriotic purpose men forget their petty vices and put into their work the enthusiasm and the self-sacrificing spirit that comes from high ideals. It is human after a great crisis to let down. Should peace be declared to-morrow it would be human for men to let down. If our men and boys are to come back fit for the work of the world which will face them on their return, if they are to take a vital part in the tremendous tasks of reconstruction which face us in this country after the war, they must come back clean and whole; they must come back with the same moral courage to meet the problems of commercial life that they have learned counts for so much in military life.

To state these self-evident facts is simply to state the fundamental value of pushing this campaign for united war work to a successful conclusion. Presidents and generals, business men and soldiers have only words of commendation for what has been accomplished. May each individual take to himself a part of the moral responsibility of the world and see that he does his part in the drive that starts on Nov. 11.

The electric power shortage in industrial centers has become worse with the shifting back of the clock to standard time. Of course, the utilities will, by cutting out circuits here and there, by overloading equipment and by sundry other expedients, manage to pull through the winter somehow or other. But without power production suffers, and production is what the country is most in need of right now. Moreover, the sad part of the situation is that the power shortage is most acute in war industry centers. We spend billions for equipping our army, but apparently do not seem to be able to raise any enthusiasm for an emergency power act which will make the steady flow of munitions to that army possible.

Overhauling and Improving Equipment

ONE does not at first think of a hydroelectric system as a natural point for inculcating fuel economy, but J. W. Andree's brief account of the California situation will quickly demonstrate the importance of the subject. In fact, there is a double chance for saving fuel in the auxiliaries of a water-power plant—first, by lessening the general need for fuel by improving the hydraulic system; second, through more efficient use of the coal or oil. Thus, on the system of the Southern California Edison Company both these remedial measures have been most successfully applied. On the hydraulic side the pipe lines have been cleared, the losses of water curtailed in every possible way, and the waterwheel plants overhauled. In particular, nozzles and valves have been brought up to date, and some changes of generators are to be made in the interest of increased efficiency. On the steam end of the equipment the big turbine at the Long Beach station is being thoroughly gone over and put in shape even to the least auxiliary, and there is here in prospect a gain of 10 per cent in efficiency. In another of the plants one-third of the boilers have been fitted for burning natural gas, with auxiliary oil burners to serve if the gas temporarily fails. The entire boiler plant, in fact, has had close attention and has been made ready to get at the winter's work in the best possible condition. It is the small details of improvement that count in a well-ordered plant; the big ones have already been taken care of. But the small items add up to a figure that is often far from negligible in the balance sheet.

Plans for economic reconstruction in the European countries, so far as the supply of electrical power for industry is concerned, center largely upon "super power stations." Our own statesmen in Washington have something oratorical to express now and then upon the advantage of building such giant industrial energizers in this country. Yet the industry here only modestly says to the whole world: "We originated and developed to success the great central station which conserves fuel, conserves human power and cheapens the cost of energy. Our basic principles are open for study and use." This is a real service to mankind.

A Resolution on Public Ownership

A RESOLUTION which was presented, but not passed, at the meeting of the American Electric Railway Association in New York last week virtually called upon the members to facilitate public acquisition of their properties. It was offered, evidently as the result of long study of conditions, by the president of a large holding company and referred to the executive committee of the association. Since the association did not pass definitely upon this important question involving the permanent control of utilities of this class, the only significant action is that the presentation of the resolution took place. What the association actually did was to adopt another resolution expressing the deliberate judgment that the entire subject of the relationship between electric railway companies and the public should have, now and after the war, most earnest consideration by both parties; and to further this end a committee is to be appointed to study reconstruction problems, "particularly those relating to local franchises."

It is not to be doubted that the electric railways are in a serious plight due to their enormous capital cost, high war-time costs of operation and the difficulty of raising fares. It is to be doubted whether the remedy for this condition now is the sale of the properties to the public. We believe that neither the companies nor the public would gain now by that procedure. What the companies—that is to say, the stockholders and bondholders—want is security of their principal and dividends or interest. What the public wants is good service at the lowest possible rates. Every one who has really studied the great obstacles to successful street-railway management will admit frankly that this class of utility is by far the most difficult of any class of utilities to operate, either physically or in public policy; but these facts call for qualities of management that are much less likely to be seen in public office under our present political system than in private corporations. Good service, however, the public must have, and if the companies do not or cannot give it, whatever the cost may be, they are certain to find a public prejudiced against any proposition that they make. If they do give it, any talk of public ownership can safely be postponed to a later day.

Whatever means the electric railways and their public take to settle their differences, it should be understood clearly by all parties that electric light and power utilities reserve the right of independent solution of the problems which they face. All of the conditions of the two classes of properties are so different that it is manifestly unjust to let the impression go out that they are equally oppressed by the existing state of affairs. The undeniable predicament in which electric railways are caught is one for their managers to solve if and as best they can with such public help or sympathy as they can gain by wise, not complaining, appeal. If they cannot settle on any other solution, we offer the suggestion that they try to depart from the extremely unscientific flat-fare principle and adopt a complete and revolutionary zone system to encourage the short rider. It is the economic salvation of the electric light and power utilities that by intensive development of power business they have built up load factor and mass production. Their rate situation, their earnings applicable to capital return, their outlook for borrowing fresh funds when conditions are again normal and the quality of their service are far better than those of the sorely beset electric railways.

From an attempt to classify industries as "essential" or "non-essential" the authorities wisely passed to the classes "war," or "essential," and "less essential." Now we see that most of the "less essential" have become or are rapidly becoming essential. The conversion of industries to a war basis has gone on very swiftly. Relatively few plants are unadaptable to war uses. It will be found that when the military need is past the products of those plants can be converted very quickly to meet the peace requirements. And, electrical energy will still be necessary for their economical operation.

Safety Devices in Switching

THE evolution of the modern switchboard has rendered necessary a great many auxiliary devices never thought of in the earlier days of the art. As the capacity of stations has increased the number and size of switches has multiplied almost beyond measure. Most of the working apparatus is remote from the switchboard proper, so that the operator cannot observe the action of the apparatus itself but can only take the necessary steps to actuate it. It therefore has become necessary to develop an indicating system, sometimes of a highly complicated character, to show the operator what has really happened. In the paper of M. M. Samuels and F. Bechof this matter of automatic indicators is taken up somewhat in detail, especially the common bell alarm to be found in a very large number of stations. The main requirement of any such apparatus is that it shall reset itself; in other words, shall be ready for renewed operation as soon as the automatic switches with which it is associated are themselves back in place. In the case of hand-operated circuit breakers with lever switches in series, such as are often found on railway switchboards, the matter is comparatively simple, for auxiliary contacts operating the bell circuit at once solve the problem. Unless there are lever switches in series it is somewhat more difficult because auxiliary switches must be provided to accomplish the same result, and in some cases the resetting of the bell alarm circuit must be done by the operator.

The commoner situation in every-day practice is that of the electrically operated circuit breaker which may be tripped by overload or reverse relays. The danger here is that if the alarm circuit were operated directly by the relays the bell would ring only momentarily, and consequently a special relay had to be developed which would hold the alarm circuit closed at least long enough to attract the attention of the operator, or until stopped by him. Several devices of this character have been used with good results. The authors, however, call attention to a weak point in the arrangement of the devices customarily made in that all the tripping coils are usually in series with the alarm relay so that if the latter is out of service all of the tripping coils become inoperative, bringing the possibility of an interruption which may cause serious results. They suggest therefore that the alarm circuit, instead of being associated with the tripping coils. ought to be provided with an auxiliary mechanical switch put into operation by the opening mechanism of the circuit breakers. This need stay closed only momentarily so long as it is relayed on to the bell signal system.

Aside from the tripping of circuit breakers, which is the chief point in mind, there are divers other things in every station to which the switchboard operator's attention should be called by some kind of alarm, and these have been indicated in various ways by bells and other audible signals. The authors enumerate some eighteen separate pieces of apparatus which may with advantage be provided with alarms, and with such a number it is rather obvious that audible signals cannot give sufficiently specified information. It therefore seems advisable to fall back on an annunciator system connected with the various alarm circuits, with a signal bell and with drops corresponding with each requirement.

At first thought such an arrangement seems like a complication, while actually it simplifies the situation if any considerable number of alarms have to be considered. Furthermore, although the parts may be duplicated to any necessary extent an annunciator is really a very simple affair and extremely unlikely to get out of order. It seems curious to think of switchboards requiring so elaborate a system of indicators to show what is actually happening; but the fact is that switchboard design has for good or ill passed far beyond the stage where the operator can take visual cognizance of the switches, and with this great increase in complication has come the actual need for new methods of keeping track of the operation of the various scattered elements which are necessary.

GREAT INDUSTRIES, LIKE GREAT BATTLESHIPS, ARE CAPABLE OF WEATHERING SEVERE STORMS AND DIFFICULTIES

Problems of the Reconstruction Era

Taking an Effective Part in the Great World War, This Country Will Necessarily Be a Powerful Factor in the Succeeding Period Closer Co-operation in the Electrical Industry Advocated

This article, pointing out the need for scientific consideration of the reconstruction problems, will be followed by others in later issues dealing with specific aspects of the subject.

MEN differ widely in their judgment on what the problems of reconstruction will mean to the electrical industry. Their viewpoint is still heated by our national immersion in the war and the preparations for still heavier participation if that is necessary; yet while we have been pursuing war aims with singleness of purpose, other nations, with their resources likewise devoted to conflict, have also found time to get plans made for meeting the new problems of peace.

Conspicuous among all the nations for its vast resources, brought to bear tardily but effectively in the great world contest, no one can seriously question that this country will necessarily be a powerful factor in the succeeding era. The reservoirs of raw materials, the American capacity for big-scale production, the manufacturing facilities greatly multiplied by war demands, and capable use of machine power and man power, together with our high national ideals, give this country a wonderful opportunity. Business and utilitarianism were not popularly supposed to mix under the old conditions, but they may be combined most successfully under the world-wide needs left by the long years of the devastating war. The ravaged peoples of Europe need a helping hand. War in business is not to succeed the cruel military onslaught of Germany; the rehabilitation era calls for fine qualities of character, honorable dealings, not bitter competition.

In the absence of definite information on which to base his forecasts, the man in the electrical industry who looks ahead a little can judge only on the basis of the fragmentary facts which he can obtain. He knows that this country has developed a stupendous industrial war machine for the rigid control of price and distribution of raw materials the less rigid but firm control of manufacturing industries, and last but by no means least in importance, active production by government agencies or through government-controlled corporations. He does not know what measure of supervision, if any, will be retained throughout the reconstruction period by the War Industries Board or a similarly comprehensive government agency. If price regulation and arbitrary allocation of raw materials and manufactured products are to be discontinued directly after the war and the old economic law of supply and demand is to prevail, the electrical industry appreciates that it will have to base plans upon a condition involving enormous possibilities of change.

There are reports that the Washington authorities have collected through the Council of National Defense a mass of data bearing on reconstruction issues, but no public hearings have occurred and the attitude of the government, if any has been formulated, is not known. It is unfortunate that the government and industry as a whole did not begin to coöperate a year or more ago in laying the foundations for a study of these problems. The plan urged by the ELECTRICAL WORLD and associated engineering papers, creation of a broad-scale commission, could have been made to yield beneficial results by this time.

In the absence of a commission specially appointed to study these vitally important matters in their relation to the welfare of the nation, the knowledge and experience of existing government agencies should be given the fullest opportunity to render service to industry. With its extensive organization the War Industries Board provides, as indicated above, the machinery for control of price and allocation of raw materials if those policies shall be found to be necessary for the welfare of the world. Undoubtedly the Shipping Board and Emergency Fleet Corporation have much invaluable information concerning tonnage which will enter into any scientific consideration of the needs of this country as well as of all other countries working together to build proper foundations for world peace.

Turning with questioning mind to see what other helps the Washington authorities can offer, the electrical business man sees the Department of Commerce, which continues steadily in its work of stimulating investigation of markets. Then his attention passes to the Tariff Commission, which is doing a very necessary constructive work in investigating tariff questions affecting industries of the country.

What is apparently lacking is some specially designated agency composed of the engineer, the statesman, the financier—men having broad vision, broad humanity of heart, large business ideas; in short, the true spirit of the big American brother who not only sees the national problems springing out of the war but also understands them in their bearing upon the problems of the other belligerent countries and the neutrals of the world. It is not yet too late to create a commission of this character, which could coördinate the enormous amount of information freely given to the Washington authorities to help in the war and draft a constructive policy for industry. Taking counsel of the existing associations in the country, seeking and hearing the engineers, business men, economists, labor leaders, bankers who are giving thought to the intricate questions involved, such a commission could still contribute suggestive recommendations. What is of as much importance, it would, by the mere fact of appointment and completion of a program, stimulate more intensive study of the subject throughout the country.

Lacking national guidance, wise national coöperation and forbearance, the industries of the country will have to face their problems without the constructive aid which European governments are generally prepared now to give to their industries. It is well known that the principal European powers have gone very carefully into the questions involved affecting their future industrial operations, material supply and markets.

It is fortunately true of the electrical industry that much which has been done under the stress of war is in reality fine preparation for the post-war period. Closer coöperation has been developed in each individual branch of the industry; and, in turn, the different branches are working more unitedly in coöperation than ever before. In the firmer union of interests which is now found government officials have taken part. They have urged coöperation to the end that economy, conservation, production might be appreciated at their real value, not for the benefit of industry as such, but for the attainment of national efficiency in war. What has happened through such channels of combined corporate and government effort, looking to the main purpose of victory over Germany, has served as an object lesson to radical government officials no less than to the representatives of the companies. The efficiency thus attained has bulked too large to be thrown away lightly. It is not likely that the advantages worked out will be lost to the world. Certainly the companies in the electrical industry will not voluntarily discard the benefits which their experience has yielded; and the government, with facts, processes and costs freely put before it in the national emergency, has found the economic strength of great units of too much advantage to the community to justify return to the old antagonism.

Some of the elements of commercialism have totally disappeared in the operations of companies under the pressure of war work, and the return to the former status of unrestricted production and unrestricted markets will be one of the principal ultimate changes.

VISION OF THE ENGINEER IN RECONSTRUCTION

BY PROFESSOR COMFORT A. ADAMS
President American Institute of Electrical Engineers

WHEN the war began it was immediately recognized by a few that its successful conduct required a degree of coördination of industry undreamed of before. In short, it meant the organization of the nation. The task was simply stupendous, and as we were utterly unprepared it is no wonder that there was much floundering and inefficiency and many misfits. The result, however, is not wholly disgraceful and has much of merit. Many lessons in industrial coöperation have been learned under war pressure, and the whole economic and industrial structure has been shaken up and in some degree remolded.

Now we are shortly to be faced with the need for readjustment to peace-time conditions, and we are just about as unprepared as we were for war. Even if we were to return completely to the pre-war order of things, the process would be a difficult one, requiring the maximum of wisdom and of organized effort; but is it not possible that some of the lessons learned during this forced period of coöperation can be employed in times of peace? Is it not possible that after this breaking away from old habits and traditions, and during this period of flux, we can get a better perspective of our duties and relations to each other, as individuals, as social or industrial groups and as nations?

Moreover, as this is distinctly an industrial epoch and as the engineer is paramount in industry, should we not as engineers take our proper place in this work of reconstruction? We are too apt to sit back and complain that we are not properly recognized in large questions of public interest, but is it not our own fault? In any case, now is our great opportunity. If we have the vision and the ability to transmit it, we will certainly be heard. Let us go to it.

Safety Features in Switching Installations

Review of Existing Alarm Systems Used to Indicate Switch Positions and Overheating of Apparatus Weak Points in the Installations and Suggestions Designed to Bring About Their Improvement

BY M. M. SAMUELS AND F. BECHOFF

In previous articles (Electrical World, Vol. 71, page 656 and page 1075) the authors discussed general safety methods in switching arrangements, giving suggestions for safe arrangements and connections of switching apparatus. It is the object of the present article to discuss in detail the problem of the bell alarm.

IN EVERY generating station or substation of good size the major portion of the switching apparatus is installed remote from the switchboard, so that the switchboard operator is not in a position to observe the automatic tripping of circuit breakers or the excessive heating of transformers and other apparatus. It is, therefore, necessary to provide some form of alarm for this purpose. In spite of the obvious importance of such alarms the subject has hardly ever been discussed in engineering literature, and a great deal of confusion and misconception with reference thereto exists in the minds even of some good designers and operators. It is the authors' intention to give first a brief review of the existing methods of alarm, then discuss their weak points and make suggestions for improvements.

The fundamental requirement of any alarm is that it must be self-resetting. In other words, when the apparatus which caused the alarm is again placed in normal operation the alarm-giving device should automatically be ready to give an alarm if trouble recurs.

Alarms for Hand-Operated Circuit Breakers

For hand-operated circuit breakers having lever switches in series with them, as is customary on railway switchboards, the alarm connections can easily be arranged as shown in Fig. 1. With this method auxiliary contacts are provided on the circuit breaker as well as on the lever switch, both the auxiliary switches being in series with a bell circuit. The auxiliary switch on the circuit breaker is open when the circuit breaker is closed and is closed when the circuit breaker is open, while the auxiliary switch actuated by the lever switch is closed when the lever switch is closed and is open when the lever is open. Thus when the breaker trips automatically it closes the bell circuit, as shown in position 2 of Fig. 1, thereby ringing the bell. The operator may interrupt the ringing of the bell by opening the lever switch as shown in position 3 of Fig. 1. When the lever switch is closed after reclosing the breaker the bell circuit is made automatically ready to give an alarm if the breaker trips again.

For circuit breakers not having lever switches in series with them the problem becomes a little more difficult. In order to provide automatic resetting of the bell circuit it is necessary to equip the circuit breaker with a double-pole auxiliary switch, one side of which is closed when the circuit breaker is closed and the other side closed when the circuit breaker is open. Such an auxiliary switch is called a "circuit closing and opening auxiliary switch." In addition to this it is necessary to provide on the switchboard a three-way snap or push switch for each circuit breaker, as shown in Fig. 2, the diagram being self-explanatory. With this arrangement the resetting of the bell circuit is not automatic but must be done by the operator. In order to remind the operator to reset the three-way push-button, the circuit breaker rings the bell when it closes and the ringing is only stopped when the operator resets the button.

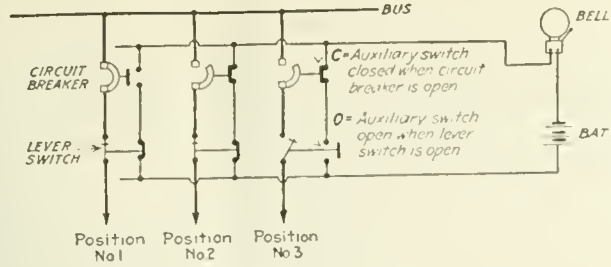
Alarms for Electrically Operated Circuit Breakers

Of far greater importance is the bell-alarm indication for electrically operated circuit breakers. Such circuit breakers are always placed at a considerable distance from the switchboard and may in some cases, as for instance in outdoor substations or along railroad tracks, be miles away from the switchboard. Automatic electrically operated circuit breakers are tripped by means of overload, reverse-energy or other types of relays. Such relays are always deënergized the moment the breaker opens, and if the bell alarm were operated directly by the overload relay the bell would only ring for a very short period and might stop ringing before the operator heard it.

To avoid this objection a special type of relay has been developed which is so constructed that the contacts which close the bell circuit stay closed even after the circuit of its coil is interrupted. Thus the bell should continue ringing until stopped by the operator. Such relays are commonly known as "bell-alarm relays." Figs. 3 and 5 show the connections of two of the best-known bell-alarm relays. The type shown in Fig. 3 is so constructed that the core which closes the bell circuit contacts stays up after it is once raised by the coil, even after the coil circuit is broken. In order to interrupt the bell circuit it is necessary for the operator to pull the core down by hand, which can be done by means of a knob at the bottom of the relay. This relay must, of course, be mounted within easy reach of the operator. With the relay shown in Fig. 5 the ringing of the bell is maintained by means of an auxiliary coil having common yoke with the main relay coil; interruption of the bell circuit is accomplished by means of a normally closed momentary push-button on the switchboard. It would not be practicable to provide a separate bell and a separate bell relay for every automatic circuit breaker; therefore it is customary to make one bell relay with its bells serve for a great many circuit breakers. This is accomplished by means of a bell relay bus, as shown in Fig. 6.

Upon carefully analyzing the connection shown in Fig. 6, which exists in practically every power house or substation using electrically operated circuit breakers, the most startling discovery is made that every trip

BELL-ALARM CONNECTIONS UNDER DIFFERENT CONDITIONS


BUS
BELL
CIRCUIT BREAKER
C=Auxiliary switch closed when circuit breaker is open
O= Auxiliary switch open when lever switch is open
BATTERY
LEVER SWITCH
Position No 1
Position No 2
Position No 3

Position No. 1 Circuit in working condition

Position No. 2 Circuit breaker opened automatically Bell is ringing

Position No 3 Operator opened lever switch which stopped bell

FIG. 1

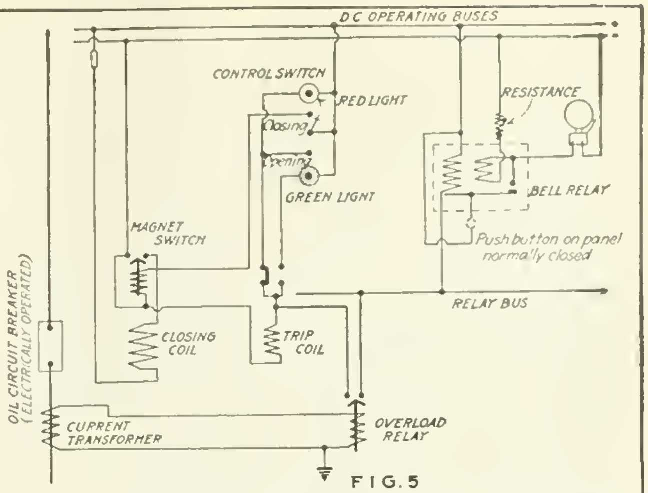
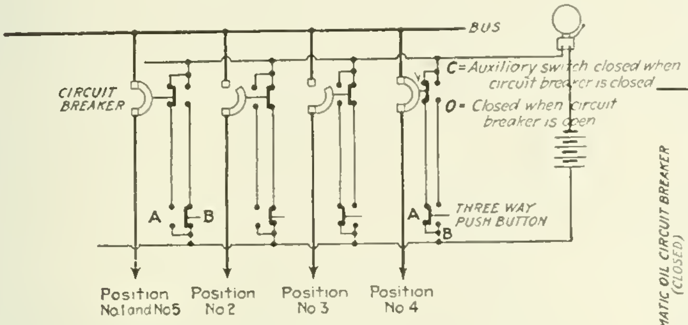


FIG. 5



Position No. 1 Circuit in working condition

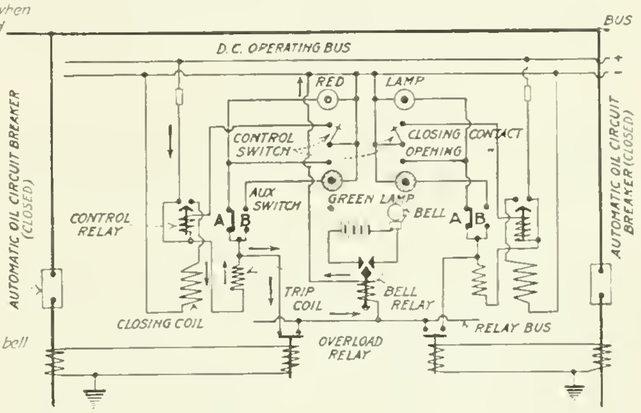
Position No 2 Circuit opened automatically Auxiliary switch starts bell

Position No 3 Operator brings three way push button from B to A thus stopping the bell

Position No 4 Circuit breaker closed again Bell rings

Position No 5 Operator brings three way push button back from A to B thus stopping bell and resetting it for next tripping of circuit breaker

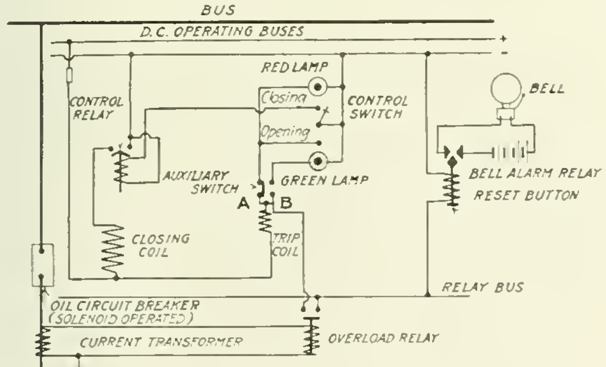
FIG. 2



A = Closed when oil circuit breaker is closed

B = Closed when oil circuit breaker is open

FIG. 6



A = Closed when Oil C B is closed
B = Closed when Oil C. B is open

FIG. 3

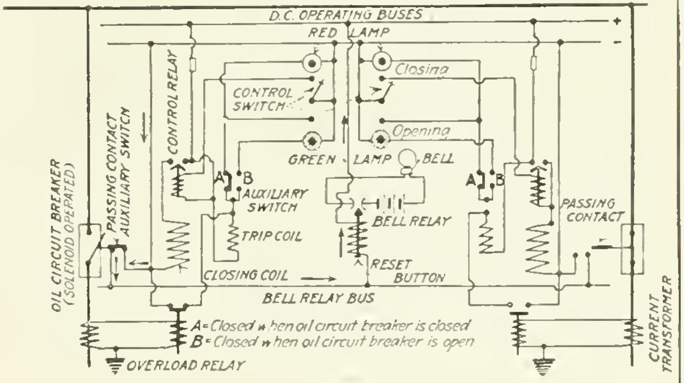
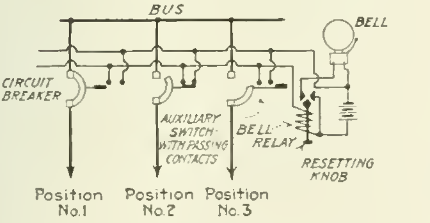


FIG. 7



Position No. 1 Circuit in operating condition

Position No. 2 Circuit breaker just opening energizing bell relay by auxiliary switch passing contacts

Position No. 3 Circuit breaker all open Bell relay not energized but bell relay contacts still closed Bell circuit can now be broken by resetting bell relay

FIG. 4

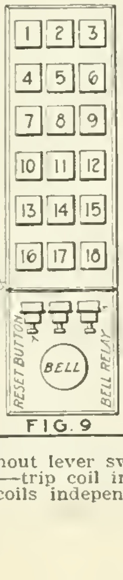


FIG. 9

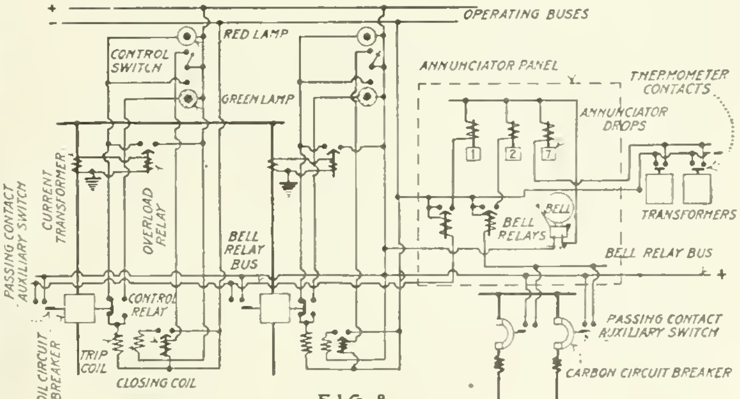


FIG. 8

1 and 2—Circuit breakers with and without lever switch in series; 3 and 5—bell relay mechanically and electrically reset; 4—auxiliary switch operates bell alarm; 6—trip coil in series with bell alarm; 7—tripping circuit independent of bell alarm; 8—connections for annunciator making trip coils independent of alarm; 9—annunciator with bell-alarm relays.

coil on the system is in series with the one bell-alarm relay coil. This means that if the one bell-alarm relay coil should be out of service it would not be possible for any circuit breaker to open under overload, short circuit or reverse energy, thus subjecting the whole system to disaster. Even though the bell-alarm relay is of very simple construction and not subject to great abuse, the possibility of an interruption is always present. It seems to be due to good fortune only that one does not often hear of station troubles caused by the failure of a bell-relay coil. It is possible that many station disasters in the past the cause of which could not be traced were in reality due to an interruption of a bell-relay circuit. A partial remedy can be obtained by the use of two bell relays in multiple, which method is now being employed in some cases. But it must be admitted that such a remedy is only a palliative and does not go to the root of the evil.

SAFE METHOD THAT FUTURE WILL DEMAND

The only safe method to be employed in the future and to be favored by insurance companies is to make the automatic tripping of the circuit breaker entirely independent of the bell-relay coil. In order to accomplish this it is suggested that there be provided on every electrically operated circuit breaker a "passing contact auxiliary switch," which should be so constructed that it is actuated mechanically by the opening mechanism of the circuit breaker. This auxiliary switch should be so arranged that it closes only momentarily during the opening period of the circuit breaker. This short period would be sufficient to energize a bell relay, the contacts of which would stay closed even after the "passing contact auxiliary switch" is open and thus would continue to ring the bell until the operator resets the bell relay. A diagram showing the simplest form of this arrangement is given in Fig. 7, which is self-explanatory. With the scheme shown in Fig. 7 the bell would also ring when the circuit is opened by hand. Instead of being a disadvantage this should be considered an advantage, because the operator who is not in the same room with the circuit breaker, when hearing the bell will know definitely that the circuit breaker actually opened. If so desired, this same auxiliary switch in its simplest form would also ring the bell when the circuit is being closed, which would be a definite indication for the operator that the switch is actually closed, even when the red lamp is burnt out. For remote-control hand mechanisms, which generally have no indicating lamps, the ringing of the bell when the operator closes or opens a circuit breaker would be of still greater importance. If the ringing feature is not desired when closing the circuit breaker it can be easily eliminated by a suitable design of the "passing constant auxiliary switch." By referring to Fig. 7 it will be seen at once that the tripping circuit has no connection whatever with the bell-alarm relay, so that an injury to the bell-relay coil circuit will not endanger the tripping of the circuit breaker under overload.

The "passing constant auxiliary switch" can also be applied to hand-operated circuit breakers, as shown in Fig. 4. This arrangement would eliminate the necessity of installing a three-way push-button for every circuit breaker, as described before in connection with Fig. 2.

In addition to the automatic tripping of circuit breakers there are a great many other things in every power house to which the operators' attention must be called through some form of alarm, and in order to distinguish the different operations which the various alarms indicate it has been the custom to provide bells of various sizes and various tones, and to use in addition electric horns, whistles and sirens. When considering the great number of alarms to be distinguished it will at once be obvious that with the many noise-making devices thus installed it is almost impossible for an operator to tell quickly and definitely just what kind of trouble has occurred when a certain alarm sounds. Without intending to give an exhaustive list of the various forms of alarms in a power house the following will give some idea of the complexity of the subject:

1. Oil-circuit-breaker alarm.
2. Carbon-circuit-breaker alarm.
3. No-voltage alarm on buses.
4. Generator overload alarm without tripping the circuit breaker.
5. Ground alarm.
6. Apparatus high-temperature alarm.
7. Transformer water-flow alarm.
8. Transformer air-blast alarm.
9. Generator air-washer alarm.
10. Storage-battery undercharge and overcharge alarm.
11. Lightning-arrester discharge alarm.
12. Track alarm on heavy railway work.
13. Lead-sheath protection alarm for heavy underground cable systems.
14. Fire alarm.
15. Telephone bell, private line.
16. Telephone bell, outside calls.
17. Generator signal system.
18. Call bell.

MAIN ANNUNCIATOR SYSTEM

It is at once obvious that if it is attempted to distinguish all the above varieties of alarms and many more through differently sounding bells or other noise-making devices, it would be almost impossible even for an operator with a musically trained ear to recognize quickly the different sounds. In spite of the obvious inconvenience of such a combination of sounds, different-tone signals are unfortunately still used in many power houses. To avoid this confusion modern power houses are being equipped with a main annunciator having a different drop for each of the kinds of alarm listed above. With this arrangement only one bell is required in a switchboard room. Such an annunciator should be made in the form of a switchboard panel, preferably installed in the center of the switchboard. On this panel can also be mounted the necessary number of bell-alarm relays and the bell. A typical panel of this kind is shown in Fig. 9, where the numbers indicate the annunciator drops corresponding to the various kinds of alarm in above list. A typical diagram of connections is given in Fig. 8. It must be understood that it is not the object of the main annunciator to indicate in detail which individual circuit breaker is tripped or which individual transformer is hot, but merely to give the group of apparatus affected. In the case of electrically operated circuit breakers the drop on the anunciator would indicate that some circuit breaker of a certain group tripped. The green indicating lamp in combination with the mechanical indicator on the control switch (see ELECTRICAL WORLD, Vol. 71, page 656) will then indicate the individual circuit affected.

INCREASING THE ECONOMY OF CENTRAL-STATION OPERATION

Overhauling Water Conduits and Prime Movers, Burning Natural Gas to Save Fuel Oil, and Other Proved Methods

BY J. W. ANDREE
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SOUTHERN California being a large fuel-oil producing section, there has as yet been no real shortage of fuel there. However, oil consumption is rapidly increasing, and there are grave possibilities of a real fuel-oil shortage in the near future. All possible means are therefore being devised to decrease the consumption of fuel oil. All the water powers of southern California are being utilized to their utmost, hardly a drop of water going to waste in this section which can be put into use at a reasonable cost. At the Lytle Creek plant of the Southern California Edison Company wells have been sunk in the river bed below the diversion dam, and the underflow of the river is pumped from these wells into the conduit leading to the power plant by motor-driven pumps.

On the Santa Ana River water rising below the diversion dams of the upper plants is diverted into the intake of the lower plants. The pipe lines of the Mill Creek No. 3 plant have been cleaned of all vegetable and animal growth to decrease resistance to the flow of water. Nature has lent a helping hand at this plant to increase its output. The winter rains always leave the river bed very rough and full of porous gravel, which encourages a large underflow of water. Early summer rains this year have brought down an abundance of silt and cement-like deposit, which has effectively filled many of the voids in the river bed and thus decreased the underflow, and as a result the flow of this river has been much larger than in other years of equal rainfall.

At the Mill Creek No. 2 plant water which flows under the diversion dams is diverted into the canal at a lower point. New buckets are being designed for this plant which should increase its efficiency from 10 to 15 per cent. The waterwheels in the Mill Creek No. 1 plant have been recently overhauled, and the design of the needle valve and tips has been changed to give the highest possible efficiency on the old-type equipment of this plant.

Increasing Waterwheel Efficiency

The design of the needle valves and tips of the Azusa plant is being changed to increase the efficiency of the waterwheels. The nozzle tip on one of the waterwheels at the Sierra plant has been made larger to increase the output of the plant during periods of high water. At this plant it is also contemplated to replace the old two-phase, 500-volt generators with 11,000-volt generators of modern design from the Pedley plant, operation of which has been discontinued. By doing this the electrical efficiency of the plant will be increased and transformer losses will be eliminated because the generators will feed directly into the 11,000-volt distribution system.

As mentioned in previous issues of the Electrical World, all important transmission systems of southern California are interconnected, the larger and more efficient plants being operated at full load and the smaller and less efficient plants used only to carry peak loads. Frequency-changer sets have been placed in operation between the systems operating at different frequencies. A 5000-kw. frequency-changer set is in operation at Colton, connecting with the Southern Sierras Power Company, and similar units are in operation at San Juan Capistrano and Magunden, connecting with the San Diego Gas & Electric Company and the San Joaquin Light & Power Company respectively.

The Kern River No. 1 plant is being operated at 60 cycles on the San Joaquin Light & Power Company's system, and it in turn is feeding the Mount Whitney Power & Electric Company at the same frequency. At such times as there may be an excess of hydroelectric power on these systems the excess can be diverted to the Southern California Edison Company's system through the frequency changer at Magunden, or the generators at the Kern River No. 1 plant may be changed to the 50-cycle system. This change can be accomplished with an interruption of only fifteen minutes (on the generator being changed) if all generators are running loaded and with no interruption at all if three or fewer are in operation.

Overhauling a 20,000-Kw. Turbine

At the Long Beach steam plant, the most efficient unit, a 20,000-kw. turbine is being completely overhauled from top to bottom, including all auxiliaries. This work is being rushed day and night with all possible speed and will probably be completed in the record time of thirty-five days. When these repairs are completed the efficiency of this unit will be increased about 10 per cent. During the time this turbine is out of service the boilers which belong to this installation are used to furnish steam to the other turbines in this station. This is done because these boilers have a higher efficiency than the other boilers of the plant, these being equipped with economizers. All boilers which are out of service are being thoroughly overhauled and put into first-class operating condition to carry a heavy load as soon as the turbine repairs are completed. While this turbine is being repaired the load is carried on the Redondo plant. The economy of the Redondo plant is slightly less than that of the Long Beach plant, but the increase of efficiency at the Long Beach plant due to this overhauling of the No. 3 turbine unit will soon counterbalance any loss due to operation of the less efficient plant during repairs at Long Beach.

To decrease the consumption of fuel oil at the Redondo plant one-third of the total number of boilers have been equipped with furnaces for burning natural gas. Those furnaces are of the multiple-burner type, there being 180 gas jets distributed over the entire floor of the furnace. The gas enters the furnace from the front through five 2½-in. (63-mm.) extra-heavy pipe laterals extending the full depth of the furnace under the furnace floor. At intervals of about 9 in. (25 mm.) these laterals are tapped on each side for 0.5-in. (13-mm.) pipe nipples, which are capped with standard pipe caps and have a $\frac{3}{16}$-in. (5-mm.) hole drilled in the top near the outer end. Over this opening is placed a fireclay burner tube 15 in. (38 cm.) long and 3 in. (8 cm.) inside diameter. These tubes have a slot cut in one side which straddles the 0.5-in. nipple with the orifice in the center of the tube and 12 in. (30 cm.) from the top.

The top of the tube is flush with the floor of the furnace, and baffle bricks are laid over the tube opening to diffuse the gas flame. The furnace floor is supported on 2-in. (5-cm.) standard pipe. This furnace burns the gas very efficiently, and the flame is so evenly distributed that there is practically no danger of burning or blistering of the boiler tubes. To avoid damage to the clay-burner tubes due to expansion of the furnace floor, the floor is loosely laid with mortar containing asbestos.

These furnaces are also equipped with front-shot oil burners for use in emergency when there is a failure of the gas supply. While the efficiency of oil burners in these furnaces is not very good, still it is more economical to use them for short periods of gas interruption rather than to warm up cold boilers which are equipped with oil-burning furnaces. The oil burners can be put into operation on instant notice so there is no interruption of the supply of steam.

In the operation of steam plants the scarcity of skilled boiler-room attendants is a very deplorable fact. It is almost impossible to obtain experienced men for this class of work, and with new, inexperienced men it is impossible to obtain good results in that portion of the plant where the greatest saving in fuel is possible by efficient operation.

COMPENSATION BY GOVERNMENT FOR BELL TELEPHONE SYSTEM

Theodore N. Vail Says that the Telephone Representatives Found an Intent and Desire to Pay All That Ought to Be Paid

Theodore N. Vail, president American Telephone & Telegraph Company, announces the principles adopted as a basis of compensation for the Bell telephone properties, taken over by the government for the period of the war. Mr. Vail states that the Bell system representatives "throughout the negotiations found nothing but helpfulness. Asking no more than they thought ought to be paid by the government, they found an intent and desire to pay all that ought to be paid, and for the protection of the property to do all that ought to be done and all that has been done in the past. In taking over the property the Postmaster-General also desires to give continuity to the service and, as far as consistent with government operation, to the personnel which has brought this property to its present degree of efficiency.

"From the first exchange of views until the close the Bell representatives were met by the Postmaster-General and his representatives in a spirit of absolute fairness and with an earnest desire to preserve the service to the public and preserve the property for the proprietors as well as to give them established returns on their securities."

The principles adopted as a basis of compensation were:

First—Any compensation fixed for the period of control was to be considered as compensation for an emergency period and not in any way considered as establishing a value for the property.

Second—The operation of the property is to be continued on a basis of efficiency relatively equal to that of the past.

Third—The property is to be fully maintained so as to be turned back to the company as good as when received.

Fourth—Appropriation from current revenue for maintenance depreciation and obsolescence to be the same as the past—an average of 5.72 per cent on the fixed capital; amortization of intangible capital to be relatively equal to the past. All unexpended balances from both to be invested in the plant of the system. Charges against the depreciation reserve to be in accordance with the rules of the Interstate Commerce Commission.

Fifth—Employees' pensions, disability benefits and death benefits now in operation to be continued.

Sixth—All taxes, municipal, state or federal, to be paid, or reimbursed if paid by the companies, by the government.

Seventh—The license and rental contract between the American Telephone & Telegraph Company and the licensee companies to be continued, and the American Telephone & Telegraph Company is to give such advice and assistance as the Postmaster-General may require, and to maintain its scientific, technical and engineering departments and its patent protection for the benefit of the property in the same manner as heretofore. The Postmaster-General is to have the benefit during the period of control, in the operation of the wire system, of all inventions, discoveries and ideas which may now or hereafter be controlled by the Bell system.

"These provisions," says Mr. Vail in his statement, "are for the protection of the property, the service and the art and provide for the continuation of the service and for the continual development of the art, as well as the protection of the developed situation, and are for the full protection of the public in its services and the proprietors in the property and development."

Other details in Mr. Vail's announcement follow:

For the security holders is provided:

(a) Payment of the interest and existing amortization charges on all outstanding securities or obligations of the Bell system in the hands of the public, including the 6 per cent convertible bonds issued Aug. 1, 1918.

(b) Payment of dividends at the existing rate upon the share capital of the Bell system outstanding in the hands of the public.

(c) Payment of any charges, interest, dividends or other costs on new securities or share capital issued in discharge, conversion or renewal or extension of present obligations.

For extension to property:

As provided above, unexpended depreciation shall be invested in property of the system. American Telephone & Telegraph Company surplus shall be invested in its property. Surplus profits from operation may be invested by the Postmaster-General.

If securities or capital can be issued at fair terms, the Bell system will issue its securities if desired, but the nominal value of the securities shall not exceed 80 per cent of the amount expended in the property.

Extensions to its property made with the approval of the Bell system by money furnished by the Postmaster-General shall be paid for in installments of 5 per cent per annum after the period of control ceases.

Extensions by the Postmaster-General to meet abnormal conditions and made without the approval of the system shall be appraised by the Interstate Commerce Commission at the end of the period of control and their value to the system as appraised shall be paid for in installments of 5 per cent per annum.

The whole basis of the negotiation on both sides was to ask no more than was right, to grant all that was right and to protect a great property and a great service to the public in every possible way.

The public should bear in mind that we are in the midst of very abnormal times. Scarcity of labor, high costs of living and great increases in demands on the service which are congested and not well distributed will create conditions which it will be difficult for the telephone systems to meet, no matter how much charges and wages are increased, and some consideration must be given before criticism is indulged in.

Inspection of Electric Welds

Lack of a Satisfactory Method for This Operation Has Been Responsible in Very Large Measure for the Hesitancy Shown in Adopting Metallic-Electrode Arc Welding—Relative Efficiency of the Various Tests Known

BY O. S. ESCHOLZ
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DETERMINING the character of welded joints is of prime importance, and the lack of a satisfactory method, more than any other factor, has been responsible for the hesitancy encountered among the engineering profession toward the extensive adoption of electric welding. To overcome this prejudiced attitude the rapidly accumulating knowledge must be shaped into an acceptable method of inspection.

The four factors which determine the physical characteristics of the metallic-electrode arc welds are fusion, slag content, porosity and crystal structure. Some of the important methods that have been suggested and used for indicating these characteristics are:

1. Examination of the weld by visual means to determine:
   (a) Finish of the surface as an index to workmanship.
   (b) Length of deposits, which indicates the frequency of breaking arc, and therefore the ability to control the arc.
   (c) Uniformity of the deposits, as an indication of the faithfulness with which the filler metal is placed in position.
   (d) Fusion of deposited metal to bottom of weld scrap as shown by appearance of under side of welded joint.
   (e) Predominance of surface porosity and slag.
2. The edges of the deposited layers may be chipped with a cold chisel or calking tool to determine the relative adhesion of deposit.
3. Penetration tests to indicate the linked unfused zones, slag pockets and porosity, by:
   (a) X-ray penetration.
   (b) Rate of gas penetration.
   (c) Rate of liquid penetration.
4. Electrictal tests (as a result of incomplete fusion, slag inclusions and porosity), showing variations in:
   (a) Electrical conductivity.
   (b) Magnetic induction.

These tests if used to the best advantage would involve their application to each layer of deposited metal as well as to the finished weld. Except in unusual instances, this would not be required by commercial practice, in which a prescribed welding process is carried out.

Relative Efficiency of Tests

Of the above methods the visual examination is of more importance than is generally admitted. Together with it the chipping and calking tests are of particular usefulness. The latter test serves to indicate gross neglect by the operator of the cardinal welding principles, owing to the fact that only a very poor joint will respond to the tests.

The most reliable indication of the soundness of the weld is offered by the penetration tests. Obviously, the presence of unfused oxide surfaces, slag deposits and blow holes will permit different degrees of penetration. Excellent results in the testing of small samples are made possible by the use of the X-ray. However, because of the nature of the apparatus, the amount of time required and the difficulty of manipulating and interpreting results, it can hardly be considered at the present time as a successful means to be used on large-scale production.

The rate that hydrogen or air leaks through a joint from pressure above atmospheric, atmospheric, or from atmospheric to partial vacuum, can readily be determined by equipment which would be quite cumbersome, and the slight advantage over liquid penetration in time reduction is not of sufficient importance to warrant consideration for most welds.

Of the various liquids that may be applied kerosene has marked advantages due to its availability, low volatility and high surface tension. Owing to the latter characteristics kerosene sprayed on a weld surface is rapidly drawn into any capillaries produced by incomplete fusion between the deposited metal and weld scarf, or between succeeding deposits, slag inclusions, gas pockets, etc., penetrating through the weld and showing the existence of an unsatisfactory structure by a stain on the emerging side. A bright red stain can be produced by dissolving suitable oil soluble dyes in the kerosene. By the means of this test the presence of faults that could not be detected with hydraulic pressure or other methods has been discovered. By the kerosene penetration a sequence of imperfect structures linked through the weld, which presents the greatest hazard in welded joints, could be immediately located. It must be borne in mind, however, that this method is not applicable to the detection of isolated slag or gas pockets, nor to small disconnected unfused areas. It has been shown by various tests that a weld may contain a considerable amount of distributed small imperfections without affecting to a great extent its characteristics.

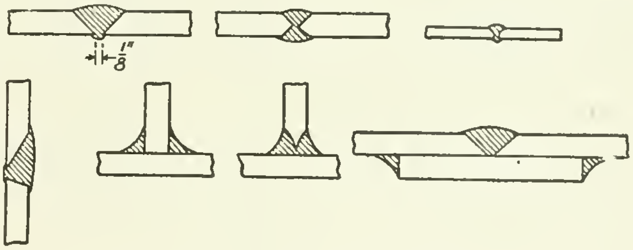

FIG. 1—TYPICAL ARC-WELD SCARFS

If a bad fault is betrayed by the kerosene test, it is advisable to burn out the metal with a carbon arc before rewelding, under proper supervision. By the means of sand blast, steam, gasoline, etc., large quantities of kerosene are preferably removed. No difficulty, however, has been encountered on welding over a thin film of the liquid.

Electrical test methods by which the homogeneity of welds is determined are still in the evolutionary stages. Obvious difficulties are yet to be overcome before the electrical test is feasible. Some of the difficulties are the elimination of the effect of contact differences, the influence of neighboring paths and fields and the lack of practicable, portable instruments of sufficient sensitivity for the detection of slight variations in conductivity or magnetic-field intensity. No simple tests are plausible, excepting those which involve subjecting the metal to excessive stresses for determining the crystal structure. Control of this phase must be determined by the experience obtained from following a prescribed process.

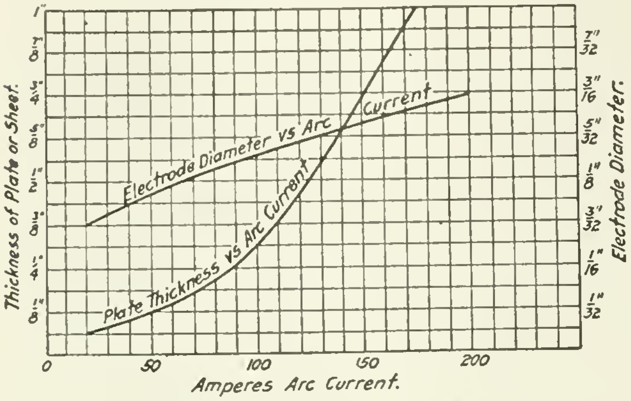

FIG. 2—ARC CURRENTS AND ELECTRODE DIAMETERS FOR WELDING STEEL PLATE OF VARIOUS THICKNESSES

The inspector of metallic-electrode arc welds may consider that through the proper use of visual, chipping and penetrating tests a more definite appraisal of the finished joint may be secured than is possible in either riveting or concrete construction. The operation may be still further safeguarded by requiring rigid adherence to a specified process.

Metallic-electrode arc welding is readily susceptible to close control. Regardless of the metal welded with the arc, the cardinal steps are:

1. Preparation of weld.
2. Electrode selection.
3. Arc-current adjustment.
4. Arc-length maintenance.
5. Heat treatment.

Sufficient scarfing, as well as the separation of the weld slants, should be provided in the preparation of the weld, so that the entire surface will be accessible to the operator with a minimum amount of filling required. When necessary to avoid distortion and internal stresses due to unequal expansion and contraction strains, the metal is preheated or placed so as to permit the necessary movement to occur. Various types of scarfs in common use are shown in Fig. 1.

The electrode selection is determined by the mass, thickness and the constitution of the material to be welded. An electrode free from impurities and containing about 17 per cent carbon and 5 per cent manganese has been found generally satisfactory for welding low and high carbon as well as alloy steels. This electrode can also be used for cast-iron and malleable-iron welding, although more dependable results, having a higher degree of consistency and permitting machining of welded sections, can be obtained by brazing, using a copper-aluminum-iron alloy electrode with the aid of some simple flux. Successful results are obtained by brazing copper and brass with this electrode. The diameter of the electrode should be chosen with reference to the arc current used.

EFFECT OF TOO LOW CURRENT VALUES

A great many concerns have attempted welding with too low an arc current, and the result has been porosity and a poorly fused deposit. This practice has probably resulted from the overheating of most electrode holders on rated currents, thus leading the operator to come to the conclusion that the current used is in excess to the amount needed.

The approximate values of arc current to be used for given thickness of mild steel plate, as well as the electrode diameter for a given arc current, may be taken from the curve in Fig. 2. The variation in the strength of 1-in. (25-mm.) square-welded joints as the welding current is increased is shown in Fig. 3.

Notwithstanding that the electrode development is still in its infancy, the electrodes available are giving quite satisfactory results. However, considerable strides can yet be made in the ductility of welds, in obtaining consistency in results, as well as in the ease of utilizing the process.

The maintenance of a short arc length is imperative. A non-porous, compact, homogeneous, fused deposit results from a short arc, while a porous, diffused deposit results from a long arc. A skillful operator usually maintains a short arc, as the work is thereby expedited, less electrode material is wasted and a better weld is obtained, due to improved fusion, decreased slag content and porosity. By observing the arc current and arc voltage from meter deflections or instrument records the inspector is able to keep a check on the most important factors which affect weld strength, ductility, fusion, porosity, etc. By the use of a fixed series re-

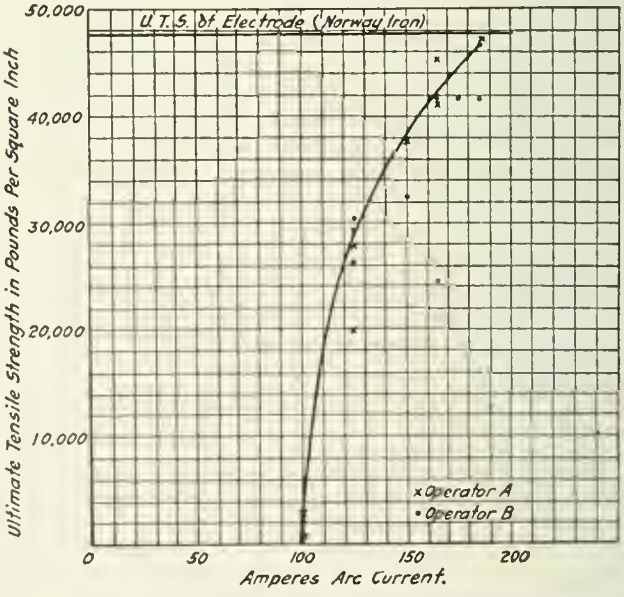

FIG. 3—VARIATION IN WELD STRENGTH WITH CHANGE IN ARC CURRENT

sistance and an automatic time-lag reset switch across the arc to fix definitely both the arc current and the arc voltage, these important factors are placed entirely beyond the control of the welder and under the direction of the more competent supervisor.

Heat Treatment and Inspection

The method of placing the deposited layers has an important effect on the internal strains and distortion obtained during contraction. It is possible that part of these strains could be relieved by preheating and annealing, as well as by preparation for the movement of the metal.

The heat treatment of a completed weld is not a necessity, particularly if it has been preheated for preparation and then subjected to partial annealing. A uniform annealing of the structure is desirable, even in the welding of the small sections of alloy and high carbon steels, if it is to be machined or subjected to heavy vibratory stresses.

In addition to applying the above tests to the completed joint and effectively supervising the process the inspector can readily assure himself of the competency of any operator by subjecting sample welds to ductility and tensile tests or by simply observing the surface exposed on cutting through the fused zone, grinding its face and etching with a solution consisting of one part of concentrated nitric acid in ten parts of water.

It is confidently assumed, in view of the many resources at the disposal of the welding inspector, that this method of obtaining joints will rapidly attain successful recognition as a dependable operation to be used in structural engineering.

War-Time Lighting Economies

Salient Features of Report Prepared by the War Service Committee of Illuminating Engineering Society for the United States Fuel Administration—Fallacies to Be Avoided—Making Maximum Use of Daylight

WHILE only about 2½ per cent of the total coal output of the United States (700,000,000 tons) is consumed in the production of artificial light, any part of this that is saved through lighting economies will assist in the conservation of coal which must be saved if the war ability of the nation is not to be impaired. In view of this fact the committee on war service of the Illuminating Engineering Society,* at the request of the Fuel Administration through the National Committee on Gas and Electric Service, has compiled some very valuable suggestions on "War-Time Lighting Economies" in the form of a bulletin. Limiting the use of artificial light to the minimum necessary number of hours per day and promoting the most efficient use of artificial light during those hours are the general methods proposed. In various places it is suggested that local lighting companies be consulted.

Discussing the problem more in detail, the I. E. S. committee on war service points out that unnecessary lighting can be eliminated by making the maximum use of daylight and by avoiding useless lighting. Dirty glassware and fixtures, dark ceilings and walls and inefficient lighting equipment are also productive of waste. Excessive or extravagant lighting must be curtailed.

Fallacies to Be Avoided

There are certain fallacies which must be guarded against in effecting lighting economies and the committee refers to these saying:

Removing reflectors or shades from lamps in order to "get more light" defeats the object. The raw light from glaring bare lamps is less effective than a smaller quantity of reasonably diffused light not exposed to the eye.

Attempting to economize by reducing the number of lamps or by using smaller lamps indiscriminately is unwise. In nearly every case ample illumination is essential to useful accomplishment. The most successful conservation is elimination of waste of light, not reduction of use of light.

In war time human energy and financial resources are to be conserved as well as fuel. Except in the greatest emergency it is unwise to save a little coal at the expense of waste of labor or impairment of health or menace to the safety of the public. Coal saved through the improvement of lighting equipment is clear gain. To diminish lighting standards in industrial plants, offices and other places where accomplishment depends in part upon vision is to reduce accomplishment or output. In such places, therefore, lighting should not be reduced. On the contrary, an increase in the standard of lighting may be the truest economy and in the best interests of the nation. The liberal use of light for protection of important property, munition factories, public works, etc., is likewise in the public interest, and under present circumstances no attempt should be made to save fuel through the reduction of such lighting.

In an acute local fuel situation an absolute lack of fuel may result in largely curtailed activities. If there is no fuel, industry must cease. Such a critical situation obviously demands radical curtailment of lighting beyond anything which is contemplated for general adoption.

In certain localities in the height of winter there may be a power shortage due to abnormally taxed generating capacity. This likewise may necessitate local lighting restrictions of a more extreme character.

In either event, when such a situation occurs, the problem is a local one, the handling of which must be governed by the particular circumstances.

Maximum Use of Daylight Saves Energy

Referring to the use of daylight, the committee says:

Use daylight during the war in preference to artificial light wherever and whenever possible.

Raise the shades to let in the daylight instead of lighting lamps. Arrange window shades to admit maximum daylight when desired. A good arrangement is to have two rollers at the middle of the window, one drawing up and the other down.

Refracting and diffusing glass in windows helps to spread the light to distant parts of the room.

Carry out operations requiring strong illumination near windows where plenty of daylight is available. Arrange machinery, furniture, etc., so daylight falls on objects to be seen, not on eyes.

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*Underlying the accepted principles of illumination are requirements for safety, conservation of vision, esthetics, comfort, convenience and economy. The Illuminating Engineering Society is committed to the preservation of these principles and to their application in lighting practice in the public interest. A number of recommendations here presented, particularly those advocating decreased use of light, are calculated to save fuel rather than to bring about most desirable illumination conditions. These are to be regarded solely as a war measure, justifiable in the present emergency, but otherwise not to be approved.

Whitened surfaces on building exteriors (especially about courts of high buildings) give more and better daylight in opposite buildings. These may reduce the period of artificial lighting by several hours each day.

Keep windows and skylights clean. Dirty windows may absorb half the daylight.

Dust window screens frequently. Remove them as soon as the insect season is passed. They absorb one-third of the daylight.

Use light-colored ceilings and walls wherever practicable to conserve daylight and artificial light.

Areas at a distance from windows often require artificial light when natural lighting is sufficient near the windows. Connect the switches, if possible, so that the light sources may be turned on in rows parallel with the windows, and the artificial lighting thus used in the several sections only as is necessary. Place the responsibility of operating these switches on designated individuals.

USELESS, EXCESSIVE OR DECORATIVE LIGHTING NOT PATRIOTIC

Useless lighting caused by failure to turn off lamps when not needed is also a great cause of waste and can be eliminated to a great extent by inviting the coöperation of the occupants of the place, attendants, etc. This will be discussed later with relation to different installations.

In regard to excessive and display lighting the committee says:

Do not use lamps which contribute merely to decoration.

Do not use more lamps or larger lamps than necessary.

Do not use all the lamps when part of them will suffice.

Extravagance in war time is unpatriotic. It involves application for selfish purposes of money and energy necessary to winning the war. Lighting in excess of that which is necessary and lighting for needless display or decoration at such a time is extravagant.

The question of illuminated advertising display is a part of the larger question of general advertising, practically all of which involves consumption of fuel. The desirability of curtailing lighting of this character would appear to depend upon the necessity of reducing advertising in general.

Proper lighting display has a place in maintaining the morale of the people no less important than amusements and recreation. Display lighting also has a certain utility in providing necessary illumination. General and needlessly extensive display and inefficient methods of lighting display under present conditions are extravagant. In planning lighting of this character every economy of energy not inconsistent with reasonable effectiveness of the lighting should be sought.

Maintaining the most efficient use of artificial lighting requires in the first place the employment of the most efficient lighting units; second, their proper location; third, the correct application of reflectors and shades; fourth, a high utilization factor, and, fifth, proper maintenance of the equipment and reflecting surfaces.

EFFICIENCY AND LOCATION OF LAMPS IMPORTANT

With relation to the type of lighting unit to use the committee says:

Large lamps are usually more efficient than small lamps, and where practicable installation should be altered to consist of the fewest lamps from which uniform illumination may be obtained under the conditions of use. Where clusters of lamps are employed under shades replace them by a single larger lamp with suitable reflector.

Do not use electric lamps of the carbon-filament type where the more efficient tungsten-filament lamps can be employed. These substitutions will result in a saving of three-fourths of the fuel used for a given candlepower.

An intelligent choice of lamps makes it possible to reduce the consumption of fuel.

Lamps should be spaced to give uniform lighting and with reference to the work so as to avoid bad shadows. This permits the use of the minimum wattage in the general lighting and makes it possible to remove most drop lamps and local lighting. The latter are objectionable from the conservation point of view because they may be left burning when no necessity exists.

FACTORS GOVERNING USE OF SHADES AND REFLECTORS

Regarding the general use of shades and reflectors the report reads:

Modern lamps are so brilliant that they may injure the eyes if used without protective equipment. Shades and globes conceal them from view, soften the light, and where desired redirect a considerable part of the light in the direction needed. Shades and globes never increase the total quantity of light, but an efficient reflector will usually increase the light where it is needed. With such a reflector a smaller lamp may suffice, thus saving coal. The advice of the lighting company should be sought when selecting such equipment.

Flat reflectors allow much of the light to escape to the walls instead of directing it to the work. They also leave the bright light source exposed to view and the glare interferes with the vision, causing a demand for still higher intensities. Use reflectors of the dome or bowl shapes for greatest economy. Except where lamps are mounted in high bay areas use bowl-frosted lamps to reduce glare reflected from the work and to soften the shadows. Be sure that reflectors are deep enough to protect the eye from the glare of the filament.

Do not use indirect or semi-indirect lighting fixtures in conjunction with dark ceilings which absorb a large part of the light.

LIGHT-COLORED WALLS AND CEILINGS SAVE ENERGY

As a rule, at least one-half, and sometimes practically all, of the light utilized in interiors is received by reflection from walls and ceilings. Good light-tinted paint when fresh rarely reflects more than one-half of the light which falls upon it. The proportion of light reflected from good white lead and oil paint under average conditions diminishes by about 10 per cent a year. The same is true of calcimine and similar coatings. It is apparent therefore that there is an opportunity for improving lighting efficiency through the employment of the best finishes for ceilings and upper walls. Painting white ordinary light-tinted surfaces may increase the light reflection by as much as 50 per cent. Therefore in order to save fuel in lighting wherever it is practicable paint ceilings white, employ light tints for the upper parts of walls, and use paint that is non-porous and easily cleaned. Light-colored surfaces reflect five to ten times as much light as dark surfaces.

CLEANING TOO OFTEN OVERLOOKED

Maintenance of lighting fixtures and reflecting surfaces such as walls, ceilings, etc., is so often neglected that particular attention should be directed to it as a means of saving fuel. The report on "War-Time Lighting Economies" reads:

The loss of artificial light due to dirty glassware and dark or dingy ceilings and side walls ranges from 30 to 50 per cent and may be avoided by renovation at necessary intervals. With indirect or semi-indirect lighting the refinishing of the ceiling and cleaning of the lighting units will frequently increase the intensity 50 to 100 per cent, permitting a reduction in wattage to the next lower size of lamp.

Keep lamps and reflectors free from dust by a regular schedule of cleaning at short intervals.

Suggestions Applying to Specific Cases

The foregoing suggestions apply to all places and may be considered the fundamental requirements of economical lighting. However, many places have conditions which are peculiar to them so additional factors have to be considered. A few of these will be taken up that apply to stores, hotels, offices and schoolrooms, and industrial plants.

Quoting from the I. E. S. report:

Stores.—The amount of fuel consumed in store lighting is of sufficient magnitude to make a consideration of possible economies worth while.

Illumination in stores should be only that necessary to enable customers to see comfortably and plainly even where the closest discrimination is required to the end that they may make selections and judgments quickly and satisfactorily and to enable salespeople to perform their duties quickly and easily. The degree of illumination suitable for any particular case may be determined by actual trial through the use of more or fewer lamps or of lamps of greater or less power.

Lamps should be so controlled that only those actually needed will be in use at any time. In small stores this may be accomplished by controlling each individual lamp or cluster of lamps at the fixture. In larger stores the lamps farthest removed from the windows should be on separate circuits, being switched on first as daylight diminishes, the outer lamps being turned on later when this becomes necessary.

Show windows should be lighted by lamps with efficient reflectors. By the use of these it is often possible to save from 25 to 50 per cent of the energy required for illumination without impairing the illumination in the window. Under no circumstances should bare lamps be visible from the street as this renders the eye less sensitive and makes a higher intensity necessary in the interior of the store, thus defeating the purposes for which these economies are urged.

Hotels.—It is suggested that waste in guest rooms be reduced to a minimum by having a notice, probably a card, placed near the door reading: "It is requested by the U. S. Fuel Administration that you kindly turn off the lights when leaving the room and help save fuel."

All employees of the hotel, especially the housekeepers having charge of the guest rooms, should be cautioned to see that lamps are not left burning when rooms are unoccupied and that when rooms are being cleaned only necessary lights are turned on. Bell boys should be instructed to turn on only the main or overhead lamp when showing the guest his room.

In dining rooms where two systems of lighting are in use, such as overhead and table lighting, one of the two should be reduced or eliminated entirely. Where overhead lighting is sufficient, table lamps solely for decorative effects should be done away with.

In public rooms, such as cafés, lobbies, writing rooms, etc., the illumination should be reduced to a point consistent with comfort. All decorative lamps, around mirrors or on brackets, etc., not absolutely essential to produce illumination of a sufficient intensity to avoid feeling of undue depression or gloom, should be eliminated.

While it is important as a measure of safety to keep stairways, passageways and halls adequately illuminated, it should be remembered that hall lights burn long hours, and in cases where convenience or safety is not menaced reductions as to the number and size of lamps must be made.

Service rooms where lamps are allowed to burn constantly should receive consideration; for example, in large barber shops where only a few chairs are in use lights over the other chairs should be turned off. In the kitchen only those parts of the room actually being used for preparation of food, washing the dishes and the like should be lighted.

Offices and Schools.—Very large economies in the operation of lighting systems in offices and schools may be effected without reducing the general illumination, which is seldom of an intensity higher than that required for the conservation of vision.

Often the greatest waste occurs through the lighting of an unnecessarily large number of rooms during the hours of cleaning. Every building superintendent and janitor should insist that lamps be lighted in a given area only when the cleaners are actively engaged there, and that the minimum number be turned on which will permit the work to be done properly.

Cards or signs should be displayed prominently in the various rooms requesting tenants to turn on only such lamps as are necessary to their work and urging that all lamps be extinguished when daylight will suffice and when the tenant leaves his office.

Large reflecting fixtures with glass diffusing bowls suspended below the lamps soften the shadows and reduce the demand for local desk lighting. Indirect and semi-indirect fixtures produce the best conditions for vision in schoolrooms and offices.

In offices and schoolrooms the requirements of vision are exacting. The occupants must view fine detail and the work in one position for long periods. The light from a lamp therefore enters the eye constantly from one direction and will prove annoying and harmful if too bright. Reflections from polished surfaces and sharp shadows also interfere with vision. If the general illumination is from amply diffused sources of proper wattage, all individual desk lamps may be dispensed with.

Industrial Plants.†—In almost every plant there is waste in the use of light, the elimination of which can be accomplished without retarding production, impairing the vision or menacing the safety of the employees. So far as possible do all lighting from a general overhead system out of the control of individual workmen. Make some individual in each department responsible for seeing to it that lamps are lighted only in such areas and for such periods as necessary.

ORDINARY VALUES OF ILLUMINATION EMPLOYED AND MINIMUM VALUES THAT SHOULD BE PERMITTED

	Foot-Candles at the Work	
	Ordinary Practice	Minimum
(a) **Roadways and yard** thoroughfares..	0.05- 0.25	0.02
(b) Storage spaces	0.50- 1.00	0.25
(c) Stairways, passageways, aisles......	0.75- 2.00	0.25
(d) Rough manufacturing, such as rough machining, rough assembling, rough bench work	2.00- 4.00	1.25
(e) Rough manufacturing involving closer discrimination of detail.............	3.00- 6.00	2.00
(f) Fine manufacturing such as fine lathe work, pattern and tool making, light-colored textiles	4.00- 8.00	3.00
(g) Special cases of fine work, such as watch making, engraving, drafting, dark-colored textiles	10.00-15.00	5.00
(h) Office work, such as accounting, typewriting, etc.	4.00- 8.00	3.00

Note.—Measurements of illumination are to be made at the work with a properly standardized portable photometer.

This table of lighting intensities required in industrial processes was issued by the Illuminating Engineering Society and subsequently adopted by the United States Bureau of Standards for the National Safety Code and government plants. The table has likewise been incorporated in the factory lighting codes or regulations issued by several of the state industrial commissions.

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†For information in regard to good factory lighting practice consult the "Code of Lighting Factories, Mills and Other Work Places," Illuminating Engineering Society.

Plant Arrangement and Costs of Construction—II

Features of Latest Station of Turners Falls Power & Electric Company, Which Bids Fair to Be One of the Most Important Steam Plants in the New England States

As pointed out in the Oct. 26 issue of the ELECTRICAL WORLD, the Turners Falls Power & Electric Company, which operates 500 miles of transmission and distribution line in the central Connecticut valley, has just built a 30,000-kw. steam station to supplement its hydroelectric plants. The new station is not for auxiliary service in the sense that it will be used merely in an emergency, but has been built to permit utilizing the maximum water power. It is an excellent example of a plant built to operate most economically. The conditions which led to its location, the obstacles which had to be overcome in building it and the method of handling the coal and ashes were related in the October issue. Additional information, including the electrical features of the plant, is given in the article which follows.

CONDENSING water is drawn from the Connecticut River through two tunnels and headworks on the banks of the stream and is discharged through a reinforced-concrete line into a lagoon connected with the Connecticut River about 500 ft. (150 m.) below the intake. The headworks structure is provided with steel racks at its entrance, heavy wooden sluicegates and stop planks to allow the making of repairs while the plant is in operation. The construction of the condenser tunnels was one of the most difficult portions of the work, involving the driving of a wooden pile foundation and the placing of concrete at an elevation of 10 ft. to 12 ft. (3 m. to 3.7 m.) below extreme low water of the river. It was necessary to surround the work with a steel cofferdam to prevent the caving in of the banks of the excavation and exclude water while the work was in progress. The discharge line was constructed at a higher elevation than the intake lines and consequently involved less difficult and expensive construction. The entire cost of condenser and intake headworks, tunnels and discharge conduit was $100,399.

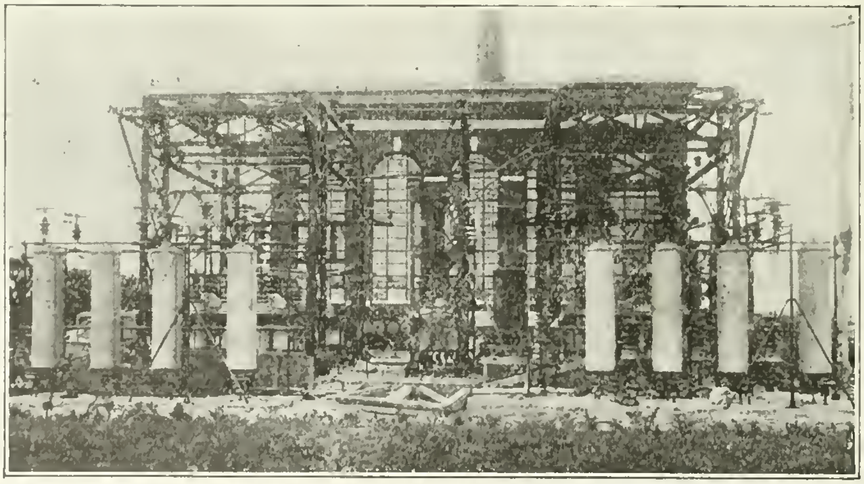


FIG. 1—OUTDOOR SUBSTATION CONNECTING STEAM STATION WITH HYDROELECTRIC TRANSMISSION SYSTEM

The boiler-feed pumps are in the turbine-room basement. Three sets have been installed. One set is driven by a General Electric induction motor of 200-hp. rating and is composed of a 3-in. (8-cm.) six-stage De Laval pump on one end of a shaft and a 4-in. (10-cm.) single-stage pump on the other end, each designed for a delivery of 300 gal. (1135 l.) per minute. The other two sets are direct-driven by De Laval turbines and are arranged in pairs, one being a 5-in. (13-cm.) three-stage pump and the other a 5-in. single-stage pump. The feed-water supply is flexibly arranged. Normally water is drawn from the hot-well suction main by the feed-pump equipment and forced through the feed-water heater and thence through a Lea V-notch meter—capacity 400,000 lb. (181,000 kg.) per hour—to the boiler supply lines. One feed pump in each set is designed for low-pressure service, delivering water into the heater, and the other pump of the set is for high-pressure service, discharging water into the boilers. A connection is made to the city water supply through a cold-water line, while a connection from the river enables water to be pumped into the hot-well suction main for make-up service. Semi-steel piping is used in the hot-water lines and wrought-iron in the cold-water lines.

Each feed-water heater has a normal capacity of 7500 hp., receiving water at a temperature of 40 deg. Fahr. (5 deg. C.) and delivering it to the boiler supply lines at 210 deg. Fahr. (99 deg. C.). A purifying attachment is provided, and the time for a complete treatment of the water, assuming a consumption of 225,000 lb. (102,000 kg.) per hour, is about fifteen minutes per heater.

Each boiler delivers steam through a side outlet to a pipe which is carried downward to the basement and thence across to a short 20-in. (51-cm.) header of cast steel $1\frac{1}{8}$ in. (29 mm.) thick near the turbine-room wall. The turbines are each supplied from the header through an independent 14-in. (36-cm.) lead of extra-heavy cast-steel pipe. The fact that the boiler-room firing aisle is 25 ft. (7.6 m.) wide between batteries increases the length of high-pressure piping slightly, but it was thought that the increased convenience of a liberally designed boiler room was worth far more than its additional cost. A free exhaust line is carried upward from the basement to a roof outlet, as shown in the cross-section printed in the Oct. 26 issue.

Each of the two turbine sets ordered for the initial installation is a 15,000-kw. horizontal unit running 1800 r.p.m., and delivering three-phase, 60-cycle energy at 13,200 volts. The steam guarantee on these machines is 12.5 lb. per kilowatt-hour at 15,000 kw., 12.3

lb. at 11,250 kw., and 12.9 lb. at 7500 kw., the steam pressure at the throttle being 200 lb. (14 kg.) with 125 deg. superheat and not over 1.5 in. (38 mm.) absolute back pressure. Each machine is provided with a 100-kw., 250-volt direct-connected exciter. One 150-hp. motor-driven exciter is provided as a spare for both main units.

The turbine-room crane has a main hoist of 60 tons capacity and an auxiliary hoist of 6 tons rating. The maximum lift is 62 ft. (18.9 m.) It is operated by General Electric three-phase 550-volt motors, and serves the entire turbine room and basement well containing the condensing and auxiliary pumping and electrical equipment. Each turbine exhausts into a cylindrical-shell twin-jet condenser equipped with twin submerged removal pumps connected through Kerr reduction gears to General Electric turbines. Air removal is accomplished by four "Radojet" ejectors per condenser. The condensers are designed to maintain a 28-in. (71-mm.) vacuum at the turbine exhaust nozzle under full-load conditions with injection water at 70 deg. Fahr. (21 deg. C.). The circulating pumps have a working range enabling them to discharge against the maximum head obtained at high river elevations. The water removal pumps are 24-in. (61-cm.) bi-rotor centrifugals, and each has a capacity of 12,200 gal. (46,200 l.) per minute. Each turbine and gear set has a rating of 250 hp. at about 3000 r.p.m., and the pumps are installed in the hot wells under the condenser shells.

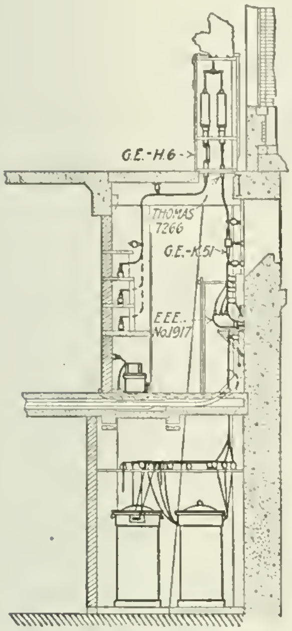


FIG. 2—SECTION THROUGH BUS AND SWITCH STRUCTURE

CONSTRUCTION OF HOT WELLS FOR GENERATORS

The hot well for each generating unit is divided into two sections separated by a weir. From each condenser a pair of 24-in. (61-cm.) pipes lead through the hot well to a conduit terminating in a discharge pit, from which a discharge main carries away the unused water to the river. Over one section of the hot well each of these condensate pipes is tapped by an 8-in. (20-cm.) pipe which delivers condensate to another section of the hot well, the amount delivered depending upon the load and upon the degree of opening of a float valve in each 8-in. pipe. The four Radojet air ejectors for each condenser take boiler steam through a reducing valve. The steam, together with the air removed from the condensers, is discharged through 5-in. (13-cm.) perforated pipes into the hot well. The float valve in the condenser-water branch discharge line keeps the water in the hot well at a constant level. After the water flows over the weir into the other section of the hot well, it is drawn through the suction line to the feed pumps and thence delivered to the heaters. The condenser injection piping is provided with a high-water by-pass loop 9 ft. (2.7 m.) high for each unit to protect the condenser from flooding at times of a high water. The hot wells are provided with overflow connections to a basement sump. Each of the Radojet air ejectors is designed to remove 13.5 cu.ft. (0.38 cu.m.) of air per minute, with a steam consumption not exceeding 1800 lb. (815 kg.) per ejector.

The generators are equipped with temperature coils, and the stator neutrals are brought out for current transformer connections to guard against short-circuit conditions. At present the connections from the generators to the controlling 13,200-volt switches are temporary. These switches are placed in brick cells on the turbine-room floor and on a basement mezzanine floor just below. The switches are operated by remote-control from a temporary switchboard on the turbine-room floor. This location will later be changed as the plant increases in size, and a separate switch house will be erected on the north side of the turbine room, situated symmetrically with respect to the final installation of generators. Ducts are now laid in the turbine-room floor with this end in view.

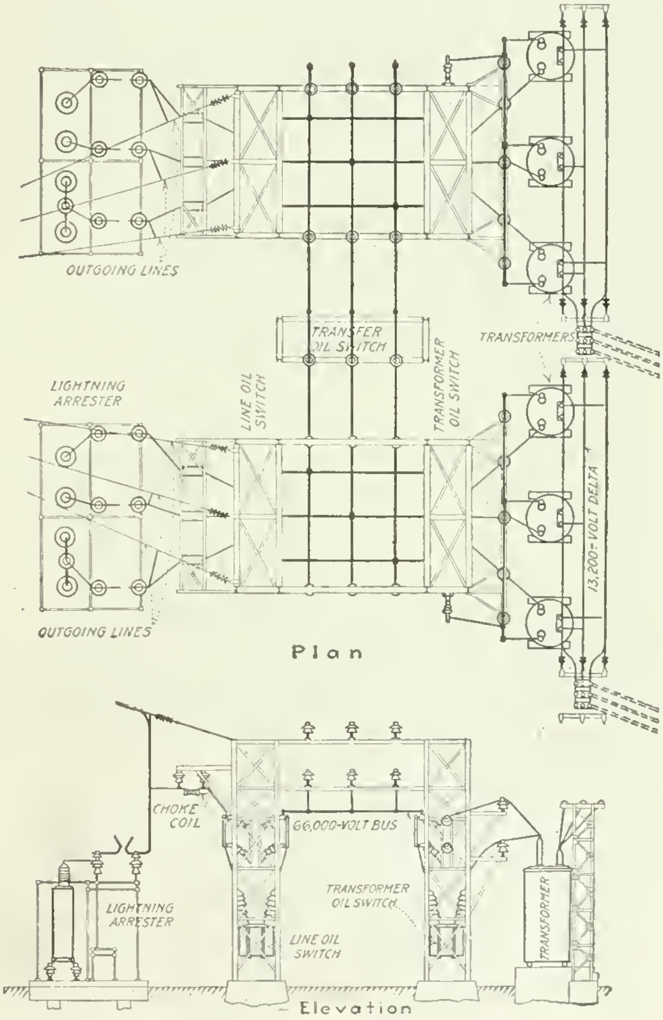


FIG. 3—PLAN AND ELEVATION OF OUTDOOR SUBSTATION; TRANSFORMER MAY BE PARALLELED ON HIGH-TENSION SIDE

All high-voltage line and transformer switches are in the outdoor substation, which is equipped with six 6250-kva. Westinghouse oil-insulated, water-cooled transformers mounted in two banks of three each, with primary and secondary connections as shown in the accompanying drawing. The transformer water-cooling coils are connected with the house service system, and the oil piping is connected to an underground tank and filtering system conveniently placed with respect to the substation. There are two outgoing 66,000-volt lines. The 13,200-volt buses are arranged in a single set in horizontal runways in the mezzanine floor of the turbine-room basement and are connected through General Electric motor-operated H-6 oil switches to the transformer banks by two underground cable duct lines. Each line consists of three armored cables made up in three 400,000-circ. mil sections per cable, three phases of each circuit being carried in each cable. A spacing of 10 in. (25 cm.) of earth is left between each two armored cables.

The 13,200-volt connections of the outdoor transformers are in delta and the 66,000-volt connections in Y, with the neutral grounded. No strain insulators are provided on the high-tension buses of the substation, all construction being of the rigid type, with pin-type insulators and bus conductors of 1.25-in. (32-mm.) double extra-heavy steel pipe. The outdoor bus affords opportunity for cross-connecting the two outgoing lines, feeding either from either transformer bank or from both banks in multiple. The bus-tie switch permits short-circuiting the station on the high-tension side if desired, leaving the transformer banks dead. Tracks are provided for the removal of transformers. The usual installation of lightning arresters, choke coils and disconnecting switches has been made. All the high-tension switches are electrically operated with remote control from the temporary switchboard in the turbine room.

AUXILIARY ELECTRICAL EQUIPMENT

The auxiliary electrical equipment of the station is unusually complete. It includes a storage battery for the operation of oil switches and emergency lighting; a charging set for the battery and for the industrial electric truck used in ash handling; a 25-hp. air compressor for general cleaning; motor-operated steam-line valves of 3-hp. drive each, supplied from the control battery; push-button stop system for conveyor-motor drive; a 200-hp. motor-driven boiler-feed pump for combination turbo-motor drive; two 15-hp. motor-driven service pumps, and five house-service power and lighting transformers aggregating 850 kva. The house power service is performed by 550-volt, three-phase motors, and the lighting service is operated on the 110-220-volt, three-wire plan. A wooden tank is installed on the roof and piped to the house-service pumps for general water supply and transformer-cooling service. The station-service 550-volt, three-phase buses are of 1-in. (25-mm.) rods supported on cleats and insulated with ⅛-in. (3-mm.) varnished cambric wrapped with flame-proof covering. The station-service transformers and storage battery for control service are in permanent compartments of the basement below the present temporary 13,200-volt bus compartment. An office for the station executive staff is provided in an "L" on the Connecticut River side of the building.

The Hampden station was designed under the general direction of F. L. Hunt, chief engineer; C. F. Mosher, superintendent of stations, and R. E. Barrett, of the Turners Falls Power & Electric Company, Mr. Barrett being resident construction engineer with headquarters at Springfield, Mass. The company's engineering and operating headquarters are at Greenfield, Mass. George W. Lawrence, Greenfield, Mass., is second vice-president and general manager of the company.

The president of the Turners Falls Power & Electric Company is Philip Cabot of White, Weld & Company, Boston, whose financial and engineering leadership has been the most important factor in the development of the company's system from its early beginnings to its present magnitude as a public utility of foremost importance in supplying electrical energy to the public and the manufacturers of the New England States.

Book Review

ELEMENTS OF FUEL OIL AND STEAM ENGINEERING. A Practical Treatise Dealing with Fuel Oil, for the Central-Station Man, the Power-Plant Operator, the Mechanical Engineer and the Student. By Robert Sibley and Charles H. Delany. San Francisco: Technical Publishing Company. 320 pages, illustrated. Price, $3.

The greater part of this book is devoted to the fundamentals of steam engineering, and the burning of oil fuel is not treated so extensively as could be desired. For example, almost half of the thirty chapters are given over to the treatment of such topics as force, work and power; gage and absolute pressures and pressure measurements; temperature scales and their conversion; elementary thermodynamics, including an explanation of the properties of steam and the use of the steam table; calculation of boiler horsepower; steam calorimeters and the determination of the quality of steam; types of steam boilers; strength of boiler shells and riveted joints, and apparatus for flue-gas analysis. All of these matters are of general application in connection with steam-boiler practice. On the other hand, the chapter describing furnaces for fuel oil and showing the different methods of admitting the air supply is excellent.

The number of types of oil burners shown is limited to four, which is somewhat surprising in view of the number of such devices on the market. Apparatus for finding the gravity, moisture content and heating value of fuel oils, testing boilers and working up the results of tests are written specifically with regard to fuel-oil practice. No mention is made of oil strainers or heaters, so far as illustrations are concerned, and little is said with regard to oil storage. The oil-fuel data that are presented are practical and useful, and it is regrettable that the various topics relating thereto are not more extensively treated.

Books Received

THE NEW SCIENCE OF THE FUNDAMENTAL PHYSICS. By W. W. Strong. Mechanicsburg, Pa.: S. I. E. M. Company. 108 pages.

THE RESULTS OF MUNICIPAL ELECTRIC LIGHTING IN MASSACHUSETTS. By E. E. Lincoln. New York: Houghton Mifflin Company. 484 pages. Price, $3.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

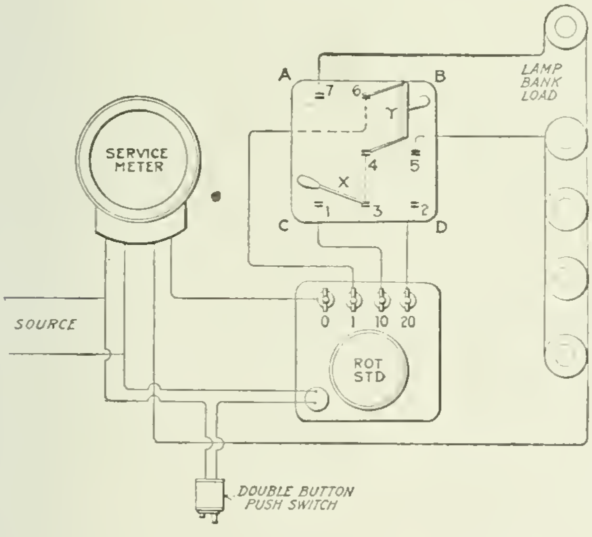
SPECIAL SWITCH MADE FOR TESTING WATT-HOUR METERS

Saves Time and Prevents Mistakes in Changing Current Coil Connections—Easily Made from Switch Parts

BY R. M. BERRY

A convenient method of testing watt-hour meters is indicated by the accompanying drawing. The part of the diagram shown at *ABCD* represents a specially constructed switch for changing the current coils on the rotating standard without having to remove the wire from one binding post to the other during the period of testing a meter. This switch has been found to be quite a time saver and helps to eliminate mistakes.

The operation of the switch is as follows: For testing with the 20-amp. coil on the rotating standard, adjust the load for 20 amp., throw switches *X* and *Y* toward *BD* and connect points 2 to 3 and 4 to 5 respectively, thus completing the circuit through the 20-amp. coil. In a like manner, for testing with the 10-amp. coil, adjust the load for 10 amp., leave switch *Y* in position *BD* and throw switch *X* toward *AC*, connecting points 1 to 3 and 4 to 5 and completing the circuit through the 10-amp. coil. In testing with the 1-amp. coil switch *Y* is thrown toward *AC*, connecting points 6 to 7 and completing the circuit through the 1-amp. coil.



SPECIAL SWITCH FOR TESTING WATT-HOUR METERS

The idea in having switch *Y* of the construction mentioned is to avoid blowing the fuse on the 1-amp. coil, as only a definite load can be placed on it. When using the other coils the latter is entirely disconnected. This switch was constructed out of fiber board of ⅛-in. (3-mm.) thickness for the base and standard knife-switch parts for the contacts. This switch can be mounted in any convenient place for shop testing, or a special cover can be made for the rotating standard deep enough to accommodate the switch when the cover is closed.

PERFORMANCE DATA ON A BRASS-MELTING FURNACE

Comparison of an Electric Furnace with an Oil-Fired Furnace Shows a Considerable Saving in Heating Units as Well as Metal Loss

Data are presented herewith on the performance of a Bailey brass-melting furnace at Louisville, Ky., indicating that 5.9 lb. (2.6 kg.) of metal loss and 233,000 B.t.u. are saved per 100 lb. (45 kg.) of metal poured, compared with using an oil-fired furnace. The figures are based on an eight-day run of yellow brass at the plant of the Standard Sanitary Manufacturing Company, Louisville. A. S. Witmer, manager of the commercial department of the Louisville Gas & Electric Company, submitted the information.

REPORT OF TEST MADE ON A BAILEY ELECTRIC FURNACE MELTING YELLOW BRASS

Date	Metal Charges, Lb.	Metal Poured, Lb.	Loss, Lb.	Gain, Lb.	Kw.-Hr.
July 8	3,000	2,950	50	...	508
9	5,000	4,748½	251½	...	795
10	6,020	5,835	185	...	644
11	6,000	5,943½	56½	...	639
12	5,900	5,032	...	32	733
13	2,400	2,532	..	132	309
15	5,822	5,809	13	...	724
16	6,000	5,945	55	...	705
Totals,	40,142	39,695	611	164	5,057
Net loss,	.....	......	164	...	...
			447		

SUMMARY

Energy per 100 lb. of metal poured, 12 7 kw.-hr
Metal loss per 100 lb. of metal poured, 1.13 lb.
Cost per 100 lb. of metal poured:

Energy, 12 7 kw.-hr., at 1½ cents	$0 19	
Metal loss, 1.13 lb., at 20 cents	0 226	
		$0.416

RESULTS USUALLY OBTAINED BY OIL FURNACE

Oil per 100 lb. of metal poured, 4 gal.
Metal loss per 100 lb. of metal poured, 7 gal.
Cost per 100 lb. of metal poured:

Oil (4 gal., at 6 cents)	$0 24	
Metal loss (7 lb., at 20 cents)	1 40	
		$1.64

ECONOMY OF FUEL

Assuming a power plant consumption of 3 lb. coal per kw.-hr., and a value of $3 per ton, and oil at 6 cents per gal., the following results based on 100 lb. of metal poured are obtained:

Oil furnace (4 gal. oil, at 6 cents)	$0 240
Electric furnace, 12 7 kw.-hr. × 3 lb., at $3 per ton	057
Value of fuel saved	$0.183

ECONOMY OF METAL

	Lb.
Oil furnace loss per 100 lb. metal poured	7 00
Electric furnace loss per 100 lb. metal poured	1 13
Metal saved	5.87

ECONOMY OF HEATING UNITS

	B.t.u.
Oil furnace (4 gal. oil × 177,000)	708,000
Electric furnace (38 lb. coal × 12,500)	475,000
Saving	233,000

CARD SYSTEM THAT GIVES RECORD OF ALL MOTORS

Facilitates Keeping Proper Repair Parts on Hand, Simplifies Handling Emergency Calls, Insures Thorough Maintenance

BY H. S. RICH

In a large plant where more than 100 motors are installed much delay was experienced in answering breakdown calls and in making repairs through lack of knowledge of each particular motor. One of the first things done by a new chief electrician was to have all motors cleaned up and numbered plainly. Then he established a card system on which were kept all the specifications concerning each motor. These cards were kept in an open box on his desk in the electric repair shop, where all the helpers could refer to them instantly. Each card showed the following:

Number of motor.
Horsepower.
Make.
Manufacturer's number.
Face of pulley.
Length of shaft.
Type.
Size of fuses.
Size and number of brushes.
Department.
Revolutions.
Phase.
Diameter of pulley.
Diameter of shaft.
Size of key.
Serial number.
Type of fuses.
Motor belted to.

The cards were arranged in the box by departments so that by referring to any one department all the motors in there could be seen at a glance. A few cards at the front of the pile had all the motors in the plant arranged by numbers consecutively, so that when any foreman telephoned in, for instance, that motor No. 15 was stopped the top cards showed what department this motor was in. Then by referring to the department card all the specifications concerning this motor were seen at a glance, and the repair man was supplied with the proper-sized fuses, test lamp and tools and dispatched to remedy the trouble.

Most jobs were completed in record time because the necessary things were taken along on the first trip, without running back and forth to see what was wanted, all of which formerly caused much delay. By "keeping tabs" on the cards all sizes of fuses likely to be needed by any motor could be provided ahead of time and kept in stock, so that no time was lost making up any when a motor shut down.

This card system was very handy to refer to when a motor burned out or broke down. Moreover, motors could be shifted around to better advantage by knowing all about them. Thus one department needed more horsepower and another department was found to have a larger motor at the same speed and pulley diameter. After seeing them both in operation an exchange was made with all knowledge of the details before either was stopped. Many times an exchange or temporary installation called for special-sized pulley with a particular bore and key. The card data made possible the assembly of this material ahead of time so that when the change was made there was no loss of time.

All new motors purchased, whether put into immediate use or into stock as reserves, had their record taken and listed along with the rest of the equipment on hand. In a space at the bottom of every motor card remarks were often penciled from time to time as trouble was found. Thus one busy 50-hp. motor was found to have very little clearance under the rotor when tested with a steel gage. This was noted on its card, and two new bearing linings were immediately made ready. On the first Saturday afternoon following, when the motor was shut down, the linings were examined and one was found to be badly worn. A new one was put in, and on Monday morning everything was ready for service with no loss of time.

Sometimes higher line-shaft speed was demanded, and by referring to the card the revolutions, pulley diameter, face and key were observed at a glance. A larger one could be made ready and slipped on the same day at noon; whereas to climb a ladder and take measures might have meant to shut down a motor which was carrying a large load; thus production would be curtailed. The time saved is the most valuable feature of this scheme.

When summer repairs are made each motor is taken in its turn and thoroughly overhauled. By following the cards none is overlooked. Also by listing the various sizes of shafts throughout the plant enough bearing linings can be ordered ahead of time and kept in stock so that no motor will be held up in an emergency for lack of them.

PROBLEM OF CORROSION OF BOILER-FEED PIPES

Increased by Dissolved Gases in Liquid—Presence of Hydrogen Ions and Roll Scale Tends to Augment the Trouble

The activity with which corrosion takes place in hot-water supply pipes like boiler-feed lines and economizer tubes is not primarily dependent upon the acid, alkaline or neutral condition of a water, but rather upon certain dissolved substances which exert a modifying influence upon the universal tendency of even the purest water to initiate the corrosion process. So say F. N. Speller and R. G. Knowland of the American Society of Heating and Ventilating Engineers. This inherent tendency of pure water to attack metal may be greatly aided by dissolved gases in the liquid, and under such conditions the term "active" typifies its corrosive qualities. The initial speed of attack is proportional to the number of hydrogen ions in the water. While pure water, with its very low concentration of acid ions, is capable of inducing the corrosion of iron water containing an acid will be proportionately more ruinous to the metal. It is, therefore, a fact that the tendency of iron to corrode depends to a certain degree upon the amount of acid present in the surrounding water.

In the first stage of corrosion iron surfaces have the appearance of ferrous compound; this will stop further action unless removed. The presence or absence of oxygen determines the possibility of corrosion. Thus an inactive water may become extremely corrosive or active upon being aërated. The controlling factor which exposes either steel or wrought-iron pipe to corrosion by dissolved gases in hot water lines is the roll scale. If this is removed by mechanical processes, the rate of corrosion is diminished to about 20 per cent of the rate for pipe carrying the usual covering of roll scale. This means an increase of about 400 per cent in the length of service.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

TRAINED NURSES VISIT VICTIMS OF INFLUENZA

Philadelphia Electric Company Has Had Four Nurses Visiting Families of Employees Suffering from Epidemic

Probably no welfare work ever undertaken by the Philadelphia Electric Company has been so thoroughly appreciated as its action in employing trained nurses to visit employees and their families suffering from the influenza epidemic, it was stated in the weekly bulletin, the *Current News*, published by the company section of the N. E. L. A.

This work, which began on Sunday, Oct. 6, was started by Thomas Sproule, who is in charge of the overhead-line construction department of the company. He has worked unselfishly and untiringly in its behalf. Four nurses each visited for a time from fifteen to thirty families each day. The reception which they had, particularly in those families where most of the members were afflicted, was, as one nurse expresses it, "impossible to describe." In a number of instances whole families were found afflicted with no one to care for them. Through the coöperation of the company prompt assistance was furnished in every severe case. Dozens were placed in hospitals and their cases followed each day. Where cases were promptly reported and where the instructions of the visiting nurses were carried out speedy recoveries resulted.

NEW PLAN OF SERVICE-CHARGE SCHEDULES FOR POWER LOADS

Refund of Normal Cost to Be Made from Energy Used by All on the Line at Rate Determined by Line Cost and Kilowatt Demand

A new customer's charge for commercial loads in excess of 5 kw. capacity has been drawn up by the Alliance (Ohio) Gas & Power Company, effective Nov. 1. This applies in any instance where the company is required to make an expenditure (1) for the installation or construction of switching apparatus, for additional or specific switchgear, meters, instruments, panels, frames, control, cables and buses, connections and transformers, in switch houses or substations; (2) for additional or specific overhead lines, including poles or towers, with necessary and usual equipment, wire, lightning arresters, line switches, ground wires or connections, or for any work on existing poles or towers, with all the attendant equipment for increasing the distribution system or transmitting direct to the consumers' premises; (3) for any transformers installed in switch houses, substations, line houses or other structures not otherwise specified, and (4) for service on customers' premises, for the installation of poles, power lines, ducts, cables, and also where the transformer capacity to be installed exceeds 50 kw. for the transformers and switching required and for special transformers of 50 kw. rating or less.

The company contracts to supply a given amount of kilowatt line capacity to the premises in question, and this capacity the company agrees to hold and reserve for use of the applicant ten years from the commenceing of supply, subject to federal, state, county, township or municipal regulation.

How the Refund Is Worked Out

A deposit of the estimated cost of the work upon the understanding that the work shall be the property of the company is required. A refund will be made of the estimated cost of this work as of July 1, 1914 (called the normal cost), (A) on the energy used by the applicant and taken from the line constructed as specified, and (B) in addition on the energy taken and used by other consumers connected to the lines so constructed, except where the work constructed consists of feeders or an addition to the network, in the general distribution system of the company, in which event refund to the applicant will be made only on the energy used by those consumers who are connected to that part of the work specifically constructed for the applicant which extends beyond the network of the general distribution system of the company. Provision is made, however, that in no case shall the amount refunded to the applicant on the energy used by any consumer exceed the normal cost of that portion of the work constructed which is useful in serving that customer. That amount refunded to the applicant should be based upon the energy taken and used within ten years after commencement of supply, and the total amount of the refund should not exceed the normal cost of the work applied for.

Moreover, the refund will be computed at a rate per unit as determined by the following formula: Refund rate per kilowatt-hour = dollars ÷ (36,000 × contracted kilowatt demand). The sum of the money in this formula is the normal cost of the work as described. The refund will be paid by the company to the applicant annually. The kilowatt demand in this formula is the capacity contracted for and reserved to the use of the applicant by the company.

No refund or interest shall be paid unless the applicant's bills for energy have been paid in full, nor shall any annual refund payment exceed 50 per cent of the sum of the bill for the energy used within the refund period from the work of construction under the application. Besides, the company reserves the right to refund at any time all or any part of the unrefunded portion of the normal cost of the specified work. No refund or interest whatsoever will be allowed on the excess cost of the specified work, which excess is the difference between the normal cost and the amount deposited.

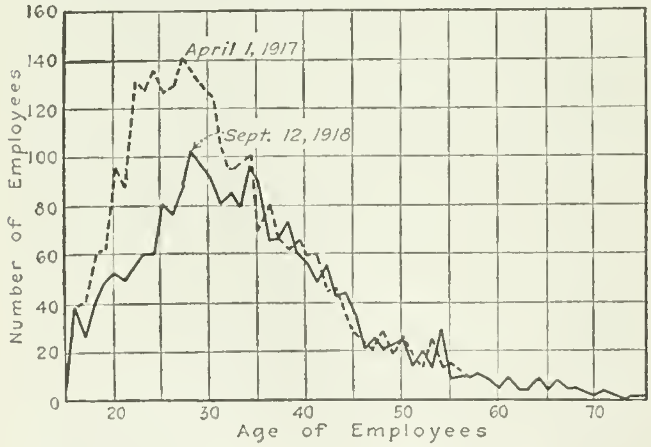
Interest not exceeding 6 per cent per annum will be paid by the company to the applicant annually upon the balance of the normal cost held at the time and subject to be refunded, and this annual rate of interest will be computed by this formula: Rate = 0.6 of 1 per cent × average hours' use per day of the contracted kilowatt demand.

The hours' use per day of the contracted kilowatt demand in this formula is to be determined by dividing the monthly average of kilowatt-hours upon which refund is allowed by thirty times the demand contracted for.

EFFECT CAUSED BY WAR ON UTILITY EMPLOYMENT

Figures for Detroit Edison Company Show an Average Annual Turnover of 125 per Cent—Average Age Increases from 31.8 to 33.6 Years

Because of the draft and voluntary enlistments, and because of higher wages offered elsewhere, electric lighting utilities are finding their labor supply in a rather fluid state at the present time. Ordinarily labor in central-station companies, particularly in large cities, is decidedly static. Figures on labor conditions with the Detroit Edison Company recently published in the company's *Bulletin* show for a period of more than two years an annual turnover in the neighborhood of 125 per cent. These figures are shown monthly in an accompanying table. The term "labor turnover" as here used designates the total number of employees leaving the company for one reason or another during a definite time divided by the average number of employees for that specified period. The percentages shown were reduced to a yearly basis by taking the monthly turnover and multiplying by 12.



HOW SIXTEEN MONTHS OF WAR AFFECTED THE RELATIVE NUMBERS AND AGES OF EMPLOYEES

The average annual turnover is in the neighborhood of 125 per cent and takes place mainly in the construction department. Spring and fall appear to be the seasons when labor turnover is greatest. In the spring higher wages entice more men away, while in the fall a certain amount of construction is stopped and many names are dropped from the roll. The increase that took place in 1917 was due principally to two causes, the reduction in the construction force brought about by certain war conditions and the call of many of the young men into military service.

Already some 627 young men from this company have entered government service, and the accompanying curve is interesting as showing the effect of this and other losses of employees on the average age of employees. It will be noticed from the curve that very little change in the number of employees over thirty-three occurred. It is also brought out that while the average age of all employees a year ago was 31.8 years, to-day the average age is 33.6 years.

It is also interesting to note that women are taking a steadily increasing share of the work since the country entered the war, particularly in the customers' accounts, collection and payroll departments. Eighteen months ago the proportion of women in the company's service was about 10 per cent. To-day it is nearly 15 per cent of the total number employed.

FEDERAL NITRATE PLANT POWER-CONTRACT FEATURES

Government to Finance New Generating Unit Required by 30,000-Kw. to 40,000-Kw. Load and to Build and Retain Transmission Line

The Union Gas & Electric Company, Cincinnati, Ohio, has recently contracted with the United States to supply power to the nitrate plant at Cincinnati. The main features of the contract are as follows:

1. The Union company is to furnish electrical energy for the operation of the plant for a demand of not less than 30,000 kw. or more than 40,000 kw., the charge for which is to be computed on a combined demand and energy basis.

2. The contract is for a term of five years beginning not later than July 1, 1919, but the guaranteed minimum demand of 30,000 kw. may be reduced if the interests of the United States so require upon three months' notice after one year's full operation—not earlier, however, than Oct. 1, 1920.

3. The power factor guaranteed by the United States is to be not less than 85 per cent at the power house. The load factor is estimated at 90 per cent or better, and the estimated consumption of energy for the five-year period is 1,750,000,000 kw.-hr.

4. A third unit of 30,000 kw. rating, with all auxiliaries, is to be added to the present equipment of 60,000 kw. in the company's new power house. The cost of this installation will be paid by the United States and will be taken over by the power company three years after the termination of the war.

5. A 66,000-volt double transmission line, carrying four three-phase circuits, will be constructed at the cost of the United States from the company's power house to the site of the nitrate plant, a distance of approximately 15 miles, with a step-up transformer station near the power plant and a step-down transformer station at the nitrate plant. The transmission line and substations are to remain the property of the United States, thereby insuring an exclusive and permanent transmission line conveying energy from the power house to the nitrate plant.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Power Factor in the Resonance Transformer Circuit. —P. BAILLIE.—The assumption that all the inductance of the circuit is external to the transformer is not quite correct. A small part of this inductance equivalent to leakage is between the points where the voltmeter is connected. The measured effective voltage is therefore a little smaller than the calculated voltage. Nevertheless, this assumption gives a means of quickly estimating, within a few per cent, the power supplied to the condenser of a transmitting plant when no wattmeter is available.—*Wireless World*, October, 1918.

Generation, Transmission and Distribution

Synchronizing of Alternators.—E. STYFF.—In this article the author compares three methods of synchronizing, namely. the bright-lamp method, for which he recommends the use of carbon lamps; the dark-lamp method, for which tungsten lamps are more suitable, and a mixed scheme of synchronizing, making use of a voltmeter and bright lamps. The last-named method the author regards as the most satisfactory.—London *Electrician*, Aug. 2, 1918.

Maxima of Overpressure in Water-Hammer Phenomena.—MAURICE GARIEL.—In this first article of a series that will constitute an elaborate investigation into the phenomena of water hammer, so important in hydroelectric construction, the author inquires into the maximum of overpressure to fear at the base of the conduit when the supply to the turbine is cut off and gives formulas to apply in this case. In his subsequent investigation he will develop analogous considerations applying to water hammer along the length of the conduit, and finally he will comment on the latest studies of de Sparre into the laws of hydro installation, which should lead to the construction of regulators insuring a minimum degree of water hammer.—*Revue Générale de l'Electricité*, Sept. 21, 1918.

Electric Surges in Transformer Coils.—W. ROGOWSKI.—The mathematical calculation of the voltage rise in coils caused by surges entering them from a transmission line is one of considerable difficulty. In the present article the author considers the somewhat simple case of a coil consisting of two turns. He promises that at a later date he will extend the theory to a coil of three turns, for which case the mathematics becomes very much more complicated. The danger to the coil appears to depend greatly on the length of the transmission line connected to the coil, and the most distant point of the coil is exposed to the greatest stresses. If the line is short the rise of voltage is independent of the distance between the turns of the coil, whereas if the line is long the voltage increases greatly with the length of the line. With short lines the oscillations are damped by the resistance of the coil alone, but with long lines the line also has a damping action. The maximum voltage across the turns does not exceed the impressed voltage with a short line, but may reach twice the impressed voltage with a long line. With a short line it does not matter much whether the line is a cable or an overhead wire, but with a long line a coil might be endangered if the line is a cable, while no danger would exist if the line were an overhead one.. It may therefore be dangerous in some cases to replace overhead lines by cables. In a few words referring to the coil with many turns it is indicated that the danger point in a coil of one layer lies near the middle in the case of a flat coil and near the ends in the case of a long coil.—*Science Abstracts, Section B*, Aug. 31, 1918. (Abs. from *Archiv. f. Elektrot.*, 6. 1918.)

Calculation of Single-Phase and Three-Phase Lines.—J. R. DICK.—In this, the first paper of the series, diagrams are included from which line regulation may be determined, and from these the commonly known trigonometric functions, useful in calculating line regulation, are derived. —London *Electrician*, Sept. 20, 1918.

More Energy for Mansfield District.—A description of the new Melco plant, 13 miles southeast of Mansfield, Ohio, is given. In this plant both natural gas and coal are utilized. The location also insures continuous and abundant supply of water and fuel.—*Power Plant Engineering*, Sept. 15, 1918.

Using Exhaust Steam.—S. E. BALCOME.—In this article the value of exhaust steam, limitations of its use, effects of engine efficiency and heat available with various types of engines are considered.—*Power Plant Engineering*, Oct. 15, 1918.

Traction

Rapid Braking in Electric Railway Operation.—J. CARLIER.—Many railway companies, the author thinks, have been deterred from installing the quickest brakes because of the initial expense. He brings forward figures from American sources to show that the interest and amortisement attending such expense is much more than compensated by the increased receipts.—*Revue Générale de l'Electricité*, Sept. 7, 1918.

Installations, Systems and Appliances

Drum Shape as Affecting the Mine-Hoist Duty Cycle and Motor Rating.—F. L. STONE.—The standardization of mine hoists from an engineering standpoint is considered impossible on account of the wide variation in the conditions and methods under which anthracite coal is mined. The problem of drum shape consists in varying the diameter of different parts of the winding drum so that the load may be accelerated and retarded at the beginning and end of its travel with the minimum consumption of power. Numerical examples of the performance of drum shapes under assumed conditions are given.—*Proceedings A. I. E. E.*, October, 1918.

Preparation in the Electric Furnace of Some Metals Useful in Industry.—JEAN ESCARD.—A discussion of the application of the electric furnace in the production of alkaline and earthy metals, such as barium and calcium, which have come into industrial use, and also of chromic metals, those formerly called secondary or special, which now play an important part in the metallurgy of iron and steel. Cobalt, nickel, manganese, molybdenum and tungsten are among the metals whose treatment in the electric furnace is described.—*Revue Générale de l'Electricité*, Sept. 14, 1918.

Use of Electric Power in Mining of Anthracite Coal.—J. B. CRANE.—This paper gives figures as to the power cost and energy consumption of anthracite mines and the reasons for these being in excess of the requirements of bituminous mines. Estimates are also given as to the additional coal that will be released by the electrification of the anthracite mines. Illustrations are included showing representative installations of electric drive.—*Proceedings A. I. E. E.*, October, 1918.

New Type of Mine Locomotive Controller.—L. W. WEBB.—The type of mine locomotive controller described in this article was developed for service on large mine locomotives where the capacity of hand-operated drum controllers would be exceeded. The matter of space precludes the use of type M control with magnetically operated contactors on any but the largest mine locomotives. The pneumatic hand-operated control for electric power equipments offers compactness, but as compressed air is not available on most mine locomotives the cam feature was adopted and the cam shaft arranged for manual operation. Diagrams are included showing the connections of the two, three and four-motor controllers. This type of controller has proved so successful in operation that it is proposed to build it with seven cam units for use on 50-ton, 600-volt switching locomotives.—*General Electric Review*, September, 1918.

Electricity's Part in Building and Navigating Ships.—H. A HORNOR.—A continuation from the July issue giving a general discussion of types of drive and a comparison between three typical methods as follows: (1) A 3000-hp. geared turbine with steam auxiliaries; (2) a 3000-hp. geared turbine with two 100-kw. turbines for electric auxiliaries; (3) one 3000-kw. electric generator turbine-driven, one 3000-hp., 150-r.p.m. motor with controller and rheostat, one 100-kw. turbine-generator for auxiliaries, two 35-kw. turbine-generator exciting units, and three 75-kva. transformers to operate the electric auxiliaries from the main generators. A cost analysis is given for these three cases, together with the advantages of electric drive.—*Electrical Engineering*, August, 1918.

Electrification of a Durham Colliery.—In the first of a series of articles on this subject the control of hoisting apparatus is taken up. Conditions promoting protection of operators are described, and the emergency protection of the electrical apparatus is covered in some detail.—London *Engineer*, Aug. 16, 1918.

Interesting Alternating-Current Rectifier.—A rectifier of the vibrating-contact type is described in this article. The usefulness of this simple type of rectifier is shown for the charging of accumulators.—*Wireless World*, August, 1918.

Wires, Wiring and Conduits

Standards for Municipal Electrical Departments; Fire-Alarm Telegraph.—Specifications for underground cable giving physical tests of conductors, rubber insulation and lead sheath are given in this article. Electrical tests and methods of manufacture for fire-alarm telegraph systems are outlined, and office location, type of battery to be used and switchboard equipment are also taken up in the report.—Report to convention of Municipal Electricians at Atlanta, Ga., September, 1918.

Electrophysics and Magnetism

Mechanical Analogies to Inductively Coupled Electric Circuits.—H. M. BROWNING.—In the first article of this series the method of using interacting pendulums to demonstrate the action of oscillations in electric circuits is described. In this article the results of the theory are set forth and it will be found how closely they agree with experiment.—*Wireless World*, August, 1918.

Oscillating Energy.—G. SZARVADY.—A study of the application of Ohm's law and of the rules of Kirchhoff to the "watted" and "wattless" components of any periodic currents.—*Revue Générale de l'Electricité*, Sept. 21, 1918.

The Fourier Theorem and Developments in Trigonometric Series.—G. A. ANDRAULT.—The author, holding that the proposition of Fourier by which any periodic function may always be expressed analytically by a trigonometric series is hardly self-evident, has evolved a new method of synthetic demonstration which not only leads to the demonstration and even to the generalization of the Fourier theorem but also to theories and observations relating to an approximate representation independently of coefficients, etc. The latter possess in the new method a physical signification suggesting a practical method for their interpretation.—*Revue Générale de l'Electricité*, Sept. 7, 1918.

A Galvanic Interrupter.—W. KASPEROWICZ.—A galvanic interrupter is described in which mercury is used as the conducting fluid medium, in place of the usual electrolytic fluid. A simple arrangement consists of two insulating vessels (made of porcelain, quartz or glass), one of which slides easily in the other, and both filled with Hg. A small opening in the inner vessel allows contact, by means of a thin Hg thread, between the two Hg masses. A single vessel divided into two parts by insulating partition will answer the same purpose. A glass or quartz U-tube, the bore at the bend of which is made very small, when filled with Hg is found particularly suitable for demonstration purposes. When such an interrupter is placed in circuit with a direct or alternating current the Hg thread is vaporized when the current is of suitable strength, and a small arc is formed, the current being thus lowered considerably or even broken. Hg vapor condenses very quickly, the thread reforms, and the current is again short-circuited. The process then commences once more. The current strength required depends upon the thickness and length of the Hg thread as well as upon its form; further, the rate of loss of heat is an important factor. A mercury thread 1 mm. in diameter and several millimeters in length will, with suitable loss of heat, act as interrupter for a current of about 200 amp It is possible also to construct a galvanic interrupter on the Wehnelt principle.—*Science Abstracts, Section A*, Aug. 1918. (Abstracted from *Phys. Zeit.*, 19, May 1, 1918.)

Electrochemistry and Batteries

Storage Batteries.—O. W. A. OETTING.—In tracing the development of storage batteries during the last four or five years the writer deals particularly with the application of these batteries to isolated lighting plants, to automobile systems of ignition, lighting and starting, and to some other applications having to do with the prosecution of the war. He states that the use of 32-volt batteries on farm-lighting systems has placed within the reach of rural communities most of the advantages commonly associated with electric service in the city. He says that the 32-volt system has become standardized owing to the short distance of distribution in isolated plants and also on account of the advantage incident to a short filament in lamps. The author states that there are some advantages in automobile ignition by battery compared with magneto ignition in that with low cranking speeds in winter time the magneto may not furnish a hot enough spark. For starting service the principal progress has been in making batteries for extremely high discharge rates. The development of storage batteries for war purposes has been principally directed to the batteries used on the Liberty trucks and also on the Liberty aviation engines. The battery for truck service was tested on a vibrating platform and the battery was required to stand up on this shaking platform for at least a million bumps in a test of about thirty hours' duration. The aviation battery is a small storage battery used for the ignition of the new aviation engine. Necessarily, this battery had to be made non-spillable, so that during the various maneuvers of the aëroplane the electrolyte was not spilled from the battery.—*Transactions Cleveland Engineering Society*, September, 1918.

Telegraphy, Telephony and Signals

Telephone Exchange Transfers and Their Organization.—F. G. C. BALDWIN.—The subject is treated under the following subdivisions: Line plant considerations; methods of effecting transfers; preparatory work on line, at subscribers' stations, at old exchange and at new exchange; final preparations; the transfer operation; traffic and operating considerations; post-transfer work, and organization.—*Journal Institution of Electrical Engineers* (British), June, 1918.

On Valve Characteristic Curves.—The characteristic current-voltage curves for vacuum valves used in radiotelegraphy are taken up in this series. In the first article the effect of the voltage of the grid on the current-voltage characteristic is particularly dealt with. *Wireless World*, September, 1918.

Physics for Wireless Students.—This series of articles has for its aim the preparation of students of wireless in the necessary groundwork of physics. In the sixth number of the series the general subjects of energy, resistance, inertia and elasticity are dealt with. It is an attempt to show the analogy between mechanical and electrical systems.—*Wireless World*, September, 1918.

Propagation of Electric Currents in an Antenna.—H. CHIREIX.—The problem of the propagation of electric currents in an antenna has not usually been treated except in the case of homogeneous antennas and for the wave length corresponding to the resonance of the system. The author takes up the case of non-homogeneous antennas and develops extended formulas in the complex instance of three antennas having different characteristics. Finally, he attempts to establish formulas in cases where self-inductance and capacity per unit of length cannot be considered as constants but vary continually according to a law determined in advance.—*Revue Générale de l'Electricité*, Sept. 14, 1918.

Miscellaneous

Use of Hydrogen-Volatile-Matter Ratio in Obtaining Net Heating Value of American Coals.—A. C. FIELDNER and W. A. SELVIG.—It is pointed out in this article that net heating value is more important and thorough than total heat of combustion in consideration of different kinds of fuel. For instance, a comparison of coke and petroleum on the basis of total heats of consumption would be unfair to the coke, since practically all of its heat is available whereas 6.4 per cent of the total heat of petroleum remains in uncondensed water vapor. By the use of curves constructed from 2000 analyses the hydrogen content of bituminous coal, semi-bituminous coal and anthracite may be estimated from the volatile matter to within 0.6 per cent. For sub-bituminous coal and lignite the limits of deviation should be extended to 0.8 per cent, and if the coals are weathered the error may approach 1 per cent. The corresponding errors produced in the reduction of "total" to "net" heat of combustion are shown herewith, the values obtained being the errors in net heat of combustion due to the errors in computed hydrogen: For 0.6 per cent error in hydrogen, 56 B.t.u.; for 0.8 per cent error in hydrogen, 75 B.t.u., and for 1.0 per cent error, 94 B.t.u. In most coals the error in the net heat of combustion calculated in the above manner will not exceed 0.5 per cent, which is no larger than the errors incurred in sampling coal.—*Technical Paper No. 197*, Bureau of Mines.

Graphical Methods for Resistances in Parallel.—W. T. MACCALL.—The best known method for determining the combined or joint resistance of two resistors connected in parallel is shown in a simple diagram. Then follows the discussion of the case of three or more resistances in parallel which can be dealt with by successive applications of the method referred to. The joint resistance of two is obtained. This is then combined with the third resistance in the same manner, and so on.—London *Electrical Review*, Sept. 6, 1918.

Electrical Industry in Russia.—ALLAN MONKHOUSE.—In this article the writer shows what companies supply the heavy machinery, motors, etc., to the industries in Russia. The point is particularly to show what hold the German corporations had on this business at the beginning of the war and also to indicate the present status. The author also takes up the manufacture of cable, electrical instruments, telegraph and telephone instruments, insulating material, etc., with especial reference to foreign control of such manufacturing.—*Electrical Review*, Sept. 20, 1918.

Water-Power Legislation.—In this article is given a brief description of the laws governing the ownership of water-power sites for Italy, Austria and Switzerland. —*Electrical Industries*, Sept. 25, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

WAR INDUSTRIES BOARD MAY BE RECONSTRUCTION AGENCY

This Will Be a Probable Outcome if the Overman Bill Is Passed by Congress—Attitude of the Republicans

BY WINGROVE BATHON
Washington Representative "Electrical World"

In connection with the possibility of a reconstruction and readjustment agency being created by act of Congress, opinion is crystallizing in Washington along the line that the members of the War Industries Board will most likely be appointed to this work in case the Overman bill, which is an administration measure and which provides for a commission of five members to be appointed by the President, is passed by the present Congress. There is every expectation that this bill will be passed, and the likelihood of its passage has been added to by the defeat for reëlection to the Senate of Senator Weeks, who proposed a reconstruction measure which would have created a reconstruction agency composed of members of Congress.

President Wilson's Probable Course

In Washington it is now believed that if the Overman bill is passed President Wilson is likely to name as members of the reconstruction commission men like Bernard M. Baruch, chairman of the War Industries Board, and some of his principal associates. It is pointed out in Washington that while Senator Weeks has been defeated his idea of a legislative reconstruction agency has not necessarily died. In other words, it is expected that during the life of the present Congress Senator Weeks' idea will be pushed. But it is also pointed out in Washington that there is every likelihood that if a congressional reconstruction agency were created, even admitting that the consent of President Wilson to do so could be obtained, the new Congress which takes office March 4 next would likely legislate out of existence, possibly by failing to appropriate moneys, the creature of the present Democratic Congress. All the present signs in Washington, however, tend to show that the Overman bill will be passed and that the machinery of the War Industries Board will be turned into after-the-war work behind the commission to be appointed under the Overman bill, under the probable leadership of Mr. Baruch as chairman of the new commission.

It is pointed out in Washington that the present agencies of the War Industries Board are in possession of complete data and information concerning the industrial, commercial, financial and transportation resources of the country. For this reason there are many who believe that the War Industries Board is the only agency equipped with machinery and supplied with the necessary information to give suitable guidance to business for after-the-war work.

Effect of the Elections

There is no means of ascertaining or predicting what effect the elections of Nov. 5 will have upon business and the necessary reconstruction period to follow the war. It must be borne in mind that a great number of Republicans newly elected to the Senate and the House will not take office until March 4, 1919, when a new Congress will come into existence. There has been much newspaper comment to the effect that if the Republicans gained control of the House and the Senate there would in all likelihood be an extra session of the new Congress early next year at which members elected Nov. 5 would take their seats. The writer sees very little prospect of that, because it is extremely unlikely that a Democratic president would call an extra session of a Republican Congress together to deal with business matters such as will be involved in the reconstruction period, and it is almost certain that the present Democratic Congress, in view of the foreign situation, will hold on and remain at work in Washington until the very last minute before March 4.

Because of the prospect of peace, members of the War Industries Board, more particularly committees of that board, are announcing in Washington their intention of preparing to return home and get ready for the reconstruction period which they must face in their own businesses. In some respects this attitude, while natural, is greatly to be regretted, according to the best opinion obtainable in Washington, because of the growing belief that the War Industries Board, which has done so much to guide business during the war, is so well fitted to continue to guide business during the reconstruction period.

SAVING OF FUEL BY THE INDUSTRIAL PLANTS

Standard Recommendations of the United States Fuel Administration Lead to Large Economies in Coal Consbmption

Through the coöperation of the industrial power plants which have thus far put into force the standard recommendations of the United States Fuel Administration to promote efficiency in the use of fuel in power plants, a saving of 7,000,000 tons annually has been effected. That is to say, in the first six months from the announcement of the national program 3,500,000 tons have been conserved, at the same time maintaining maximum production in the factories. The largest savings have been in Massachusetts, Pennsylvania, Connecticut, Illinois, New York, Missouri, Michigan, Minnesota and Wisconsin.

The Time Has Now Come to Give

That the light may shine afar off. This big sign is illuminated at night and throws its welcome message of good cheer far into the gloom.

CONSTITUTION AMENDED BY THE JOVIAN ORDER

Annual Convention in Dallas Places Entire Control in Hands of Elective Committee—L. O. Ripley, Wichita, Kansas, Elected Jupiter

Adoption of an amended constitution for the Jovian Order was the most important business before the order's sixteenth annual convention at Dallas, Tex., Oct. 24 and 25. About 150 delegates were in attendance.

The amended constitution carries forward the constitution as amended in 1916, with the amendments included that were adopted in 1917 and with further amendments creating what is termed Jupiter's cabinet. This cabinet is composed of six members elected from among the members of the order who are executives in corporations that have become, by reason of their own voluntary action, underwriting members of local Jovian leagues. This cabinet will fill the place of a financial committee, executive committee and board of directors combined. Three members will be elected each year, after the machinery is in motion, thereby leaving three hold-overs each year. The budget covering the expense of running the central office and other expenses properly pertaining to the order will be approved by the cabinet.

The amended constitution further provides for a different schedule of dues, permitting the younger members who draw smaller salaries to pay dues of $2 per year. It also provides that such members as are eligible to Jupiter's cabinet must pay $20 per year.

The following officers were elected for the ensuing year:

Jupiter—L. O. Ripley, Wichita, Kan.

Mercury—Ell C. Bennett, St. Louis, Mo.

Jupiter's Cabinet—H. J. Pettingill, St. Louis; W. B. Head, Dallas; Martin J. Insull, Chicago; Henry L. Doherty, New York; Henry Harris, Pittsburgh, and J. F. Porter, Kansas City, Mo.

Congress.—First district, Hartwell Jalonick, Neptune, Dallas, Tex.; second district, Charles B. Burley, Mars, Boston; third district, George W. Fells, Vulcan, New York; fourth district, H. E. Shelton, Pluto, Wilmington, Del.; fifth district, E. B. Zimmerman, Triton, Cleveland; sixth district, T. W. Moore, Avrenim, Atlanta; seventh district, Guy E. Seyler, Apollo, Richmond, Va.; eighth district, Galen Crow, Hercules, Guthrie, Okla.; ninth district, Fred Johnson, Ajax, St. Louis; tenth district, Carl Goland, Argus, Milwaukee; eleventh district, William T. Wallace, Amphion, Boise, Idaho; twelfth district, T. B. Burneigh, Atlas, Denver, Col.; thirteenth district, J. N. Colkitt, Comus, Los Angeles; fourteenth district, George C. Ruff, Chiron, St. Catharines, Canada; fifteenth district, H. W. Billings, Cadmus, Winnipeg, Canada.

In selecting Mr. Ripley as Jupiter the delegates felt that the office was being given to a man who had shown deep interest in Jovianism and who resided in a section of the country where the keenest interest in the order centered. Mr. Ripley has been unusually active in Jovian work ever since he went to Kansas in 1909. He has occupied various offices in the order, including the position of Ajax in the sixteenth congress. He has an unusually large circle of acquaintances in the Southwest. Mr. Ripley was graduated from Union College, Schenectady, N. Y., in 1900. He spent the next three years doing construction and storage-battery work throughout the East. In 1903 he was employed as superintendent of light and power by the Schenectady Railway Company. In 1906, when the illuminating and railway company were separated, Mr. Ripley became general manager of the illuminating company, which position he held until 1909, when he removed to Wichita, Kan., to become general manager of the Kansas Gas & Electric Company. He was soon ofterward made vice-president of that concern, which position he still holds. Mr. Ripley is an active member of the National Electric Light Association.

JUPITER-ELECT RIPLEY

OUTLOOK FOR FOREIGN TRADE AFTER THE WAR

E. M. Herr, M. A. Oudin and W. W. Nichols Speak Before American Manufacturers' Export Association on the New Problems

Several addresses presenting the viewpoint of electrical manufacturers were made before the convention of the American Manufacturers' Export Association at the Hotel Waldorf-Astoria, New York, on Oct. 30 and 31.

E. M. Herr on Ships After the War

E. M. Herr, president Westinghouse Electric & Manufacturing Company, made an address on "Our Ships After the War. The Manufacturer's Viewpoint."

Having an adequate fleet under our flag and laying aside for the moment the fact that this fleet is owned by the government, Mr. Herr asked, what other things are essential to the full development of our foreign trade?

First—This great fleet must be adequately manned. During the war these vessels will be entirely used by the United States government and therefore will form a part of the United States Navy and Army transport service. As such they will be manned by our young enlisted men who will thus be trained as sailors in much greater numbers than would otherwise be possible, and while many will return to other vocations at the termination of the war, a large number will still be available for the manning of these ships in export trade. Many of the sailors of other nations whose marine trade has to a greater or less extent been injured by the ravages of the great war will also be available, so that it would seem reasonable to expect no very great difficulty in manning our new merchant fleet.

Second—Will money be available adequately to finance this expansion of overseas transportation on which we are now embarking? There is no doubt that the ending of the war will not only leave the United States the greatest creditor nation on earth but also the nation with the greatest command of financial resources. It should, therefore, be entirely possible, and perhaps comparatively easy, to arrange the financial resources necessary for the conduct of this great business.

As government ownership of transportation facilities has never brought cheap rates and efficient service and in Mr. Herr's judgment never will—especially under a republican form of government, or in fact any form of government now to be considered, the speaker took up the question of the need of modifying present shipping laws to assure successful results under private ownership.

"This means the repeal of the LaFollette seaman's act and the enactment of such new legislation as the necessities of our competition may require," he said. "Let us endeavor to shape this legislation so that while fair, even liberal, to American labor, it will place no embargo on the employment of such foreign labor as may be necessary on our ships to enable them to be successfully operated.

"Let us remember that perhaps the greater problem in economics is distribution. Our ships, docks and the terminal facilities of our railroads are among the most important factors in this great problem of distribution. These must be coördinated and developed in the American way. We have all the problems in connection with labor, industry and finance which other nations have, but none of these problems is more serious for us than for others, while in many respects we are much more favored than any nation. If we pursue our course in the true American way, utilizing to the limit our demonstrated ability in organization and the scientific development of improved efficiency, we can confidently look forward to an area of progress and development in the United States such as the world has never seen."

Mr. Oudin on Foreign Trade Service

"If we are to maintain our present economic position, an export trade is indispensable," said M. A. Oudin, foreign manager General Electric Company, in his address on "Foreign Trade Service in the Present Emergency; An Essential Service."

Mr. Oudin's paper pointed out "that service abroad in the interest of American commerce is essential to our national prosperity and security; that it combines patriotism with the spirit of adventure, and finally that such service is surpassed in usefulness and dignity by no other service, to which the very best type of our citizens can devote themselves, and in consequence educational preparation for it is fundamental."

After discussing the necessity of training men to be business diplomats in the widest sense, as well as salesmen, Mr. Oudn discussed international conditions, saying in part:

"With the return of peace, we shall cease to be only merchandisers in the foreign trade. We shall be investors in foreign enterprises and purchasers of the obligations of foreign countries, thereby becoming associated as partners with the business men of other countries. When post-war experience has shown, as it will, that the high cost of production in America has put us at a serious disadvantage in a free market, we shall realize the chief benefit of foreign investments.

"Our commerce will continue to meet with unprecedented competition, but economically we shall probably attempt a harmony of effort with all the countries, large and small. If we are to attempt a league of nations, unless there be an economic understanding of equal extent and effect, one may well inquire as to the advantage of such a political arrangement. I do not believe that the smaller nations, which are numerically greater than the others, will be satisfied to surrender any of their present measure of political liberty unless the legitimate development of their economic life be guaranteed.

"An international millennium will by no means immediately follow upon peace. Yet we may in a way visualize the future. There will be a Europe with its three hundred millions of people, reasonably assured for many years of the free development of their national life. We see a Latin-America progressing under the stimulus of an ever-widening trade and the coöperative development of its natural resources. With increasing material prosperity and political importance and as members of some kind of an international association, their need and our need of a Monroe Doctrine grows distinctly less, if indeed that political policy does not tend to become obsolete. We see English colonies united more firmly than ever to the home country by a spiritual solidarity, even extending to India, which, paradoxical as it may seem, becomes with a larger measure of self-government a closer member of the democratic and greater British union. We see a united China, free from the bugaboo of spheres of influence and the incubus of bad treaties forced upon her and of debts against which her resources have been pledged, a powerful and therefore self-respecting China, leaning and relying upon the friendship of her great sister republic and no longer subject to the 'purpose and interest' of other nations.

"In this new world after the war coöperative international relations will take on increasing importance, while exclusive economic policies will become unpopular. World politics by which the stronger nations profit will play a part of gradually decreasing importance."

W. W. Nichols on Education and International Good Will

W. W. Nichols of the Allis-Chalmers Manufacturing Company, who presided as chairman of the "Education for Foreign Trade Service" session, called attention to the importance of education of two kinds: "The education of public opinion comes first and foremost," he said, "because public opinion will shape all federal legislation to make or break our enterprise; and second, the peculiar education of the individual whose life work will be foreign trade."

Mr. Nichols, speaking of the need of the world for international good will, said in part:

"While we are contributing freely of the prime resources of our national strength,—the lives of our strongest and the great wealth of our nation—for the complete victory of right over might, a peace assured by good will and the right to live our own best lives, at the same time we solemnly prophesy with the coming of this glorious peace the beginning of a commercial rivalry beyond precedent, a fierce competition the mere contemplation of which makes us miserable because it stirs in us the same base desire for conquest found in the German Kultur we condemn so unequivocally.

"I submit that, if we support the trend of present events, we can not admit for a single minute the glaring inconsistency embodied in the ever recurring phrase 'trade war after this war.'

"Look at it! We are fighting strenuously to save a political democracy in order that, when established in connection with a league of nations it will forever prevent a recurrence of the war now raging. By the same token why can we not recognize in commerce a similar democracy to the same effect? Democracy in commerce would prompt us to recognize the rights of our foreign competitors and to seek the welfare of those with whom we trade in order that we may continue to share in a welfare to which we contribute; mutual good will inevitably follows and where good will exists war is impossible. It prescribes the continual exercise of what has been called the Golden Rule of business.

"I would not ignore the many foreign trade measures already in the making in Europe. I would meet organization there by organization here, and hope for the same governmental support. We must act and act soon or our position in foreign trade will suffer great handicaps and possible irreparable injury. We must and should meet foreign competition—for truly here also competition is the life of trade—but it should be the right kind of competition to set an example to the rest of the world—constructive, not the destructive variety too long prevalent with us to the amazement and probable amusement of foreign business opinion.

"Under present circumstances the United States takes a foremost place and therein assumes an enormous responsibility in shaping coming events. Its leading position as a creditor nation of well-nigh unlimited resources, of genius, of enterprise and of an indefatigable ability in filling the position given us in a happy alliance which stirs our best emotions, can continue after this war if we accept the leadership in readjustment which will logically fall to us. In other words, we shall furnish the example in the prosecution of international trade. Let us rise to the occasion, meet bravely the heavy responsibilities which will be ours in spite of all we can do, instead of fighting for the false German monopoly, become an active factor in establishing an international good will that shall include all who do not deliberately forfeit their right to it."

W. S. GIFFORD RESIGNS FROM NATIONAL DEFENSE COUNCIL

Director of the Government Organization Retires and Is Appointed Comptroller of the American Telephone & Telegraph Company

Walter S. Gifford, until recently director of the Council of National Defense, has been appointed comptroller of the American Telephone & Telegraph Company and has entered upon his new duties. Mr. Gifford was formerly chief statistician of the American Telephone & Telegraph Company and was loaned by that company at the request of Secretary of War Baker to assist in the organization of the Council of National Defense Previously he was supervising director of the committee on industrial preparedness of the Naval Consulting Board.

In accepting Mr. Gifford's resignation as director of the Council, Secretary Baker wrote as follows:

> The Council of National Defense has charged me with the expression of its deep appreciation of the services which you have rendered as director and to express its regret at your separation from the public service and from the work of the council. Your letter submitting your resignation very generously leaves the council to determine whether the exigencies of the public business justify its acceptance. We have therefore weighed the matter and feel that we would not be justified in asking Mr. Vail and the telephone company further to extend your leave of absence in view of the circumstances recited by your letter, and also in view of the fact that much of the constructive work which the council was called upon to undertake in the preparation of the country for war activities has now been performed and committed to regularly organized parts of established agencies of the government for future performance. We therefore reluctantly accept the resignation.
>
> The termination of your activity as director of the council gives me an opportunity to express the grateful appreciation of the council for the energy, loyalty and success with which you have acted as the executive officer since the formation of the council. The work intrusted to us and to you was difficult, urgent and of great importance; to its successful performance you have contributed at every point, and it will always be a satisfaction to you to know that the members of the council feel that the conversion of America from a country at peace to a country prepared for war and waging war successfully was the work in which you had borne a helpful and considerable part.

PRIORITY RULES FOR POWER DISTRIBUTION

Regulations of Priorities Division of War Industries Board Governing Distributions of Electrical Energy by Preferential Classes

Rules and regulations governing the distribution of electric energy by light and power companies are contained in Circular No. 45 of the Priorities Division of the War Industries Board. The complete text of this circular, which was signed by Judge Edwin B. Parker, Priorities Commission, under date of Oct. 7, follows:

Under date of Sept. 3, 1918, there was published by the Priorities Division of the War Industries Board Circular No. 20, known as Preference List No. 2, which furnishes a guide to all governmental agencies and all others interested in (1) the production and supply of fuel and electric energy, (2) the supply of labor, and (3) the supply of transportation service by rail, water, pipe lines or otherwise, in so far as such service contributes to production of finished products.

Where the supply of electric energy is equal to the demand, there is obviously no occasion for use of the preference list; but where the demand exceeds the available supply, owing to lack of generating capacity or any other cause, then the producers and distributors of electric energy are directed to use the said preference list as a basis for distribution.

Whenever an individual plant has a preference classification differing from that of the industry to which it belongs, the individual plant classification shall govern.

Consumers having 100 hp. connected load or less will, save in extreme cases, be treated as in Class I, irrespective of their preference list classification. It has been determined that, speaking generally, the saving of electric energy through a curtailment of these small consumers would not justify the loss, damage, inconvenience and industrial disturbance that would follow. Where, however, it becomes absolutely necessary to do so in order to supply important Class I plants, even such small consumers should be curtailed.

Industries and plants grouped under Class I are only such as are of exceptional importance in connection with the prosecution of the war. Their requirements must be fully satisfied in preference to those of the three remaining classes.

The requirements of industries and plants grouped under Class II, Class III, and Class IV shall have precedence over those not appearing on the preference list.

If, however, after satisfying the requirements of Class I the requirements of the industries and plants grouped in the remaining three classes can not be fully satisfied, then they shall be rationed, giving to each class a per cent of its requirements in the ratio of 5, 3 and 2, which represents the relative value or importance of each class as fixed and determined by the Priorities Board.

A simple illustration of the application of this "method of weighted needs" as applied to the distribution of electric energy may tend to clarify this rule, under which there should be applied as nearly as practicable the formula following:

(a) The aggregate kilowatt demands of each of the four classes of all industries and plants shall be approximately ascertained.

(b) The available supply of electric energy shall be ascertained.

(c) Should the available supply equal the requirements or demands, then the requirements of all industries and plants on the Preference List shall be fully satisfied.

(d) But should the requirements or demands exceed the available supply of electric energy, then there shall be deducted from such supply the requirements of Class I, 100 per cent of which must be delivered, and the remainder shall be prorated between Classes II, III and IV, giving to each a per cent of its requirements in the ratio of 5, 3 and 2.

Assume that the available supply of electric energy in a particular city or district is 100,000 kw. while the requirements are as follows:

	Kw.
Class I requirements (including customers having 100 hp. connected load or less)	20,000
Class II requirements	40,000
Class III requirements	50,000
Class IV requirements	60,000
Total requirements	170,000
Available supply	100,000
Supply Class I in full	20,000
Balance for distribution between Classes II, III and IV	80,000

After having allotted Class I its full service, obtain the amounts of power to be served to the other classes as follows: Multiply the requirements of Classes II, III and IV by their priority ratio of 5, 3 and 2 respectively to obtain the "relative figures" as shown in the example following. The total available power for Classes II, III and IV (80,000 kw.) is then divided by the total of their "relative figures" (470,000 kw.), giving in the example a decimal of 0.17021. If the "relative figure" for any class is multiplied by this decimal, the result will be the power allotted to that class.

Class	Requirements, Kw.	Multiplied by Priority Ratio	Equals Relative Figure	Multiplied by Decimal	Equals Power Alotted, Kw.	Proportion of Requirements Served	Ratio of Service, per Cent.
II	40,000	5	200,000	0.17021	34,042	85.10	5
III	50,000	3	150,000	0.17021	25,532	51.06	3
IV	60,000	2	120,000	0.17021	20,426	34.04	2
Total	..		470,000	....	80,000	.....	...

Note—80,000 ÷ 470,000 ÷ 0.17021.

Under this formula it will be seen that the power allotted to each of Classes II, III and IV will always fill a proportion of the demands of the classes in the ratio of 5, 3 and 2.

It will, however, sometimes happen when Class 2 or 3, or both, have extremely small requirements in proportion to the total requirements of the district, that the formula will allot to one or both of these classes an amount in excess of their respective requirements. In such a case the over-allotted class or classes should be given 100 per cent of their requirements and the balance of their allotment under the formula should be distributed either:

(a) Between the classes given incomplete service by the formula, in the ratio of their respective priority ratios (5, 3 or 2). This procedure is to apply where two classes are left incompletely served; or

(b) If only one class is left incompletely served by the formula, the over-allotments of the other two classes are to be assigned to the incompletely served class.

The allotment of more than 100 per cent under the formula to a small class of high importance shows that the shortage in the district was primarily caused by the large amount of less important work in the district and that the small class or classes of higher importance should not be penalized, since they are not responsible for the shortage.

It is not practicable, and it is not intended, that an attempt should be made to apply this formula with literal and mathematical accuracy, but it will afford a workable basis for rationing industries and plants embraced within Classes II, III and IV, where the available supply after satisfying Class I is less than their aggregate requirements or demands.

In case any consumer shall be dissatisfied with the applications made and the electric energy furnished him under these rules and regulations, such consumer may present his complaint in writing to the Priorities Division of the War Industries Board, sending a copy of such complaint to the power company interested. Pending further directions from such Priorities Division the power company shall continue to distribute electric energy in accordance with these rules and regulations notwithstanding the lodging of a complaint by a dissatisfied consumer.

The War Industries Board fully appreciates and is grateful for the support and whole-hearted coöperation which it has received at the hands of both the producers and distributers of electric energy on the one part and their consumers on the other in connection with the handling of such cases of power shortages as have already arisen. These rules and regulations have been promulgated with the view of stimulating production to meet the requirements of the war program and at the same time reduce to a minimum the inevitable disturbance to industry due to power shortages. With confidence we bespeak the continued coöperation of all interested parties in our efforts to reach sound and just solutions of these difficult and constantly recurring problems.

Committee on Development Proposed for the American Institute of Electrical Engineers

At a recent meeting the board of directors of the American Institute of Electrical Engineers passed a resolution providing that a committee on development shall be appointed by the president "to consider suggested or proposed modifications in the field and methods of work of the Institute and to make recommendations to the board of directors concerning these matters."

This committee will be similar in scope and plan of work to like committees, of the American Society of Civil Engineers, the American Society of Mechanical Engineers and the American Institute of Mechanical Engineers. It will take up matters that it deems advisable affecting the activities of the Institute.

WAR CONSERVATION IN ELECTRICAL SUPPLIES

Delay in the War Industries Board Announcements Is Due to the Desire to Receive Criticisms of Tentative Schedules

The delay on the part of the War Industries Board in making public the expected announcements in regard to conservation in electrical equipment, including heating devices, panelboards, reflectors and supplies, is understood in Washington to be due to the fact that the board wishes to give time for complaints to come in based on the tentative announcements which have been and are being placed in the hands of dealers, manufacturers, etc.

The Washington correspondent of Electrical World has been informed by the board that the delay in making public the announcement concerning electrical heating devices is due to the fact that Chairman Stearn's committee has made a complaint in regard to that tentative schedule and that some readjustment is being asked before the formal announcement is signed and published. It is stated in Washington that a period of two weeks has been set by members of the board for complaints to come in in regard to the various items of manufacture and supplies mentioned, and that if at the end of two weeks no complaints of consequence have been received it will be fair for the government to assume that the tentative schedules will work out well in practice.

The feeling prevalent in Washington is that a large number of manufacturers of electrical devices are turning out a greater variety of these than war conditions warrant. Moreover, it is felt that a considerable curtailment could be effected without material injury to the branches of manufacture involved. This means that not only will material and equipment be conserved, but the stocks of manufacturers and jobbers, together with the investments which these entail, would be considerably reduced, and a fair amount of iron and steel, so urgently needed by the government for purely war purposes, released.

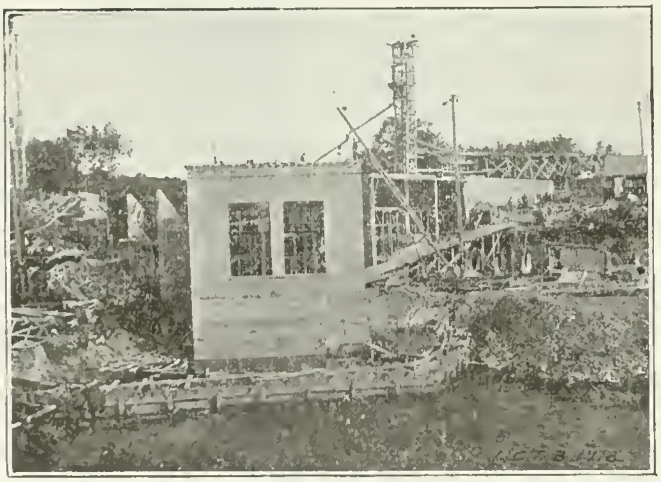
For instance, in the manufacture of lighting fixtures for industrial and public uses, some manufacturers have agreed with the government that the number and styles of angle reflectors and flat-cone reflectors could be reduced to one style for a particular angle to hold a certain limited range of lamp sizes. This is also true of deep cone and flat reflectors, as well as dome types for interior lighting and deep bowls or extensive-type reflectors. These are for the most part made of tin or steel, porcelain-enameled or painted. Thus it is felt that with angle reflectors, for instance, five types would take care of all angles of from 30 deg. to 90 deg. and of all sizes of lamps from 15 watts to 1000 watts, both in painted-enamel and porcelain-enamel finishes.

The same general reductions, it is pointed out, might be carried out without serious inconvenience in the other lines.

In the case of panelboards and cabinets conferences between the manufacturers and the War Industries Board have developed that panelboards with main switches without fuse connections, with main fuses only, and with through feeders with no fuses, might be eliminated. It would also suffice if only one type of branch panelboard with plug fuses in the branches, one type of branch panelboards with night switches and fuses in the branches and two types of safety branch panelboards were hereafter manufactured. No hardship would be entailed if all single-branch panelboards were eliminated.

A rather complete survey has also indicated possible savings in the manufacture of cabinets. All styles of steel boxes, except the side-wiring gutter type, could be eliminated. Standardization on the thickness of the steel for the cabinets and fronts would not only save material but simplify manufacturing operations, and all special hardware, especially that requiring brass or bronze, could be dispensed with to advantage. Slate for bases need not be over 1 in. (2.5 cm.) thick, and there could be severe restrictions on the finishes on the current-carrying parts of panelboards. The manufacturers of switch parts have already made a considerable reduction in the number of finishes of switch plates, etc., so that the above curtailment in panelboard finishes is in line with the general policy of the War Industries Board to effect the greatest possible conservation in the use of materials in the interest of the war program.

Maine Hydroelectric Station Nearing Completion



The Rice Rips hydroelectric station of Central Maine Power Company is rapidly approaching the point of installation of generating equipment. It is planned to have this plant in operation during the winter peak. It will add 2700 hp. to the energy available for handling the important war industry loads on the Central Maine system, notably in the Bath district. The population of Bath has increased so fast on account of the shipbuilding development that additional electric service has constantly been required. Approval of the government was promptly given to the issue of securities by the Central Maine company for the construction of this plant and the necessary line and substation equipment. At Rice Rips the Messalonskee Stream will be utilized a third time for electrical energy generation by the company within a distance of about 10 miles. The company controls the outlets of the Belgrade Lakes, which contain about 30 square miles of storage area and discharges into the Messalonskee Stream, so that the water is used to the utmost advantages. Ninety-seven per cent of the 45,070,042 kw.-hr. generated in 1917 by the company was produced by hydroelectric stations.

IMPROVING CONDITIONS OF INDUSTRIAL-LIGHTING

Instructional Session for Special Guidance of State Factory Inspectors Held in Boston—Program of the Meeting

Through the courtesy of the Edison Electric Illuminating Company of Boston and under the auspices of the divisional committee on lighting of the Advisory Commission Council of National Defense, an instructional session was held at the Edison laboratory, Boston, on Oct. 31.

This session was for the special guidance of the factory inspectors of the Board of Labor and Industries in improving the conditions of industrial lighting throughout the state. It consisted of a series of somewhat informal talks by various specialists in lighting, together with laboratory demonstrations of practical lighting, its technique and measurement.

The program of brief lectures and demonstrations included:

"The General Principles of Artificial Lighting," by Dr. Louis Bell, consulting engineer Edison Electric Illuminating Company, past-president of the Illuminating Engineering Society.

"The Hygienic Aspect of Lighting," by Dr. F. H. Verhoeff, pathologist and ophthalmic surgeon, Massachusetts Eye and Ear Infirmary, assistant professor of ophthalmic research Harvard University.

"How Illumination Is Measured," by S. L. Keyes, photometrist of Edison Electric Illuminating Company, with demonstrations of practice in the laboratory.

Demonstrations of lighting intensities with relation to work.

"The Lighting of Textile Mills," by Prof. William L. Puffer, consulting engineer.

"Machine-Shop Lighting," by S. C. Rogers, General Electric Company.

"General Industrial Lighting," by H. W. Jordan, illuminating engineer, Edison Electric Illuminating Company.

Special effort was made to present these subjects in as simple and untechnical manner as possible with direct reference to the application of principles laid down to industrial lighting as it is found to-day under war conditions in the commonwealth.

Among those who attended the meeting were Edwin Mulready, Commissioner of Labor of Massachusetts, the deputy commissioner and about thirty inspectors and also a representative of the United States Department of Labor.

ONE should say a word for the Signal Corps, that all-essential arm of a modern army. Often before the Germans were cleared out of villages our signal men would have their telephone lines run. One youth told me that the line he put up was shot down twenty-four times. "What did you do?" I asked. He said: "I put it up the twenty-fifth time." I afterward learned that this boy guided a squad to a German machine gun in the nearby woods which had bothered his signal work. Because he led it there the wire stayed up after the twenty-fifth time.—*From a cable to the New York Times from Edwin L. James, "with the American Army in France."*

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Increased Rates at Hoyleton, Ill.—A temporary order by the Illinois Public Utilities Commission permits the central-station company at Hoyleton, Ill., to increase its rates until Oct. 1, 1919, unless otherwise ordered. The commission allowed a depreciation of 4½ per cent on a $5,000 valuation. The rates for lighting range from 16 cents per kilowatt-hour to 11 cents per kilowatt-hour gross with a $1 net minimum bill.

Granting Relief but Avoiding Revision of Schedules.—Deciding to approve increases in electric rates under certain conditions by the Aurora, Elgin & Chicago Railroad and subsidiaries, the Illinois Public Utilities Commission says in part: "An examination of the rate schedules filed by the company discloses that in general the increases requested for lighting and power service will amount to 25 per cent for all lighting service, including municipal street lighting, and 33⅓ per cent for all power service. In the schedules proposed by the company, several rates which have heretofore been in effect have been eliminated, and in some cases new rates are substituted of different character. It is probable that these changes would result in disproportionate increases of rates as applied to individual consumers. The commission has previously expressed itself to the effect that utilities applying for relief from present emergency conditions should not attempt materially to adjust and revise existing rate schedules unless complete justification therefor is submitted. It would therefore appear that the Aurora, Elgin & Chicago Railroad Company, pending further investigation, should keep in effect rates of the same character as the rates at present in effect and applicable to the same consumers and for the same character of service. The schedules as filed herein are unsatisfactory in form and do not comply with the general orders of the commission. The commission, having considered the rates herein proposed, all the testimony adduced and the representations and arguments made, and being fully advised in the premises, finds that the Aurora, Elgin & Chicago Railroad Company, the Ardmore Electric & Gas Company, the Elgin Merchants' Light Company and the DuPage County Electric Light & Power Company should be temporarily authorized to increase their rates for electric lighting service (but not for municipal street-lighting service) by an amount of 25 per cent of the net rates at present on file with the commission and should be temporarily authorized to increase their rates for all power service by the amount of 33⅓ per cent of the net rates as at present on file with the commission, subject to the conditions regarding refunds of advanced rates or such portions thereof as may be found to be unjust."

Extensions in War Time.—Some time ago the Eastern Wisconsin Electric Company, which operates the electrical railway utility at Sheboygan, Wis., the gas, electric and railway utilities at Fond du Lac and the railway at Oshkosh, formulated a rule whereby no extensions would be made in gas or electric mains or lines unless the prospective consumer would agree to deposit the approximate cost of the extension and accept reimbursement in the form of service, and extensions under this rule would be made only in case the acquisition of the new business would be considered desirable under ordinary conditions. This rule was made the subject of a complaint by Alexander Marcow of Fond du Lac, and after due hearing the Railroad Commission of Wisconsin has issued a decision. The decision says in part: "The prospective consumers of gas on Sibley Street have been offered service under the provisions of this rule, but have declined to make the required deposits. The question at issue is, therefore, whether the company's temporary rule is reasonable under present conditions. Agencies of the United States government have repeatedly requested all public utilities as well as other industries to defer until after the war all extensions or betterments unless an immediate war purpose is served thereby. This request was again made by the War Industries Board on Oct. 3, 1918, in a letter from the chairman of the Capital Issues Committee. From the facts presented at the hearing it would be impossible to demonstrate clearly that the proposed extension of gas mains is needed for war purposes. Full compliance with the recommendation of the War Industries Board would therefore have prompted the company to refuse to make the extension under any conditions. The company, however, inasmuch as it has the necessary material on hand, is willing to make the extension under the rule above stated. The commission feels that it should coöperate in every way with the government in curtailing the use of materials and labor for non-essential purposes during war time, and that it should not require utility extensions unless they are found to be vitally necessary even under war conditions. In the present case the prospective consumers have managed for some time to serve their necessities with other fuel than gas, and we feel that they should be willing to continue to do so until the emergency is past. However, no objection will be interposed if the company sees fit to extend the mains subject to compliance on the part of the consumers with the conditions of the rule above referred to."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Public Service Company of Northern Illinois Section.—The Public Service Company of Northern Illinois Section of the National Electric Light Association has elected S. B. Cushing chairman and N. Leonard secretary.

A. I. E. E., Cleveland Section.—Prof. C. A. Adams, president of the American Institute of Electrical Engineers and chairman of the welding committee of the United States Shipping Board, Emergency Fleet Corporation, will address the Cleveland Section of the American Institute of Electrical Engineers on "Recent Developments in Electric Welding as Applied to the Building of Ships." The meeting will be held at the Hotel Statler on Tuesday evening, Nov. 19.

American Electric Railway Association.—A conference of the American Electric Railway Association was held Nov. 1 in New York City. At the morning session there was an address by President John J. Stanley, a report of the Electric Railway War Board was read, and members present discussed the needs of the interurban electric railway. The afternoon session was devoted to the discussion of lightweight cars, the zone system, higher fare, subsidies and public ownership.

Chicago Society Meeting Dates.—Before Jan. 1, 1919, the Chicago sections of the American Institute of Electrical Engineers and the Illuminating Engineering Society and the electrical section of the Western Society of Engineers will hold a number of joint meetings. The first of these was to have been held Oct. 28, but was postponed because of the influenza epidemic. It is planned that the speaker for the first meeting, Prof. C. E. Clewell of the University of Pennsylvania, will deliver an address on or near Nov. 15, on the subject "Industrial Lighting and the War." On Nov. 25 two papers on fuel conservation will be presented. Harold Almert, Chicago, will speak on the work of the Illinois Fuel Administration, and Preston S. Millar, New York, on lighting curtailment. The meeting scheduled for late in December, probably Dec. 30, will be a joint luncheon meeting for the three engineering societies and the Electric Club-Jovian League. Comfort A. Adams, president of the American Institute of Electrical Engineers, will speak on "Electric Welding in Shipbuilding." The secretaries of the three engineering societies are A. F. Riggs for the A. I. E. E., A. O. Dicker for the I. E. S., and Edgar S. Nethercut for the Western Society of Engineers.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Use of Water Power in Spain.—United States Consul General Carl Bailey Hurst, Barcelona, writes that the laws in force in Spain for the use of public water power are the outgrowth of legislation of 1866 and 1879, enacted before the advent of the great hydroelectric enterprises. Rapid development has necessitated numerous additions to the laws, which by their diversity caused certain misinterpretations. Accordingly, by royal decree the dispositions relative to securing concessions for the use of water power and the classification of various bodies of water as public utilities, as well as adjacent land necessary for construction work, have been coördinated and published in the Spanish official organ, Gaceta de Madrid, of Sept. 12, 1918.

Increased Rates Needed in Toledo.—The Toledo (Ohio) Railways & Light Company has sent a communication to Mayor Cornell Schreiber calling his attention to the necessity of temporarily increasing the receipts from domestic consumers in order to meet the increasing expenses of the electric department. For this purpose a service change of 50 cents per month is suggested. At the same time rates to wholesale consumers will be increased, this being the second time the step has been taken. President Frank R. Coates' letter to the Mayor says: "We had hoped that conditions might return to normal without the necessity arising for increasing our domestic lighting rates, but the time has come, in spite of very considerable advances which we have made in our wholesale rates, when we are obliged to ask for further relief, and we can only see our way clear by requesting each individual customer to bear a small share of the increased burden. It is our intention at this time to increase also our rates for wholesale power service, but the sum total of all proposed increases will be only sufficient to cover the present increased cost of production. We have studied the matter carefully and believe that as a means of relief the desired end can best be attained by increasing the bill of each individual customer 50 cents per month in the form of a service charge. This will in no way change our present domestic lighting rate of 8 cents per kilowatt-hour with 1 cent discount, but will simply be an additional charge per customer per month. Because of the fact that the regulation of all municipal and decorative lighting is now controlled by the Fuel Administration, we deem it unfair at this time to ask for any increase along these lines."

Electric Taxicabs Successful in America.—A. Jackson Marshall, secretary Electric Vehicle Section, National Electric Light Association, says that the electric taxicab installations in several American cities continue, after prolonged and exacting tests, to give excellent service. Shortly prior to our entrance into the war plans were maturing rapidly for the inauguration of extensive electric taxicab service in New York, Philadelphia and other large cities, the initial installation in New York City to have consisted of 500 such cabs, which were to have been augmented to meet the anticipated demand. When financial conditions will permit, this development will be launched, Mr. Marshall says.

Heavy Increase in Operating Costs.—In announcing new rates, effective on Oct. 21, the Helena (Ark.) Gas & Electric Company writes to customers that a few years ago it sold electricity at 20 cents per kilowatt-hour. As soon as operating costs would permit, the price was voluntarily reduced to 16 cents per kilowatt-hour. Later, in February, 1917, the price was again voluntarily reduced to 13 cents in spite of increasing costs due to war conditions at that time. The company says: "In April of this year, after operating several months at a material loss, it was found necessary to increase slightly the prices of electricity and gas. The increases made effective at that time were less than the condition required, but it was hoped that by effecting economies in operation and by careful and painstaking business planning the company could for the duration of the war maintain the prices made effective May 1. However, because of continued advances in cost of operating, we regret to say that this has not been possible and that the time has come when it is imperative that we make a further slight advance in rates. The fact is that the company has been operated at a loss of nearly $500 a month for the past seven months. It is almost unnecessary for us to explain the reason for this. The increase in freight rates about July 1 alone means an added expense to this company of nearly $5,000 a year. The taxes of the company were increased nearly $5,000 this year over the year previous. Our labor has demanded and has received increases commensurate with the increased cost of living expenses. The cost of all materials entering into the operation of our plants has increased, in some cases as much as 300 per cent. We wish it to be understood that the increases are not permanent, but are necessary to tide us over the present temporary emergency, during which our operating expenses are substantially greater than our income. When the war is over and normal and natural economic reactions bring about a decrease in the cost of operating our plants, our consumers can expect, and will receive, a corresponding reduction in the cost of gas and electricity." The maximum lighting rate is now 17½ cents.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Measure for Damages in Water-Power Diversion.—The difference in the value of the water power before and after the diversion of water is the correct rule of damages, the Supreme Court of New York has held (172 N. Y. S. 16).

Admissible Evidence in Action for Death.—In action for death of defendant's engineer from contact with charged chain hanging above a lamp-testing apparatus, wherein defendant offered evidence that it furnished rubber gloves, testimony of one who worked with deceased until eight months before accident that no gloves were then furnished was relevant, according to the Supreme Court of South Carolina in Eargle versus Sumter Lighting Company (96 S. E. 909). Opinions of expert electricians that place and appliances were reasonably safe were admissible. Evidence of repairs of alleged defects after the accident was inadmissible. In action for employee's death plaintiff may show subsequent alterations or repairs so far as necessary to show that defective conditions existed at the time of accident to aid jury in determining whether appliances were reasonably safe, but not to prove negligence as to conditions then existing.

Considerations in Rate Fixing.—The making of rates to be paid to a public utility is a legislative function to be exercised by the Legislature or subordinate body to which the power has been delegated, and where the steps prescribed by the Legislature have been followed an order of such body will not be reversed by the court unless it appears from the record of the proceedings that it is unreasonable or unlawful, the Supreme Court of Ohio held (120 N. E. 330). By the provisions of the general code, the Public Utilities Commission, in fixing reasonable rates to be charged by a public utility, is required to have due regard to the value of all the property of the utility used or useful for the convenience of the public, excluding therefrom the value of any franchise or right to own, operate or enjoy the same in excess of the amount actually paid to any political subdivision of the state or county as the consideration of such franchise or right, and exclusive of any value added thereto by reason of monopoly or merger, and of the necessity of making reservation out of the income for surplus, depreciation and contingencies, and of all such other matters as may be proper according to the facts as after due investigation they may be found to exist in each individual case.

R. W. Lamar, superintendent of electrical distribution with the Central Power Company, Canton, Ohio, has been commissioned a captain in the United States Engineers Corps.

J. W. Jones, general superintendent of the Central Power Company, Canton, Ohio, has resigned to become electrical and steam engineer for the United Alloy Steel Corporation.

Harry I. Blake of Pitcairn, Pa., formerly associated with the Cumberland Valley Railroad Company, has been named superintendent of the local power plant of the Pennsylvania Railroad Company.

George Leach, who was appointed superintendent of electrical distribution of the Central Power Company, Canton, Ohio, to succeed R. W. Lamar, who has been commissioned a captain, has also received the commission of captain in the United States Engineers Corps and has gone to Camp Humphreys, Va., for training.

F. V. Underwood, superintendent of the electric department of the Birmingham (Ala.) Railway, Light & Power Company, has resigned to take up work in the operating department of the Alabama Power Company. Mr. Underwood began work for the Birmingham company as troubleman, and he has held almost every position in the electric department.

Charles H. Forsgard has been appointed district manager of the Western Light & Power Company in its northern division, which includes the towns of Berthoud, Fort Collins, Greeley, Gilcrest, Loveland, Windsor, Wellington and adjacent territory, with headquarters at Fort Collins, Col. Mr. Forsgard is a graduate of the Agricultural & Mechanical College of Texas. He was manager of the Childress division of the Texas Gas & Electric Company. Previous to that he was connected with the Houston (Tex.) Lighting & Power Company.

Charles A. Semrad has been appointed general manager of the Western Light & Power Company, Boulder, Col. He had been acting general manager since April of this year. Mr. Semrad is a graduate of the University of Wisconsin and was connected with the Madison (Wis.) Gas & Electric Company and the Union Light & Power Company of St. Louis, Mo., before being connected with the Northern Colorado Power Company in 1909, the predecessor of the Western Light & Power Company. He was manager of the Cheyenne (Wyo.) Light, Fuel & Power Company, one of the subsidiaries of the Western Light & Power Company, until April of this year,when he was transferred to Boulder as acting general manager at the time H. U. Wallace resigned to take a commission as major in the army. Mr. Semrad is president of the Wyoming Central Station Association and a member of the Wyoming Legislature as representative from the city of Cheyenne. He is also active in civic, social and business affairs.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

John H. Pardee, president of the J. G. White Management Corporation, New York, has been elected president of the American Electric Railway Association. Mr. Pardee was graduated from Hamilton College in 1889 and two years later was admitted to the New York bar and began practicing law in Buffalo. As a result of his successful reorganization of the Ontario Light & Traction Company and the Canandaigua (N. Y.) Light Company as attorney for the principal financial interests he was made general manager of the companies. It was in this administrative capacity that he entered the public utility industry. In 1902 he was appointed general manager of the Rochester & Eastern Railway, when he discontinued the practice of law to devote all of his time to utility management. It was in 1907 that Mr. Pardee joined the organization of the J. G. White Company, Inc., as operating manager of the company's utility properties. He was elected to the office he now holds of president of the J. G. White Management Corporation, then newly organized, in 1913. Mr. Pardee occupies the position of president or vice-president of a large number of utilities, among them being several electric light and power properties.

J. H. PARDEE

Prof. Thomas Witt Fitzgerald, who has been head of the department of electrical engineering at the University of Arizona for the last four years, has resigned to take charge of the department of maintenance and of electrical construction for the Ray Consolidated Copper Company at Hayden, Ariz. He also acts in a consulting capacity for these departments with the same company at Ray, Ariz.

Charles G. Du Bois has been elected a vice-president of the Western Electric Company, Inc. Mr. Du Bois entered the employ of the company in 1891 at its New York office and occupied successively the positions of chief clerk, secretary and supervisor of branch houses. In 1907 he became comptroller of the American Telephone & Telegraph Company and in this capacity inaugurated and supervised a comprehensive system of accounting for the Bell telephone system. During the winter of 1917-1918 he was in Washington in the capacity of comptroller of the American Red Cross, which position he still retains. Mr. Du Bois is forty-eight years of age and was graduated from Dartmouth College in 1891.

Obituary

William Mortimer Comstock, an inspector in the designing engineering department of the Edison Electric Illuminating Company of Brooklyn, N. Y., died at his home last week from pneumonia following influenza.

George M. Torzillo, general sales manager for the Sangamo Electric Company, Springfield, Ill., died Oct. 24. Mr. Torzillo had been in the employ of the Sangamo Company for more than five years. He was made sales manager in January, 1918.

Paul H. Cordes, first lieutenant of Company C, Thirteenth Engineers, was killed in action Sept. 12. Lieutenant Cordes was thirty-one years old. He had been in the employ of the Worthington Company twelve years, for the last five years holding the position of sales engineer in the Chicago office. His death will be regretted by his many friends and by his employers in civil life, who speak very highly of his loyal and efficient service.

Prof. Ichisuke Fujioka, president of the Tokyo (Japan) Electric Company and director of several other firms, died of apoplexy on March 5, 1918. Professor Fujioka was particularly well known in electrical circles in the United States. He was an honorary member of the National Electric Light Association and an associate member of the American Institute of Electrical Engineers. Besides, he was a fellow of the Royal Scottish Academy and a member of the British Institution of Electrical Engineers.

Howard H. Duff, assistant to vice-president, Lehigh Navigation Electric Company, Hauto, Pa., died on Oct. 24 a victim of the influenza epidemic. Mr. Duff was thirty-five years old. He was born in Jamaica and came to the United States to engage in power engineering. Prior to his connection with the Lehigh Navigation Electric Company he was with the Westinghouse company at Philadelphia. He then went to Allentown with the Lehigh Valley Transit Company, the main subsidiary of the Lehigh Navigation Electric Company. One of his most creditable accomplishments in the past year was the rehabilitation of the Front

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

SOME FACTORS THAT WILL IMPROVE JOBBERS' SERVICE

Existing Labor Conditions Force Supply Houses to Make a Stand with Regard to Returned Goods, Claims and Tracings

Great difficulties are being experienced by wholesalers in the matter of returned shipments, lost goods and customers' complaints about prolonged deliveries. Unusual conditions brought on by war are undoubtedly for the most part the cause. Yet in not a few instances the customer through carlessness brings about this confusion. It was so easy before the war to order anything and if it wasn't what was wanted to return it with a complaint and get satisfaction. It is always so in a buyers' market. In these times, however, care must be exercised in making out an order, and jobbers are now beginning to insist that it be done.

Where, however, goods must be returned or tracings made, or in event the goods are lost, the task involved must be made as easy as possible. Help is short. In this connection a prominent electrical jobber of the Northwest has formulated a set of rules which are now applied to these cases.

In order to return goods this house insists on the customer securing authority and sending notification. It has been found that considerable correspondence can be eliminated if it is known what material is being returned and why. In some instances the goods should be returned to the factory and not the jobber.

Claims for lost shipments and for damages in shipment, this house now insists, must be made by the customer. The jobber will help with all of the information possible but will not continue to enter and follow up claims.

In the matter of tracing shipments the house points out the difficulties in transportation and the federal regulation regarding L.C.L. shipments. Under these conditions the customer is told that it is useless to attempt to secure action on a tracer unless at least two weeks have elapsed since date of shipment.

GOODS IN FOREIGN TRADE MUST COMPLY WITH LOCAL REGULATIONS

Evidence of What Might Happen to Unapproved Electrical Equipment Furnished by the City of Winnipeg, Manitoba

In the program which electrical manufacturers will make for foreign trade after the war especial consideration must be given to local rules and regulations regarding electrical equipment. It will generally be folly to attempt to sell goods in a foreign market which do not fit local specifications. American manufacturers have been criticised quite severely in the past for apparently refusing to recognize peculiarities of foreign markets.

Evidence of the necessity for being careful in this connection was furnished at the recent convention of the International Association of Municipal Electricians, when F. A. Cambridge, city electrician of Winnipeg, Manitoba, told of the activities in Winnipeg in keeping unapproved electrical appliances out of the market. A law was passed in April, 1917, giving the city electrician the power of examination of devices and appliances. Since that time a considerable number of appliances have been examined, and the following have been condemned: Three lines of toy transformers (three different makes), two lines of bell-ringing transformers, three types of medium-base sockets, two types of warming pads, one type of water sterilizer, one type of grounding clamp, one type of electric kettle, one type of lamp dimmer, two types of cluster plugs, six types of electric heaters, and two miniature Christmas-tree lighting outfits.

In addition to these, a number of devices which have been offered for inspection have been withdrawn from sale by agents, pending alterations in design.

The author stated that most of the goods offered are of American manufacture and have never been submitted to the Underwriters' Laboratory. The natural course is to refer the maker to that organization, and the result has been that preliminary steps have been taken in some cases to obtain information as to procedure. It was pointed out that in the case of toy transformers there was not one make of this article on the approved list before the city took the drastic action above related. Now, it is said, one manufacturer has obtained approval of four types and as a result has secured Winnipeg's trade.

EASIER NOW TO REPLACE JOBBERS' STOCKS OF CONDUIT

Supplement to Priorities Circular No. 4 Gives A-6 Rating for Replacement of Iron and Steel Stocks for Orders Rated A or AA

Jobbers should be in a better position as regards stocks of iron and steel products, of which conduit in this connection is probably the most important, as a result of the rules and regulations contained in Supplement No. 2 to Priorities Circular No. 4, issued Oct. 15 and reviewed in the ELECTRICAL WORLD for Nov. 2.

According to Section 8 of the supplement, jobbers retain their rating of B-4 for maintenance of stocks of iron and steel products except where these stocks are used exclusively for purposes for which A-6 or higher classification has been provided or for use to complete orders covered by A-6 or higher priority certificates. In this case such jobbers' stocks may be maintained with an A-6 rating.

It is important to understand that the allowance of A-6 ratings is for iron and steel products of an unmanufactured nature. Thus, according to a strict reading of Subdivisions af and ag of Section 8 of Supplement No. 2, jobbers are not entitled to A-6 ratings on manufactured iron and steel products such as outlet and switch boxes, conduit fittings, pole-line hardware and other similar manufactured products.

Before a jobber may use the automatic ratings provided for in this supplement he must first have filed with the Priorities Committee and also with the director of steel supply his pledge. Also the jobber must require of the retailer or customer a pledge.

Each jobber shall, not later than the fifth of each month, file with the director of steel supply, on forms to be furnished by him, a certified statement covering shipments made by him during the preceding month. In this statement it will be necessary for the jobber to indicate the tonnage on which he is entitled to place the A-6 rating for replacement and the tonnage on which he is entitled to the B-4 rating for replacement. The jobber may report as orders covered by an A-6 or higher rating all orders received directly from the War Department or the Navy Department of the United States, or the United States Shipping Board Emergency Fleet Corporation, or the Bureau of Industrial Housing and Transportation of the United States Department of Labor or the United States Housing Corporation, and also all orders received by him from his customers which bear the certification of an A rating.

The jobber may report as orders entitled to a B-4 rating for replacement all orders other than those covered by the A-6 replacement which were delivered for uses entitled to preference treatment as from time to time determined by the Priorities Division, or which orders were covered by permits from the Director of Steel Supply. The jobber shall likewise report the quantities ordered by him. Each jobber shall keep a file of the certifications on the basis of which he makes affidavit entitling him to A-6 rating on replacement tonnage. Any mill having any question as to the right of the jobber to ask for replacement on either the A-6 or B-4 basis should bring the matter immediately to the attention of the director of steel supply, War Industries Board.

To secure the ratings on the orders for replacement the jobber must accompany his order by the affidavit prescribed in Section 8, or by the affidavit and certifications prescribed in Section 9-B, both of Supplement No. 2, which may be obtained from the Priorities Division of the War Industries Board.

METAL MARKET CONDITIONS

Prices Show Effect of Armistice with Austria—Tin Regulation Announced

Evidence of the effect of the signing of the Austrian armistice is seen in the various markets for metals. Prices generally are breaking, and for the most part buying is listless. There are reports that copper, even, was sold down to 25½ cents last week. This was somewhat surprising in view of the fundamental condition of the copper-producing industry. The buyers of metals are somewhat disturbed over the part the government will play in the market after the war.

On Nov. 1 the War Industries Board announced the regulations under which importations of tin will hereafter be distributed. Arrangements are being made for licensing. No selling price has been announced, but probably one will be announced before the end of the year. A report to the board as of Oct. 1 indicates that there was a maximum stock of spot tin on hand in the United States at that date. Purchases for shipment here are progressing satisfactorily the Board announced.

NEW YORK METAL MARKET PRICES

	Oct. 29	Nov. 4
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26.00
Casting	Govt. price 26.00	Govt. price 26.00
Wire base	28.75	28.75
Lead, trust price	8.05	8.05
Antimony	12.75	10.50
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	15.00	15.00
Spelter, spot	9.10	9.00
Tin, Chinese *	77.00 to 77.50	No quotations
Aluminum, 98 to 99 per cent	Govt. price 33.10	Govt. price 33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	23.00 to 23.50	22.75 to 23.25
Brass, heavy	13.50 to 14.00	13.00 to 13.50
Brass, light	11.00 to 11.25	11.00 to 11.25
Lead, heavy	7.50 to 7.75	7.50 to 7.75
Zinc, old scrap	6.25 to 6.50	6.25 to 6.50

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* No Straits offering.

THE WEEK
IN TRADE

BUSINESS generally is as good as ever and shows few signs of weakening on peace negotiations. The Pacific Coast reports a decline in the volume of business, but this is owing largely to the influenza epidemic. In the East this epidemic is pretty well played out, and in New York business went back to normal time on Wednesday.

Elections and electioneering played no part this year in business in spite of the great significance attached to this election.

New priority regulations announced last week are expected to help jobbers greatly in replacing stocks of steel goods sold on A priorities. The absence of such a ruling heretofore has placed the jobber in rather an unsatisfactory position when it came to serving the country at some future date.

NEW YORK

Little effect outside of the motor market is noticed as a result of the peace negotiations. In the motor market industrial plants engaged in war work seem somewhat disinclined to place orders at present. The government, however, has shown no tendency to let up on its purchases.

The situation on metal conduit and fittings appears to be clearing somewhat, and as a result of the latest supplement on priorities local stocks are expected to be placed in a better condition.

The building industries are making plans to start activities on a large scale as soon as it is possible to get materials, and after a meeting next week it is expected that an announcement will be forthcoming permitting a more liberal use of material in this connection.

BATTERIES.— Manufacturers have not yet been able to meet the demand for dry cells owing largely to the labor situation. There is a large domestic demand for standard batteries. Foreign demand for government use is principally for the flashlamp sizes. Local stocks are generally very low.

FLASHLAMPS.—Production is still below the demand, and local stocks are as a result very low. Deliveries in some cases are running a month and more. There is a large foreign business for government use. Domestic business is also large.

LAMPS.—Sales in this territory are running far in excess of last year. September sales through agencies were probably 30 per cent greater than in September, 1917. October sales, it is known, were large, but until agency reports are in (agents are allowed until the 10th to report) no definite figures will be available. General business also is large. It appears to be too early yet to notice any effect of the change back to the former daylight schedule. Stocks at present are in good shape, and any shortage that should arise here or there can be quickly taken care of.

MOTORS.—Peace talk appears to be retarding sales somewhat. One prominent distributer stated that up to three weeks ago he had been extremely busy on new work. Since that time, however, business has been dull. Last week it picked up somewhat. The falling off in business was noted to be for the most part from plants engaged principally in government work. The larger sizes have been affected most. Prices show no change, but an opinion was voiced that they might change shortly.

POLE-LINE MATERIAL.—The market locally shows no change. Business, which is largely of government nature, as far as could be learned, has not been affected by the recent peace talk. For some time government business has been lower than early in the year. This condition, however, was brought about largely by the policy of the government to place projects in the Middle West rather than in the industrial congested East.

CONDUIT.—Some material is beginning to come in for jobbers' stocks from manufacturers not loaded up with A orders. It is expected also that supplement No. 2 to Circular No. 4, just issued, will help stock considerably. Here jobbers are permitted to replace stocks sold on an A or AA rating by an A-6 priority. All told, the iron-conduit situation is looking better than it has for some time.

WIRE.—No change is reported in the wire market. Shipments for use by the Signal Corps in France are going ahead and domestic demand is the same. As soon as peace is declared a temporary lull is expected, but new building projects, it is believed, will then come into the market and more than absorb existing capacity.

CHICAGO

There have been no price changes during the week. The price situation is described as one in which "everybody is sitting tight." The peace talk has had no noticeable effect as yet on the jobbers' business, as far as can be seen. Some big extensions may have been delayed, but business of the week has been good. Firms which are working on government contracts have contiued to buy, and if there is any difference in the size of their orders it is of a somewhat trifling nature.

The most noticeable effect of the peace reports comes from the electrical manufacturing and allied fields. Here can be seen evidence in quantity of belief in early cessation of hostilities. It comes in the form of news of new products ready to announce. Moreover, the scope covered by this general movement is broad, the character of new products incuding lines that vary all the way from prime movers to sockets. Such a situation indicates that American manufacturers are thinking ahead.

The war order situation in the Chicago district continues to improve, the Middle West getting a better share of the contracts.

TIME SWITCHES.—While the domestic market is dull, a situation has developed in Australia which is helping manufacturers. Every one who wants electric service in a certain Australian city must put a time switch in his circuits in order to give the operating company a means of assuring itself that no energy will be taken on peak. American switches are being sold for this purpose.

SOCKETS.—Stocks of pull sockets are reported in some centers to be badly depleted. This will be helped to some extent locally by a new line being placed in the field. The new line offers a 600-watt, 250-volt pull socket which will be sold on a basis where quantity exercises a controlling power over the price.

INDUSTRIAL LIGHTING FIXTURES.—Demand for this type of fixture continues good with deliveries fair. Some manufacturers report that they have more business than they can take care of.

WASHING MACHINES.—The demand continues heavy. One washing-machine manufacturer who recently raised his price $15 is contemplating another increase of $10. In this field collections are slow. The labor situation where factories are located in the smaller towns is becoming more acute.

HIGH-VOLTAGE SPECIALTIES.—The demand from industrial plants on this equipment continues good, with deliveries about the same. Several manufacturers have noted a recent increase of business in this line from central stations.

ORNAMENTAL LIGHTING FIXTURES.—Most of the smaller manufacturers, taking care of local trade only, have taken on additional appliances for resale for the period of the war.

INDUSTRIAL CONTROL EQUIPMENT.—One manufacturer has stated that 55 per cent of his business is done direct with the government and the rest is indirectly government business.

BOSTON

The demand for electrical products continues heavy, and in some quarters inquiries and sales appear to be increasing somewhat. Many jobbers, however, are somewhat less rushed with new business than a few weeks ago. Activity averages well on the whole in industrial lines, and there are signs of increased interest in holiday products. Prices are about the same as last week, with no downward tendency as yet. Every one is talking about the possible end of the war in the near future, but very little let-up is permitted in the war service work of the industry by those who realize the importance of maintaining production at top speed until complete victory is established.

Stocks are running lower except in lines where there is very little demand. Deliveries are getting worse, and transportation conditions show little improvement, if any. Except in western Massachusetts and Connecticut, the retarding effect of the influenza epidemic is rapidly becoming a thing of the past. Collections have been hampered somewhat on this account, but are reasonably satisfactory at present.

The shortage of labor is little less than appalling, considering the demand. It is likely that the government authorities will soon be obliged to redistribute labor to some extent in New England in order to advance vitally necessary war work at the cost of less essential industries. A vigorous movement to deflect holiday trade to the present month so far as possible will shortly be under way.

ELECTRICAL SUPPLIES FOR AUTOMOBILES.—A fair business is being handled, but both supply and demand are tempered to the advancing season and difficulty of obtaining materials in the metal field.

INDUSTRIAL ELECTRICAL TRACTORS.—An order for forty tractors for the Boston army base has been placed with the Baker, Rausch & Lang Company, Cleveland. Exclusive of storage batteries, which are yet to be purchased, the order represents about $50,000. The order for 600 trailers for this installation has not yet been placed. Navy yard inquiries are a feature of the industrial truck market at present.

WIRE AND CABLE.—The demand still far exceeds the supply. Weatherproof wire is quoted on a 32-cent base and rubber-covered around 33 cents, subject to quantity advances and reductions. Stocks are low, especially in sizes of wire smaller than No. 8. One concern which received an order for 200,000 miles of twisted wire for field telephone service abroad has distributed the insulation work among others in order to multiply production. It is understood that other large wire demands are likely.

STORAGE BATTERIES.—Stocks are low, government business predominates, and within a few days it is expected that all the standard makes will have attained the 10 per cent average advance in price started last month.

REFLECTORS.—Stocks have been greatly reduced for three years, and the demand still keeps up. The municipal street-lighting market is virtually dead. Prices are about 20 to 25 per cent higher than a year ago. Recent business includes orders for ordnance base depots in France, units for military railroad construction by the use of special reflector cars, equipment for Y. M. C. A. cantonment huts (frequently 150 units per hut), and overseas orders from New Zealand, India, China and Australia. Substitutes for tin are urgently needed.

FARM-LIGHTING SETS.—The sale of these equipments has lagged somewhat in New England this summer, and while good progress has been made in preliminary canvassing, much remains to be done along the line of educating the rural market to appreciate the benefits of such apparatus. The outlook is good for next year's business.

MOTOR-DRIVEN SEWING MACHINES.—The demand is good. It is thought that the saving in material accomplished by some of the more compact outfits will be a factor in permitting normal production to be kept up for some time.

WASHING MACHINES AND VACUUM CLEANERS.—The demand for washers grows automatically and the supply is far below what could be handled if it were available. The business in cleaners is fairly brisk and stocks are meeting the situation reaonably well.

ELECTRIC RADIATORS.—The market has been virtually cleaned out of some of the more popular units, so far as the jobber goes. The retailers in many cases cannot supply specific products.

ATLANTA

The consensus of opinion from several sources throughout the Southeast would indicate that the volume of business in the electrical field has reached the crest. The pivotal point has been reached where ordinary commercial buying is suppressed to almost the minimum, and purchases for government account are now at what appears to be the maximum pitch.

The drought, which has broken, has been the most severe and protracted that there has been in thirty-five years. While it was universal in its nature, a large area of the Southeastern States was hit severely, including the following water-power territories: Atlanta, Macon, Columbus, Augusta, Ga., Alabama, Tennessee, North and South Carolina. The Mathis reservoir of the Georgia Railway & Power Company was practically empty on Oct. 21, and one week later, owing to heavy rains, water was flowing over the crest. The precipitation was so heavy in the Asheville (N. C.) territory that considerable damage was caused to several plants.

The American Fish Products Company, with the Ocean Leather Company, Fort Myers, Fla., contemplates the expenditure of $1,000,000 for dehydrating plants. The Valdosta (Ga.) Street Railway Company has applied to the Railroad Commission for an increase in street-car fare from 5 cents to 6 cents.

METERS.—Manufacturers report sales as moderate and considerably off as compared with the same period last year on residential types. Shipments are fairly prompt, and stocks are in good shape. There has been no price change recorded lately.

TRANSFORMERS.—The volume of business in the heavy-power type over 100 kva. has been slowly sagging off for the past six months, and sales are estimated as being 25 per cent behind last year. The demand for 2300-volt distributing types is holding up well, and on a comparative basis of one year ago there is no decrease in the volume of sales. Up to 50 kva. shipments are excellent, and Southeastern stocks are ample to take care of fall requirements.

WIRE.—Some sections report that rubber-covered wire is scarce. However, a few distributers have large stocks on hand. Weatherproof is fairly active and local stocks are complete, with the exception of No. 8, which is growing scarce, owing mostly to large drafts for government account coming sporadically.

STREET-LIGHTING EQUIPMENT.—There is little call for new equipment of this type from central stations, except for maintenance. Activity of an industrial nature exists, however, from government and indirect government plants. The sales of 100-cp. lamps are good. Shipments on fixtures show some improvement.

SEATTLE—PORTLAND

The volume of sales during the past week decreased materially as compared with the past several weeks. The influenza epidemic in the Northwest cities apparently is not lessening. Sales of retailers and small dealers for the past week show marked decrease with no improvement in sight. Jobbers' sales to shipyards and allied industrials show a slight decrease, but this is not blamed altogether upon influenza. Beginning Nov. 1, Seattle's wholesale and retail establishments were ordered closed prior to 10 a. m. and after 3 p. m. until the situation shall be well in hand.

The recent announcement of Chairman Hurley of the United States Shipping Board of plans to eliminate between fifteen and twenty wooden shipbuilding plants from the government program because of inefficiency is causing little concern in the Northwest, as yards in Seattle, Aberdeen and Portland districts are far ahead of schedule in both launching and deliveries. The supervisor of woodship construction in the Portland district reports that contracts for the 5000-ton Columbia River type vessel will be distributed shortly. The number of vessels has not been announced. Authorities state that the ending of war cannot affect the steel shipbuilding industry in the Northwest for at least two years, and the period of activity will probably continue for three or four years. In the Portland district the increase of building has been particularly noticeable during the past week. The Northwest Trust Company, Portland, has received permission to proceed with the erection of 100 homes in the peninsula district for war workers. These structures will range in price from $1,200 to $1,700. The Todd Dry Dock & Construction Company, Tacoma, will immediately erect seventy-five bungalows to cost between $2,000 and $4,000. Government agents in Oregon stated that, inasmuch as a survey has shown that the Northwest is amply provided with grain elevators, permits for the construction of additional elevators will be refused.

The labor situation is showing no signs of improvement. The shortage of labor in some steel yards is slowing up production in spite of overtime. Increased efforts to relieve the freight situation are resulting in slightly better Eastern freight deliveries. Oriental shipments are congesting local docks, and bottoms are not available.

SAN FRANCISCO

The electrical business from established sources continues below normal, but this is more than offset by special orders growing out of war conditions. Other Pacific Coast business, except for luxuries and semi-luxuries caused by unaccustomed high wages, continues below normal. The labor problem is again serious both as regards the supply and the wages paid. Efficient clerical and sales help is difficult to get. Shipyard wages have again been raised, the Pacific Coast receiving a 20 per cent advance as compared with a 15 per cent advance for the rest of the nation. The proposed shipping program has been curtailed, and it is reported that no contracts beyond 1919 construction will be placed. The influenza epidemic is now at its height along the Pacific Coast, but drastic measures are checking its spread.

Brisk showers fell during the week, and there is every promise of a welcome wet winter. A revised return on various crops shows that the increased acreage and increased production have offset the rain losses. The future of the grape crop is threatened by the fact that California will quite possibly go dry six months in advance of the United States. Other crops that have suffered are prunes, which are only 30 per cent of normal; nuts, including walnuts and almonds, which are 80 per cent of normal, and oranges, which are 60 per cent of normal. The last-named crop, by the way, is recovering, for 1917 was only 45 per cent of normal. These figures have a direct bearing upon the prosperity of their respective crop sections.

POLES.—With the exception of about 100 miles of tying-in lines, there has been small opportunity for the sale of poles. A few hundred have been sold for the new lines in the upper Sacramento valley, but although there are projects on paper there is no further actual construction in sight for many months. Besides lumber districts provide a competition that it is impossible to meet.

SCHEDULE MATERIAL.—Several large companies have built special departments to handle the extraordinary demand for marine schedule material. Coast jobbers find it good policy to offer a 10 per cent inducement for 1000-piece orders.

LAMPS.—Sales of carbon lamps have dropped off to a minimum because of the Fuel Administration's regulations. All frosted lamps are restricted. Standard lamps are seriously short because of the crippling of the Oakland lamp works through influenza.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B & S. Size	List per 1000 Ft.
No 14 solid	$61 00
No. 12 solid	71 00
No. 10 solid	90 00
No. 8 solid	106 00
No 6 solid	145 00
No 10 stranded	95 00
No. 8 stranded	115 00
No 6 stranded	160 00
No 4 stranded	205 00
No. 2 stranded	266 00
No. 1 stranded	315 00

Twin-Conductor

No. 14 solid	104 00
No. 12 solid	135 00
No. 10 solid	185 00
No. 8 stranded	235 00
No. 6 stranded	370 00
No. 4 stranded	575 00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20% to $73 20
Coil to 1000 ft	List

	No. 12 Solid
Less than coil	+20% to $85 20
Coil to 1000 ft	List

Twin-Conductor

	No. 14 Solid
Less than coil.	$115.00
Coil to 1000 ft	100.00

	No. 12 Solid
Less than coil	+20% to $162 00
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std pkg	+20%
1/5 to std. pkg	List
Std pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std pkg	+30% to 12%
1/5 to std. pkg	+5% to 20%
Std pkg	18% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No 6 Ignitor
Less than 12	$0 45—$0 46	$0 45—$0 47
12 to 50	40	40— 41
50 to barrel	35— 36	36— 37
Barrel lots	32— 329	33 339

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 40 to $0 45	$0 40 to $0 45
12 to 50	.35 to 39	35 to 39
50 to barrel	.319 to 362	.329 to 382
Barrel lots	.289 to 332	.299 to 342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5 00
3/8	250	7 50
1/2	100	10 00
3/4	50	13 00
1	50	21 00
1¼	50	26.00
1½	25–50	35 00
2	25–50	45 00
2½	25–50	52 00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
3/8-in. single.trip.	$75 00	$63.75— 69 75
3/8-in. double strip	75 00— 82 50	72 00— 75 00
1/2-in single strip	100 00	85 00— 93 00
1/2-in. double strip	100.00—110 00	96 00—100 00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75 00	$63 75 to $64 25
3/8-in. double strip	78 25 to $90 00	71 25 to 75 00
1/2-in. single strip	100 00	75 00 to 85 00
1/2-in. double strip	105.00 to 120 00	93 00 to 100.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0.05½	1	$0 25
1/4	.06	1¼	33
3/8	.09	1½	40
1/2	.12	1¾	.47
5/8	.15	2	55
3/4	.18	2½	65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$25 00–51 70	$24 00–35 20	$23.00–30.25
1/4-in.—	30.00–56.40	28 00–38 40	26.00–33 00

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$44 00–60 00	$30 00–33 00	$26 50–29 15
1/4-in.—	48 00–65 00	33 50–37 50	29 00–31.80

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
1/4	$0 08½
3/8	08½
1/2	08½
3/4	.11½
1	.17
1¼	23
1½	27½
2	37½
2½	58½
3	76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
1/4	$0 05	$0 19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	13	.37
1¼	17	.45
1½	21	.50
2	28	1.10
2½	.40	1 80
3	60	4 80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	7% to 7 1%	9% to 9 1%
2500 to 5000 lb.	10% to 10 1%	12% to 12 1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+5.5% to 3 5%	+3.5% to +1.5%
2500 to 5000 lb.	+2.5% to +0.5%	+5% to 1.5%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$6.00 to $7 00
Discount	20% to 30%

CHICAGO

List price	$6.00 to $7 00
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	Lis
3-amp. to 30-amp	100	$0.25
35-amp. to 60-amp	100	.35
65-amp. to 100-amp	50	90
110-amp. to 200-amp	25	2 00
225-amp. to 400-amp	25	3 60
450-amp. to 600-amp	10	5.50
600-Volt		
3-amp. to 30-amp	100	$0 40
35-amp. to 60-amp	100	60
65-amp. to 100-amp	50	1.50
110-amp. to 200-amp	25	2 5C
225-amp. to 400-amp	25	5 50
450-amp. to 600-amp	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41% to 45%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30% to 31%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$6.00 to $9 37
1/5 to std. pkg	5.25 to 7 00

Standard packages, 500. List, each, $0 07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8 00
1/5 to std. pkg	7 00

Standard packages, 500. List, each, $0 07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0 35
60-watt—B	100	.40
100-watt—B	24	85
75-watt—C	50	70
100-watt—C	24	1.10
200-watt—C	24	2 20
300-watt—C	24	3 25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4⅜-in., Frosted:		
100-watt—G 35	24	1 15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30 47—$40 77
Coil to 1000 ft	27 42— 30 22

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$38 00
Coil to 1000 ft	28 00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24 00

CHICAGO

Net per 100	$23 93 to $30 00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S C., 6200, 320	$30 00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30 00
103—C.A., 9, 4R, B 1½	25 00
106—F.A., 7, C.S., 1½, 3 R	20 00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%	20%
$10.00 to $50.00 list	36%	31%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20%	10%
$10.00 to $50.00 list	30%	20%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	5%
1/5 to std. pkg	15%
Std. pkg	25%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$21.00 to $34 00
1/5 to std pkg	17.85 to 28 90

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$16 80–24 15
1/5 to std. pkg	15 80–21 00

Standard package, 2200. List per 1000, $20.00–21 00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.—Solid Nail-it	Std Pkg. 4000 —N.C.
Less than 1/5 std. pkg	$16 00 to $22 00	$32 00
1/5 to std pkg	13 60 to 18 70	27 20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid Nail-it	Std. Pkg. 4000 —N.C.
Less than 1/5 std. pkg	$11.70–$18 40	$33 85–$36 80
1/5 to std. pkg	10 15– 16 00	26.60– 32 00

SOCKETS AND RECEPTACLES

	Std Pkg.	List
½-in. cap key and push sockets	500	$0 33
½-in. cap keyless socket	500	30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List
1/5 std. pkg	10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0 80
60-amp. S. P. S. T	1 20
100-amp. S. P. S. T	2 25
200-amp. S. P. S. T	3 48
300-amp. S. P. S. T	5 34
30-amp. D. P. S. T	1 20
60-amp. D. P. S. T	1 78
100-amp. D. P. S. T	3 38
200-amp. D. P. S. T	5 20
300-amp. D. P. S. T	8 00
30-amp. 3 P. S. T	1 80
60-amp. 3 P. S. T	2 68
100-amp. 3 P. S. T	5 08
200-amp. 3 P. S. T	7 80
300-amp. 3 P. S. T	12 00
Low Grade:	
30-amp. S. P. S. T	$0 42
60-amp. S. P. S. T	74
100-amp. S. P. S. T	1 50
200-amp. S. P. S. T	2 70
30-amp. D. P. S. T	68
60-amp. D. P. S. T	1 22
100-amp. D. P. S. T	2 50
200-amp D. P. S. T	4 50
30-amp. 3 P. S. T	1.02
60-amp. 3 P. S. T	1 84
100-amp. 3 P. S. T	3 76
200-amp. 3 P. S. T	6 76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15% to +10%
$10 to $25 list	+10% to 2%
$25 to $50 list	2% to 5%
	Low Grade
Less than $10 list	+5% to list
$10 to $25 list	List to 8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 15%
$10 to $25 list	List to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15% to 16%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp single-pole	250	$0 28
5-amp single-pole, ind	250	32
10-amp. single-pole	100	.48
10-amp. single-pole, iod	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp single-pole	100	$0 45
10-amp. three-way	50	70
10-amp doul [illegible]	50	70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to 10%
1/5 to std. pkg	+5% to 16⅔%
Std. pkg	18% to 25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0 34
No. 160	60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 30%	Net to [illegible]0%
$2.00 to $10.00 list	10% to 35%	5% to 40%
$10.00 to $50.00 list	20% to 37%	10% to 52%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 50%

TOASTERS, UPRIGHT

NEW YORK

List price	$6 00 to 6 50
Discount	20% to 30%

CHICAGO

List price	$6 00 to $6 50
Discount	20% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0 54–$0 66
No. 18, full spools	.52– .56

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0 65 to $0.72
No. 18, full spools	.55 to .65

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$20 00–$25 00	$15 00–$17 00	$15 00–$15 75
12	23 58– 27 09	21 62– 29 09	17 68– 23 22
10	30 20– 37 80	27 45– 32 40	23 47– 32 40
8	42 74– 53.34	38 85– 45 72	33 21– 45 72
6	61 50– 84.42	55 35– 72 36	52 58– 55 48

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$25.00	$18 00–$25 00	$15 50
12	$29 46– 31 44	29 46– 31 44	$25 54– 31 44
10	41 10– 43 84	41 10– 43.84	34 62– 38 36
8	57 00– 61 76	57 90– 61 76	50 18– 54 04
6	85 31– 97 68	85 31– 85 47	72 21– 85 47

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Broid, Size 4 0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$39 75 to $44 00
25 to 50 lb	39 75 to 42 00
50 to 100 lb	38 75 to 40 00

CHICAGO

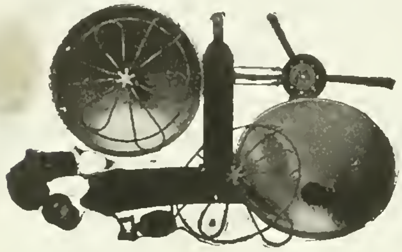
	Per 100 Lb. Net
Less than 25 lb	$41 00 to $41 76
25 to 50 lb	39 75 to 40 76
50 to 100 lb	38 75 to 39 76

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Twin Radiant Heater

Equipped with two heating elements and two reflectors, the twin radiant heater being manufactured by the American Electrical Heater Company, Detroit, Mich., is virtually two heaters in one. Being adjustable, these reflectors permit the heat to be thrown not only in any desired direction but also in two different directions at the same time.


PARTS ARE REMOVABLE AND INTERCHANGEABLE

For insuring cleanliness and efficiency all parts of the heater, reflectors, heating elements and the protecting wire guards are removable and interchangeable without the use of tools. The heater is light in weight, has a handle and comes equipped with an 8-ft. (2.4-m.) cord, a detachable plug and lamp-socket attachment plug, making it available for use anywhere. The power required for each heating unit is 330 watts, making a total of 660 watts for the whole heater.

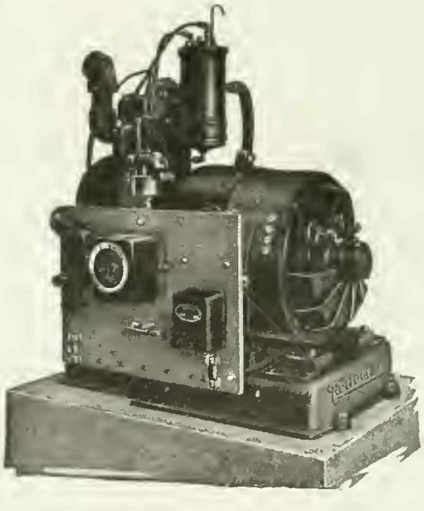
Electric Dishwasher of Family Size

A dishwasher to meet the requirements of an ordinary family is being manufactured by Redmon, Edgar & Redmon, Cedar Rapids, Iowa. It washes dishes by rotating them in a round metal open-work basket in a rectangular tank. The motion of the round basket in the square tank causes sufficient agitation of the water, it is claimed, to wash the dishes. The rotary motion is obtained through the use of a 1-6-hp. General Electric motor belted to the driven shaft. Each basket of dishes is rinsed by pure hot water after it is lifted above the level of the washing water. The rinsing water is supplied through spray pipes placed in the upper part of the tank in such a manner as to reach all parts of the dishes. The machine occupies a floor space of approximately 2 ft. by 2 ft. (61 cm. by 61 cm.) with the tables dropped, and 2 ft. by 5 ft. (61 cm. by 152 cm.) with the tables up. One basket for dishes and one for silverware are provided with each machine. To install the machine connections for gas, hot water and a sewer outlet must be available in addition to an outlet for electrical energy.

Low-Voltage Lighting Plants

Comprising an engine directly connected to a generator, a controlling switchboard and a set of storage batteries, automatic and semi-automatic farm-lighting plants are being made by the Perfection Storage Battery Company, Rhodes Avenue and Fortieth Street, Chicago.

The water-cooled engine develops 3 hp., is equipped with a carburetor for either kerosene or gasoline burning and has a power pulley for running pumps, feed grinders, milking machines and other labor-lightening devices. Generators are of either 32-volt or 65-volt type, have a capacity of 1500 watts, or seventy-five 16-cp., 20-watt lamps, and utilize a fan on the engine flywheel for cooling and to prevent overheating.


SMALL, COMPACT AND SIMPLE TO OPERATE

Improper connection of the "Perfection" sealed-in glass-jar batteries is said to be obviated by safety straps. The control panel contains a combined automatic cut-out start and stop switch, an ampere-hour meter, an auxiliary ignition switch, a battery-charging switch, light fuses and a bell signal of the semi-automatic style to indicate when the batteries need recharging. On the automatic-type plants the batteries are kept full without outside attention.

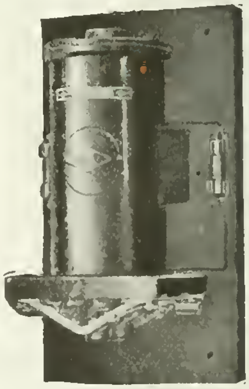
There are no exposed moving parts in the plants, yet inspection and adjustment are made possible by a removable cylinder head and inspection plate in the crank case. A self-contained oiling system is employed, thus eliminating grease or oil cups, while gages indicate the condition of both oil and fuel supplies, the latter being stored in the plant subbase.

Industrial Elevating Truck

Adapted to carry the platforms used by hand trucks, an elevating platform electric truck is being manufactured by the Buda Company, Railway Exchange, Chicago. Platforms for very short hauls may be carried by hand trucks while the electric may handle these platforms for longer hauls. The maker says this will greatly facilitate "process manufacture." The truck, which elevates a 4000 lb. load 3 in. (8 cm.) and steers on all four wheels, is equipped with Edison storage batteries and a Diehl motor with a Cutler-Hammer controller.

Remote-Control Switch

Automatic no-voltage-release equipment known as the "type A Diamond H" remote-control switch has been recently brought out by the Hart Manufacturing Company of Hartford, Conn. This outfit has been designed with a low-resistance closing coil and a high-resistance locking coil, the former operating only while the switch is closing and the latter being continuously in circuit when the switch is closed. If the control switch is opened or there is a failure in line voltage, an armature suspended by the high-resistance coil falls, thus unlocking a main armature and allowing the switch to open by gravity. The manufacturer points out that this equipment is especially applicable for marine service, such as con-


MAY BE USED TO CONTROL SWITCHES WHERE HAND OPERATION IS DANGEROUS

trolling the externally visible lights of a ship from the bridge, a watertight "Diamond H" marine switch being provided for use of this kind.

Fittings for Lighting of Gages

For the lighting of gages for transformers, boilers, etc., the Appleton Electric Company of Chicago has designed the fitting shown herewith. This fitting is furnished complete with receptacle having a lamp grip, thereby insuring against the lamp falling out. The reflector is stamped from steel, rounded to give proper diffusion of light, and is fired with white enamel. It has a hinged door which can be securely fastened and permits of easy access when necessary to remove lamp for renewal or to clean the reflector. This fittting is to be known as the type "RGL Unilet."

HINGED DOOR ALLOWS EASY ACCESS TO LAMP

Floodlight Projector

The Pittsburgh Reflector & Illuminating Company, 3117 Penn Avenue, Pittsburgh, Pa., has placed on the market a new reflector for type C lamps. The lamp in this unit is placed vertically so that the reflector partly surrounds the lamps and makes possible great efficiency in its use as a floodlight projector. The company claims that this reflector, not being a shallow reflector placed entirely back of the lamp but extending somewhat in front of the lamp, utilizes 75 per cent of the lamp's energy as against perhaps 35 per cent in the case of shallow reflectors.

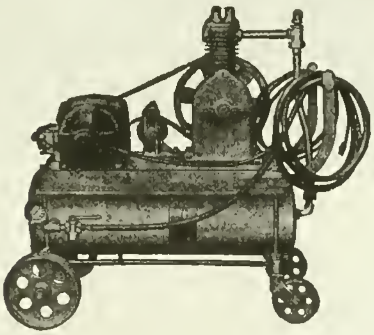
REFLECTOR PARTIALLY SURROUNDS LAMP

In addition to a strong center beam of light, this unit gives a distribution covering 24 deg., making it extremely suitable for all kinds of floodlighting.

Economical Splash-Oiled Air Compressor

Especially adapted for inflating automobile tires, the Curtis Pneumatic Machinery Company of St. Louis is marketing a motor-driven air compressor which has the advantage of a storage tank in addition to that of portability. An especially well-designed splash self-oiling system is said by the manufacturers to be one of the distinctive features of the compressors. The regulated supply of oil is splashed into the cylinder as it is needed, resulting, it is stated, in the use of much less oil, in the need for very little attention and in the prevention of oil flooding the cylinder and thereby injuring tires and tubes by oil in the air supply. The flywheel of the compressor has fan-blade spokes and cools the cylinder when run in either direction—one way the air is blown against the cylinder and in the opposite direction the air is pulled past it.

The possibility of broken valves dropping and so injuring the machine is prevented by a safety cage, while a hand unloader permits starting the compressor against tank pressure without burning out the motor or blowing the fuses. While the valves may be inspected without removing the head, still pipe connections need not be broken should it be desired to remove the head, since but one gasket is used.


HAS STORAGE TANK AND MAY BE EASILY WHEELED AROUND

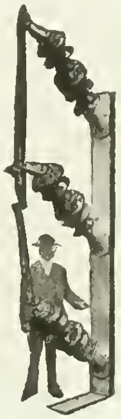
The model illustrated is obtainable with either belt or gear drive, as is also a special model for use in limited space. A stationary outfit is also manufactured, and all three models may be had with five different sizes of compressors.

Portable Floodlighting Projector

A portable floodlighting unit, known as the "Litekraft" projector, has been placed on the market by C. W. Cole & Company, Los Angeles, Cal. Measuring 14 in. (35 cm.) in diameter, the reflector of the unit accommodates floodlighting or stereopticon lamps of from 220 watts to 500 watts rating. It is said to be correctly designed and built to throw a powerful light a considerable distance. The reflector is of highly polished silver plate and is inclosed for protective purposes in an outer shell, the entire unit being finished in baked enamel.

High-Voltage Switching and Protective Equipment

A feature of some 110,000-volt switching and protecting equipment recently made by the Electrical Engineers' Equipment Company of Chicago for Stone & Webster lies in the insulator units. These supports are made up of two standard 70,000-volt pin insulators stacked one on top of the other. The insulators are held together by a rugged set of clamps. To the bottom clamp of each insulator a malleable pin is fastened, which is cemented into the pin hole. This type of construction makes a strong unit and is less expensive than a pillar-type insulator for the same voltage.


110,000-VOLT SWITCH IS 12 FT. HIGH

The switch parts proper were made with the double-blade type of construction, spring washers being used to secure proper contact. The switch is rated at 300 amp. When in use the unit is mounted in the position shown in the illustration with the blade vertical. It measures approximately 12 ft. (3.7 m.) from the lower end to the top of lock ring.

Washer with Copper Tub

An electric washer with a copper tub supported in a wooden frame is being manufactured by the Barlow & Seelig Manufacturing Company of Ripon, Wis. Among the features of the machine pointed out by the maker is the employment of a special ball-bearing 11-in. (27.5-cm.) roll wringer, which can be swung out of the way when not in use, and has an easy reversing mechanism as well as a release for use in case of accidents. Both chain and gears are quiet, the latter being partly inclosed for protective purposes, while a belt is used for connecting the motor and the washer mechanism. Special bracings are provided for the legs, and red cypress is employed wherever the wood frame comes in contact with water. Washing the clothes clean is said to be materially assisted by the dasher, which has four spouts.

Trade Notes

Changes in Northwestern Organization

The following changes are reported in the sales forces of the Northwestern Electric Equipment Company, St. Paul and Duluth, Minn., jobber:

A. M. BALDWIN, formerly manager of the Duluth house, has returned to the St. Paul office to the duties as manager of sales.

W. A. GRIMES has succeeded Mr. Baldwin and is now manager of the Duluth house.

B. C. HOLST, formerly covering the Iowa territory, has been called into the home office to take charge of the new specialty department recently created. This department covers the sales of heating material, washing machines, vacuum cleaners and various other specialties. E. V. Brown succeeds Mr. Holst in the Iowa territory.

C. H. RITTER, owing to changes made and reorganization in the office, has been made manager of the supply department.

GOVERNMENT CONTRACTS. — The General Supplies Division of the Quartermaster's Department, Munitions Building, Potomac Park, Washington, is calling for bids on or before Nov. 14 for two alternating-current 110-volt motors (no size given), four 220-440-volt electric irons, eight sewing machines with 220-volt motors, 160 soldering irons, two sewing machines with 110-volt direct-current motors and one 16-lb. flatiron complete.

ONLY ONE COPY OF EXPORT APPLICATION FORMS REQUIRED.—The War Trade Board calls the attention of exporters to the fact that in submitting applications for export licenses only one copy of form X and of any supplemental form is required. The only documents of which more than one copy is required are the lists of commodities which in some cases are attached to form X in answer to question 5. These lists must be furnished in triplicate.

INDUSTRIAL PLANT SURVEY.—A survey of all industrial plants producing war materials will shortly be undertaken at Boston under the supervision of E. W. Lord, state director of the federal employment service. The work will be done by the federal office organization instead of by community effort, as at first considered, in the interest of greater speed and better systematization of data. The detail of the work calls for figures on the amount of labor and material used, with the object of establishing a reservoir of information which will enable advantage to be taken of any surplus on hand from time to time in any local plant.

LYNN-G. E. LABOR FINDING.—The National War Labor Board has made public its findings in regard to the labor situation at the Lynn plant of the General Electric Company. The right of the workers to organize in trade unions and bargain collectively through a chosen representative is recognized and affirmed. This right shall not be denied, abridged or interfered with by the employer in any manner whatsoever. The board's decision provides for the election of shop committees and election supervisors and the creation of a general committee which will meet to adjudicate wage and labor questions. Hours of labor are to be the same as those at the Schenectady plant of the company, with comparable pay.

BRITISH EXPORTS OF ENGINEERING APPLIANCES.—In discussing export of engineering machines, Leonard Andrews in the *Journal* of the British Institution of Electrical Engineers for June, 1918, states that there is abundant evidence that results fall very short of possible attainment. A large amount of machinery and engineering appliances of all descriptions is imported into Canada every year, but it is estimated that less than 5 per cent of these imports that come in are manufactured in the United Kingdom. It is the author's opinion that maximum efficiency will only be attained by grouping the various elements upon which successful overseas trade is dependent under three self-contained, closely allied and interconnected sections which may be classified as production, coordination and distribution. The author also points out that the national welfare of the British Empire is so dependent upon the engineering industries that the use of state credit for the purpose of improving the overseas distribution of engineering appliances appears to be justifiable.

LIST OF FOREIGN IMPORTERS AND DEALERS.—The Bureau of Foreign and Domestic Commerce, Washington, D. C., is constantly receiving lists of importers and dealers in all kinds of articles throughout the world. Therefore it is suggested that American manufacturers and exporters should first ascertain whether a list desired is on hand at the bureau before writing to the consuls.

NOW POSSIBLE TO GET MANGANIN OF AMERICAN MANUFACTURE. —The Leeds & Northrup Company, Philadelphia, manufacturing electrical measuring instruments, announces that it has recently completed experiments which have taught it the exact process of making on a commercial scale manganin of a grade superior to any which has in the past years come from Germany. Prior to the war all manganin was imported from Europe, and as a result the stocks after the war rapidly became exhausted, so that instrument manufacturers were of necessity forced to use substitutes which were not altogether satisfactory. The Leeds & Northrup Company has now made arrangements with a metal manufacturer to produce manganin, and the company states that it has already been furnished in all sizes of a superior quality from large rods to the smallest wire.

LIBERTY LOAN DISPLAY WINDOW OF DANVERS (MASS.) COMPANY

LIBERTY LOAN DISPLAY.—The Consolidated Electric Lamp Company of Danvers, Mass., was very active in its appeal to the community in which it is established for Liberty bond subscriptions. The effective massed display of loan posters in the company's window is shown on this page.

EXPORT CONSERVATION LIST.—An amended Export Conservation List, effective Oct. 15, has just been distributed. To export articles on this list licences must be obtained, and where followed by an X supplementary information forms with these numbers must be used. The suggestion is made by the War Trade Board that applications for export licenses must be accompanied by adequate descriptions of the constituents of the commodities mentioned in the application. Trade names for commodities should be avoided unless the name conveys a generally accepted description of the article. The list includes the following items of interest to the electrical trade, all of which must use supplemental form X-2: Copper wire (individual licenses not required to Canada and Newfoundland), carbon and graphite electrodes, electrolytic cells, searchlight reflectors, parts and generators.

REVISED PROCEDURE FOR LICENSING SHIPMENTS.—The War Trade Board announces the revision, effective Nov. 1, 1918, of the procedure set forth in W. T. B. R. 184, dated Aug. 3, 1918, for the issuance of export licenses for shipments which are (a) destined to the United Kingdom, France, Italy or Belgium (excluding their colonies, possessions and protectorates), either directly or by way of any other country or colony, or (b) destined to any country or colony by way of the United Kingdom, France, Italy or Belgium, excepting shipments destined to Switzerland by way of France or Italy. The change in the procedure is in regard to the manner of granting licenses for the exportation of commodities to France. The French government, owing to the shortage of tonnage, has instructed the French High Commission in this country to indorse applications for export to France only when definite instructions have been received from the French government that such indorsement should be given. Full details are to be found in W. T. B. report 293.

NEW ESTERLINE REPRESENTATIVE.—The Esterline Company has just completed arrangements with the Electrical Sales Engineers, Inc., 19 South Fifth Avenue, Chicago, to act as its exclusive representative in northern Illinois and Indiana. Paul W. Koch is president and general manager of the Electrical Sales Engineers, Inc., and has had a long experience in the electrical field. The concern's engineers have made a special study of the construction and use of Esterline instruments and are well qualified to give assistance or information in connection with the solution of metering problems. The Esterline Company has appointed the C. B. Fall Company, 2046 Railway Exchnge Building, St. Louis, its exclusive representative for the State of Missouri and southern Illinois. C. B. Fall, president of the company, is an experienced instrument man, having received his early training in the laboratory of the Esterline Company. For a number of years he was in charge of meters and testing for the Indianapolis Light & Heat Company.

RIGHTS OF PRICE CUTTERS DENIED.—In the Federal District Court for the Eastern District of Virginia, Colgate & Company were upheld in their practice of refusing to sell to retailers who persistently cut published prices. The court held that the manufacturers had an interest in the resale price. "Price cutting," said the court, "would almost inevitably result in reducing the defendants' business in a given community to only those engaged in that practice and deprive it of the patronage of the great body of wholesalers and retailers engaged in what they believed to be a fair and legitimate conduct of their business. It by no means follows that, in the end, the public would be benefited as the price cutter could easily raise his prices after the demoralization caused by his conduct had been brought about and profit individually by so doing. What the public is interested in is that only reasonable and fair prices shall be charged for what it buys, and it is not claimed that the defendant's manner of conducting their business has otherwise resulted."

THE GENERAL ELECTRIC COMPANY OF GREAT BRITAIN desires to announce that it has completed the purchase of the Erith Works and of the good will of the manufacturing business hitherto carried on by Fraser & Chalmers, Ltd. Practically the whole of the personnel have transferred their services to the General Electric Company, which will carry on the business as a going concern and under the title of Fraser & Chalmers Engineering Works.

THE INTERNATIONAL WESTERN ELECTRIC COMPANY, which was organized recently to conduct the Western Electric Company's foreign business, has done a vast amount of war work. Fully one-third of its business is the supplying of materials which are used directly by the fighting forces of the United States and its allies. The materials for the Allied armies have been supplied as the result of orders received through the company's houses in

London, Paris and Milan and through the various purchasing commissions maintained by the Allied governments in this country. The American, French, British and Italian armies all are being supplied through these channels.

C. R. HORRELL, who was formerly with the Electric Appliance Company at Chicago, has been made assistant sales manager of the Sangamo Electric Company, Springfield, Ill.

LANDERS, FRARY & CLARK, New Britain, Conn., had a fire in their plant on Oct. 29, caused by an explosion in the celluloid vault. The loss is placed at approximately $15,000.

THE BAKER-JOSLYN COMPANY, manufacturers' agent, announces the removal of its San Francisco office and warehouse to 183-199 First Street. There is no change of address of the Seattle or Los Angeles branches.

ARTURO R. CALVO, for the last five years manager of sales of the Permutit Company, has resigned to become an officer and director of the Hercules Engineering Corporation and its affiliated interests, the Electrolytic Engineering Corporation and the Technical Products Company.

W. A. HARLACHER, who was recently appointed manager for the Chicago Electric Lamp Company, 136 West Lake Street, Chicago, was formerly employed with the United States Incandescent Lamp Company, the Westinghouse Lamp Company and the Sterling division of the General Electric Lamp Company.

E. I. VAN DOREN, who for several years past has been at 332 River Street, Troy, N. Y., with a line of electric motors and supplies, announces the opening of his new ground-floor store, "The Edison Shop," on or about Nov. 9 at 81 Fourth Street, where he will offer a new and varied line of electric motors, "Mazda" lamps, heating devices, etc.

THE HABIRSHAW ELECTRIC CABLE COMPANY has rented two buildings in Yonkers, which it is equipping with machinery to take care of government work, particularly the manufacture of outpost wire. The government is asking the wire industry to turn out 65,000 miles of this outpost wire a month. Present manufacturing facilities are inadequate, particularly in braiding machines, to meet entirely the demands of the government, and additional machinery such as is being provided by the Habirshaw company will be necessary.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, automobile equipment department, announces that on Dec. 1, it will close its Indianapolis office, at 512 Merchants' Bank Building, until after the war. The business for both the Indianapolis and Chicago districts will be handled out of Chicago. The automobile equipment department's office will be combined with the general offices of the company in the Conway Building, Clark and Washington Streets, Chicago. Prescott C. Ritchie, at present in charge of the Indianapolis office, will take charge of the office in the new location. In addition to soliciting equipment business for passenger cars and trucks, arrangements are being made to give special attention to the tractor field.

THE WETMORE-SAVAGE COMPANY, electrical jobber, Boston, is sending a neat leaflet to the trade pointing out the difficulties which must be overcome in order to render the best possible service in the face of the labor shortage resulting from the entrance of employees into the army and navy. Forty-four of the company's staff are now in the national service, as indicated in a border of service stars printed on the leaflet. The company calls attention to the spirit in which these employees quit their homes and their civilian work and to the earnest efforts of those who have taken up their duties during their absence to become acquainted with the individual needs of their customers. The patience and consideration of the trade are urged in cases where delays or other annoyances arise from the absence of regular staff members, and constructive criticism is welcomed. The fact that Uncle Sam has "the right of way" in materials, transportation and in everything that can help crown the Allies' efforts with victory, is also noted as a reason for temporary inconveniences. In manly fashion the bulletin emphasizes the company's intention to do its best for the trade, pointing out that if shipments are delayed or if mistakes sometimes occur, those whose skill and experience could have prevented these things are now fighting our battles for us across the water. The coöperation of the trade is cordially sought in meeting the present difficult situation.

THE CHICAGO PNEUMATIC TOOL COMPANY announces the appointment of A. M. Brown as district manager of sales, 1740 Market Street, Philadelphia, succeeding G. A. Barden, who remains in Philadelphia as sales representative for the company. For some time past Mr. Brown has been stationed in the New York offices of the company as assistant manager of the compressor sales division

THE NATIONAL ELECTRIC & WELDING COMPANY, 90 West Street, New York, has been appointed New York sales agent for the C & C Electric & Manufacturing Company and has also been appointed Eastern sales agent for the Wesche Electric Company of Cincinnati. The personnel formerly connected with the New York sales office of the C & C Electric & Manufacturing Company is now handling both C & C and Wesche machinery, the lines of apparatus having been extended to include alternating-current and direct-current equipment, arc welders, etc.

Trade Publications

LIGHTING PLANTS.—Illustrations and descriptions of a light and power plant suitable for foreign markets are given in a two-color folder of the Essandee Corporation, 39 South La Salle Street, Chicago.

MOTORS.—The methods of merchandising Phoenix motors are told in a circular of the Phoenix Electric Company which contains pictures of a number of applications to which these motors have been put.

COMPRESSORS.—In bulletin C-5 portable and stationary air compressors equipped with economical oiling systems are described, illustrated and priced by the Curtis Pneumatic Machinery Company of St. Louis.

FUSES.—The M. B. Austin Company, 700 West Jackson Boulevard, Chicago, has issued a broadside in red, white and blue telling of the installations of its fuses in shipyards, munition plants and other large industrial institutions.

WASHING MACHINES.—A bulletin has been issued by the Oshkosh Washing Machine Company, Oshkosh, Wis., showing the parts of a machine disassembled. This is to aid dealers in ordering repair parts or making slight adjustments.

REFLECTORS.—Many styles of interchangeable steel reflectors, holders, sockets, covers and clamps for different kinds of industrial lighting with 100-watt type "C" lamps are illustrated in a folder from Harvey Hubbell, Inc., of Bridgeport, Conn.

CHAIN DRIVES.—A silent drive for textile mills is illustrated and described in "A Chain of Evidence," publication No. 13 from the Morse Chain Company of Ithaca, N. Y. Front-end drives for automobile engines are also described with illustrations in another publication.

VACUUM PUMPS.—Bulletin No. 107 of the J. P. Devine Company, Buffalo, N. Y., illustrates and describes dry vacuum pumps of the rotary and slide valve types, together with wet vacuum pumps, jet condensers and complete drying outfits for industrial and laboratory use.

COPPER PRODUCTS.—The uses of its blue vitriol in electric batteries of the "gravity" type in wire mills, etc., and other of its copper products are briefly mentioned in a recently issued booklet of the Nichols Copper Company, 25 Broad Street, New York City.

INDICATING INSTRUMENTS. — The Esterline Company, Indianapolis, has issued a folder illustrating and describing type "W" duplex instruments which are combinations of ammeters and voltmeters or wattmeters and ammeters or voltmeters in a single case.

SEARCHLIGHT.—A number of two-color folders have been issued by the F. W. Wakefield Brass Company of Vermilion, Ohio, describing the "Red-Spot double-duty searchlight," the light of which can be converted from an ordinary white beam into a red danger signal.

ELECTRIC POLISHING AND GRINDING.—Motor-driven machines for polishing and grinding on both direct-current and alternating-current circuits are described and illustrated in a sixteen-page booklet issued by Roth Brothers & Company, Adams and Loomis Streets, Chicago.

FUSES.—The "Trico" renewable cartridge fuse is illustrated and described in a circular of the M. B. Austin Company of 700 West Jackson Boulevard, Chicago.

SWITCHES.—Preventing accidents that delay production by means of "Square D" steel inclosed switches is the subject of a folder issued by the Square D Company of Detroit, Mich.

GROUNDING APPARATUS.—The Paragon Electric Company, Old Colony Building, Chicago, has issued a twenty-four-page booklet giving engineering information on grounding for telephone systems, telegraph systems, railway signal installations, lighting and power circuits and trolley circuits.

MARINE LIGHTING AND SIGNALING APPARATUS. — Additional information sheets and a new price list for insertion in its marine lighting and signaling apparatus catalog are being mailed by the Benjamin Electric Manufacturing Company, 806 West Washington Boulevard, Chicago.

MOTORS.—A catalog published in Spanish is being issued by Roth Brothers & Company, Adams and Loomis Street, Chicago. It illustrates and describes in detail the construction of the company's motors and generators for direct-current circuits and discusses the application of the motors to the more common machine tools. Motor-generators and alternating-current motors are also listed.

DIRECT LIGHTING. — The National X-Ray Reflector Company, Chicago, has published catalog No. 21, describing its direct lighting reflectors. This catalog covers all X-ray reflectors for industrial, flood, show-window and showcase lighting. In order to observe the government's regulations on paper conservation there has been no general mailing of this catalog. It is being sent only upon request.

ENGINEERING SERVICES.—The consulting engineering firms of Charles L. Pillsbury Company, Minneapolis, and Vaughn & Meyer, Milwaukee, have issued a 130-page booklet to point out the advantages of consulting engineering services. The booklet covers the following functions of the consulting engineer: Preliminary conferences, preliminary survey, designs, technical conferences, plans and specifications, business conferences, supervision, tests, accounting, completion, inspections and miscellaneous.

New Incorporations

THE RELIABLE ELECTRIC PLATING COMPANY of West Orange, N. J., has been chartered with a capital stock of $50,000 by Joseph Danbeck, Helen Danbeck and Adolph Danbeck, all of West Orange, N. J.

THE ELECTRIC TRANSPORT COMPANY of New York, N. Y., has been incorporated by J. C. Norris, R. Sugden and W. A. Anderson. The company is capitalized at $100,000 and proposes to manufacture motor-driven conveying equipment, underground carriers, etc.

THE LINCOLN METER COMPANY of Toronto, Ont., Can., has been incorporated with a capital stock of $100,000 to manufacture electric meters, electrical machinery, devices, etc. The incorporators are Edwin G. Long, corner Bay and Melinda Streets; Harry S. Sprague, Albert Means, and others.

THE ARCWELL CORPORATION OF CANADA of Toronto, Ont., has been incorporated by Arthur L. Reid, 1126 Traders' Bank Building; William W. Perry, Charles H. C. Leggott and others. The company is capitalized at $1,000,000 and proposes to manufacture electrical machinery, generators, storage batteries, appliances, etc.

THE NAGARA FALLS (N. Y.) POWER COMPANY has been incorporated with a capital stock of $26,000,000 by F. Chormann, N. Biddle and E. D. Adams, 71 Broadway, New York, N. Y. The company is a consolidation of the Cliff Electrical Distributing Company, the Niagara Falls Power Company and the Hydraulic Power Company of Niagara Falls.

THE ELEVATOR ENGINEERING COMPANY of New York, N. Y., has been incorporated with a capital stock of $25,000 to manufacture elevating and conveying systems for handling coal, sand, grain or other bulk commodities. The incorporators are W. Valis, 2023 Washington Avenue; H. Pearsall, 315 East 175th Street, and A. S. Mayer, 208 East Tremont Street, New York City.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

BRISTOL, ME.—Plans are being considered by the Village Improvements Associatiin for lighting the streets by electricity. The Lincoln County Power Company of Damariscotta supplies electrical service in Bristol.

SKOWHEGAN, ME.—The Central Maine Power Company, it is understood, will take over the pulp mill of the Skowhegan Pulp Company about Jan. 1. The power company, it is reported, will install electric generating equipment in the basement of the building to supplement its hydroelectric power at this point.

LACONIA, N. H.—The Laconia Gas & Electric Company has purchased the water rights at Profile Falls, near Hill, for the purpose of establishing a hydroelectric plant. Surveys have been made and plans prepared for developing the power at the falls and transmitting it to Laconia. Nothing, it is understood, will be done in regard to the project until after the war.

METHUEN, MASS.—The City Council is considering the installation of additional street lamps in different sections of the city. Street-lighting service is supplied by the Lawrence (Mass.) Gas Company.

SALEM, MASS.—The State Gas and Electric Light Commission has granted the Salem Electric Lighting Company permission to issue $113,050 in additional capital stock.

SPRINGFIELD, MASS.—Congress has been asked for an appropriation of $35,000 for the construction of an aërial tramway, a target house and a storehouse at the Springfield Armory.

EAST HAMPTON, CONN.—Plans have been prepared by the Central Connecticut Power Company for the construction of an addition to its power station at Leesville on the Salmon River. Jenks & Ballou, 735 Grosvenor Building, Providence, R. I., are engineers.

STAMFORD, CONN.—The entire power plant and a section of the works of the Waterside Mills were recently deslroyed by fire, causing a loss of about $100,000. The company, it is said, will rebuild at once.

Middle Atlantic States

BUFFALO, N. Y.—Plans have been completed by the Pierce Arrow Motor Car Company for the construction of testing works, reassembling plant and boiler house on the Niagara River Road at Tonawanda.

BUFFALO, N. Y.—Revised plans are being prepared for the construction of the proposed charging plant of the Prest-O-Lite Company to be located at Colgate Avenue, Hopkins and Tifft Streets. The plans provide for the erection of four one-story buildings.

BUFFALO, N. Y.—Work is progressing rapidly on the construction of the new factory and power plant of the General Electric Company of Schenectady, to be located on Fillmore Avenue. The cost of the work is estimated at about $200,000.

HERKIMER, N. Y.—Arrangements are being made by the Municipal Commission for the erection of an addition to the municipal boiler plant, to cost about $50,000. H. B. Smith, Clarendon Building, Utica, is architect and engineer for the commission.

NEW YORK, N. Y.—Plans have been filed by the United Electric Light & Power Company, 130 East Fifteenth Street, for the erection of a new power station, screen and well house. Contract has been awarded to the Kenwell Contracting Company, 841 Broadway.

NEW YORK, N. Y.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning to install coal and ash-handling equipment, to cost about $80,000 (Specification 3607); the installation of two electric traveling cranes, to cost about $12,000 (Specification 3609); extension to fire protection system at section base, to cost about $5,000 (Specification 3591), and to rebuild shipway No. 1 at a cost of about $400,000 (Specification 3590).

ROCHESTER, N. Y.—The Construction Division of the War Department, Washington, D. C., contemplates the construction of hospital buildings at Expedition Park, to cost about $200,000.

WESTCHESTER, N. Y.—The Construction Division of the War Department, Washington, D. C., contemplates the erection of hospital buildings at Westchester, to cost about $250,000.

DOVER, N. J.—The Radium Luminous Material Corporation of Boonton has awarded a contract to the New Jersey Power & Light Company for additional electric power to increase operations at its plant.

ELIZABETH, N. J.—The Elizabethtown Water Company is negotiating with the State Board of Conservation and Development for permission to erect a motor-driven pumping station above the Landing Bridge in the vicinity of Milltown, to cost about $150,000.

HOBOKEN, N. J.—A portion of the plant of the F. J. Rooney Lamp Company, Thirteenth Street and Willow Avenue, was recently destroyed by fire, causing a loss of about $8,000. The company manufactures electric bulbs for the government.

MAY'S LANDING, N. J.—Contract has been awarded to Cramp & Company, Denckla Building, Philadelphia, Pa., for the construction of an electric power plant at the shell-loading plant at May's Landing. The plant will consist of twelve units to form the main works and will be operated by the Bethlehem Loading Company, a subsidiary of the Bethlehem Steel Company.

NEWARK, N. J.—The Rubber & Celluloid Products Company, Wilson Avenue, is planning to rebuild its plant, recently destroyed by fire. The loss is estimated at about $100,000.

NEWARK, N. J.—Plans have been filed by Baker & Company, 54 Austin Street, for the construction of an addition to the engine room of their power plant, 24 ft. by 37 ft., at 416-18 New Jersey Railroad Avenue, to cost about $8,400. Contract has been awarded to Fred Kilgus, 13 South Sixth Street.

ELDERSVILLE, PA.—Contract has been awarded by the Superior Coal Company to the McDonald (Pa.) Electric & Fixture Company for the installation of an electric lighting system in its new town near Eldersville. The contract includes wiring all the houses, finished and under construction, of the Superior company for electricity. Thirty street lamps will be installed.

HAZLETON, PA.—The Cranberry Coal Company has nearly completed an electrical installation at the Cranberry mine, at a cost of nearly $1,000,000.

MARKLETON, PA.—Plans are under consideration for the installation of a new heating system in the local United States hospital building.

PHILADELPHIA, PA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning to install mechanical stokers at the local navy yard, to cost about $51,000 (Specification 3586).

PHILADELPHIA, PA.—Plans are being considered by the William Cramp & Sons Ship & Engine Company, Beach and Palmer Streets to erect a new engine house, 306 ft. by 400 ft., to cost about $100,000.

PHILADELPHIA, PA.—Work has begun on the erection of the proposed new boiler plant at the works of the Baugh & Sons Company, 20 South Delaware Avenue. The cost is estimated at $20,000.

PHILADELPHIA, PA.—A section of the main power house at the Frankford Arsenal was recently destroyed by fire, including the coal-conveying system. It is understood that it will be rebuilt at once.

PHILADELPHIA, PA.—Plans have been prepared by the Philadelphia Rapid Transit Company, 810 West Dauphin Street, for the installation of two new electrically operated cranes and for other alterations and improvements in its repair shop at Frankford Avenue and Bridge Street. The cost of the entire work is estimated at $45,000.

PITTSBURGH, PA.—The West Penn Power Company has engaged Sanderson & Porter, 52 William Street, New York, N. Y., as designing engineers and to supervise the construction of its proposed power plant at Springdale, to cost $5,000,000. The government has advanced $2,000,000 for the project.

BALTIMORE, MD.—Contract has been awarded by the Baltimore & Ohio Railroad, Company to W. Dwyer, Second National Bank Building, Cincinnati, Ohio, for construction of engine house and shop at Keyser, W. Va., to cost $200,000 and for an engine house at Clarksburg, W. Va.

BALTIMORE, MD.—The Mount Vernon-Woodberry Mills, 506 Continental Building, has awarded general contract for construction of power house, 40 ft. by 100 ft., to Gladfelter & Chambers, Thirty-sixth Street and Roland Avenue, Baltimore. Plans were prepared by Joseph Evans Sperry, Calvert Building, Baltimore.

ELKINS, W. VA.—Contract has been awarded by the United States Railway Administration to the Price Construction Company, Maryland Trust Building, Baltimore, Md., for the construction of railway shops in Elkins for the Western Maryland Railroad Company, to cost about $500,000. H. R. Pratt, Continental Building, Baltimore, is engineer.

SOUTH CHARLESTON, W. VA.—Steps have been taken by local business men to organize a company to establish and operate an electric light plant in South Charleston and surrounding communities. Electrical service is now furnished from the plant of the West Virginia Water & Electric Company of Charleston.

SWISS, W. VA.—The Kanawha Collieries Company, Charleston National Bank Building, Charleston, it is reported, would like to receive prices on equipment for power plant at its local mines.

NORFOLK, VA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., contemplates the installation of mechanical stokers at the local navy yard, to cost about $24,000.

WASHINGTON, D. C.—Plans are under consideration by the Construction Division of the War Department, Washington, D. C., for the construction of an emergency hospital, to cost about $1,000,000.

WASHINGTON, D. C.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of an emergency hospital, to cost $300,000, to the Turner Construction Company, Twenty-third and B Streets, Washington.

North Central States

DETROIT, MICH.—Plans are being prepared by the Detroit Copper & Brass Rolling Mills for an addition to its plant, to cost about $50,000.

DETROIT, MICH.—Plans, it is reported, are under consideration by the Packard Motor Car Company, Boulevard and Belt Line, for the construction of an erecting plant and an enameling plant, to cost about $700,000 and $75,000, respectively.

ISHPEMING, MICH.—Plans are under consideration by the Cleveland-Cliffs Iron Company of Ishpeming for the construction of two electric power plants, to be located at its works at Ishpeming and Republic.

LANSING, MICH.—The entire plant of the Olds Motor Works will be devoted to aircraft production and the manufacture of Liberty motors. The cost of converting and equipping the plant for the work is estimated at $1,250,000.

PORT HURON, MICH.—Bids will be received by the City Commission, City Hall, Port Huron, until Nov. 20 for furnishing pumping equipment, including two motor-driven centrifugal pumps, each of 6,000,000 gal. capacity in twenty-four hours, one 24-in Venturi meter with indicator, register and recorder, water valves, valves and pump fittings, etc. Lorrain C. Elliott is city clerk.

RAVENNA, MICH.—Plans are under consideration for the installation of a small electric light plant in Ravenna next spring. C. E. Alberts is interested.

CLEVELAND, OHIO—Contract has been awarded by the Cleveland Welding & Manufacturing Company to the Hunkin-Conkey Construction Company of Cleveland for the construction of a new power house, 80 ft. by 100 ft.

LORAIN, OHIO—Plans have been prepared by L. G. Findlay, engineer, 503 Union Building, Cleveland, for the construction of a chemical plant, consisting of six one-story and two-story buildings in Lorain, for the Cleveland Salt Company, 5912 Central Avenue, Cleveland. The cost is estimated at about $200,000.

BURGIN, KY.—The proposal to install a municipal electric light plant in Burgin will soon be submitted to the voters. S. D. Ison is city clerk.

LOUISVILLE, KY.—The Louisville Gas & Electric Company is contemplating extensions and improvements to its plant to enable it to supply energy for war industries.

LOUISVILLE, KY.—Plans are under consideration by the Gordon-Miller Coal & Coke Company for the erection of a power plant and to install electrically driven machinery.

SMITH'S GROVE, KY.—The Smith's Grove Light & Ice Company has erected a high-tension transmission line to Bowling Green, and has contracted with the Kentucky Public Service Company for electricity to operate its system. The local generating plant of the company has been dismantled.

EAST CHICAGO, IND.—The International Lead Company is contemplating the construction of a new pumping station and boiler plant at its local plant, to cost about $20,000. Bids, it is understood, have been received for the works.

LOGANSPORT, IND.—Contract will soon be awarded by the Logansport Heat & Power Company for the erection of a high tension transmission line to supply electricity for lamps and motors in the towns of Winamac, Royal Center and Star City. The cost of the improvements to the plant and construction of transmission line is estimated at $75,000. The line is to be completed by Jan. 1, 1919. F. L. Good is manager.

PEORIA, ILL.—Extensions and improvements are being made to the plant of the Holt Manufacturing Company, including the installation of a power plant.

PEORIA, ILL.—The Central Illinois Light Company and the Canton (Ill.) Gas & Electric Company have petitioned the Public Utilities Commission for permission to connect their lines.

APPLETON, WIS.—Plans are being prepared by Arthur J. Sweet, engineer, Palace Theater Building, Milwaukee, for extensions to the street-lighting system.

CLINTONVILLE, WIS.—The Clintonville Power Company has been organized by interests connected with the Topp-Stewart Tractor Company of Clintonville to take over the new hydroelectric power plant under construction at Heyman Falls on the Embarrass River. The company will supply electricity for industrial and domestic purposes. Levi C. Larson, Dr. Charles Topp, L. Cole, H. F. Zarling and Frank Buchholtz of Clintonville, and others, are interested in the company.

SUPERIOR, WIS.—The United States Steel Corporation is reported to be considering the construction of four fabricating plants in Superior, to cost about $15,000,000.

ST. PAUL, MINN.—Bids, it is reported, are being received by H. P. Smith, president of the Northern Pacific Benefit Association, 203 Railroad Building, St. Paul, for the construction of a hospital and power plant, to cost about $300,000.

MAQUOKETA, IOWA—At an election held recently the proposal to issue $65,000 in bonds for the installation of a municipal electric light plant was carried.

INDEPENDENCE, MO.—The Independence Airless Company is planning to equip a plant for the manufacture of airless inner tubes and is reported to be in the market for machinery, motors, boilers, vulcanizers, engine, etc.

JOPLIN, MO.—The new-250-ton milling plant of the Bankers' Mining Company, now in course of erection at its properties near Bell Center, will be equipped with electrically operated machinery.

KANSAS CITY, MO.—Plans are nearly completed and bids will soon be asked for the construction of children's building, laundry, garage and power house building for the children's home at Sixty-eighth Street and Troost Avenue, owned by the House of the Good Shepherd. H. F. Hoit, 315 East Tenth Street, Kansas City, is architect.

ST. LOUIS, MO.—Contract has been awarded by the Oliver Electric Manufacturing Company to Amber & Zimmerman, 1228 Pine Street, for the construction of a new plant, to cost about $45,000.

ST. LOUIS, MO.—Plans have been prepared by G. P. Wuest, architect, Wainwright Building, for the erection of a laboratory building, 60 ft. by 100 ft., for the Pan Electric Manufacturing Company, 735 South Fourth Street.

MUNICH, N. D.—The Dakota Valley Engineering Company of Valley City has been awarded contract for the installation of an electric light system in Munich. The plant will be installed this fall.

LIBERTY, NEB.—Plans are under consideration by the town officials for the erection of an electric transmission line to Pawnee City to secure electricity to operate the local system. L. E. Baldwin is engineer of the municipal system.

OMAHA, NEB.—Bids, it is reported, are being asked for electric wiring, plumbing and other sub-contracts for the new packing plant of the Skinner Packing Company, to be erected in South Side. The cost of plant is estimated at $1,500,000. Collins Brothers, Rialto Building, Kansas City, Mo., have the general contract.

DORRANCE, KAN.—The proposal to issue $10,000 in bonds for improvements to the municipal electric lighting system will be submitted to the voters.

HUTCHINSON, KAN.—Contract has been awarded by the Barton Salt Company of Hutchinson to the Stamey-Mackey Construction Company for construction of additions to its plant, including coopershop, evaporator room, boiler room and installation of two Stirling boilers. The cost of the work is estimated at $50,000.

LURAY, KAN.—Preparations are being made for the installation of a municipal electric light plant. George H. Wells will have charge of the plant.

Southern States

ATLANTA, GA.—The Southern Iron & Equipment Company, Grant Building, Atlanta, it is reported, would like to receive prices on a 140-hp. to 175-hp. oil or Diesel type engine directly connected to a three-phase, 60-cycle, 220-volt generator; higher voltage could be used. Also an 80-hp. to 90-hp. oil or Diesel type engine suitable to connect to generator.

SPRINGFIELD, GA.—Surveys are being made of the local creek with a view of developing the water power and supplying electricity to the city of Springfield and to industrial plants. R. M. Davison and others are interested.

SUMMERVILLE, GA.—Steps have been taken to organize a company to establish an electric light plant in Summerville. The company will be known as the City Light & Power Company and is to be capitalized at $7,500. Work, it is understood, will begin at once on the installation of the system. John D. Taylor, president of the Summerville Cotton Mills, is interested in the project.

CUTLER, FLA.—The War Department, Washington, D. C., is planning to erect two additional units at the army aero gunnery school, for which $650,000 has been appropriated.

PENSACOLA, FLA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is contemplating an expenditure of $180,000 for housing personnels (Specification 3534).

MONTGOMERY, ALA.—The property of the Montgomery Light & Traction Company, including the electric lighting plant and street railway system, it is reported, has been purchased by Isadore Newman & Sons of New Orleans, La. Improvements involving an expenditure of about $250,000 to the street railway, etc., it is understood, are contemplated by the new owners.

WAYNE, ALA.—Improvements are contemplated to the municipal electric light plant involving an expenditure of about $25,000. Post office address, R. F. D. Dixons Mills.

LAMBERT, MISS.—The Council has granted the Quitman Light & Power Company of Marks a franchise to supply electricity in Lambert for a period of twenty-five years.

TUTWILER, MISS.—The proposal to issue bonds for the installation of a municipal electric light plant will soon be submitted to the voters.

HAVANA, ARK.—Kyle & Company, it is reported, are planning to install an electric light plant to supply electricity for lighting the city.

NEW ORLEANS, LA.—The War Department is reported to be considering a chlorine plant in New Orleans to manufacture poison gas for shells and bombs, to cost about $10,000,000. For further information address Major H. H. Hanson, Chemical Welfare Service, care of Mayor Behrman, New Orleans.

SEMINOLE, OKLA.—Arrangements have been made by the city officials with the Ada Electric & Gas Company for furnishing electrical service in Seminole. Work will soon begin on the erection of the transmission line.

SAN ANGELO, TEX.—C. C. McBurnett is reported to be considering the construction of an electric plant, to cost about $12,000, for the Angelus Hotel.

Pacific and Mountain States

SEATTLE, WASH.—The Forest Service has granted the American Nitrogen Products Company, Securities Building, Seattle, a preliminary permit for the location of power sites on the Sauk and Suittle Rivers, tributaries of the Skagit River, in western Washington. The company operates a nitrogen products plant at La Grande.

SEATTLE, WASH.—A preliminary permit has been granted the Sound Power Company, a subsidiary of the Sound Paper Company, both of New York, N. Y., for the development of power in the National Forest Reserve in western Washington. H. O. Pond of New York, N. Y., is president of the company.

PORTLAND, ORE.—A site of 32 acres has been purchased at Wilbridge station, on the Columbia River, on the outskirts of Portland, by the Pacific Steel Company, on which it proposes to erect a steel plant. The equipment will include two open-hearth furnaces of 40 tons capacity each and two rolling mills. The plant will be equipped with electrically operated machinery. Energy for operating the proposed plant will be purchased. J. P. English is manager. The office of the company is located in the Northwestern Bank Building, Portland.

TILLAMOOK, ORE.—The Great Power Company of Tillamook will soon place in operation a 20-mile electric transmission line from Tillamook to Brighton. This line will supply electricity to operate the planing mill of the Brighton Mills Company.

CAMP KEARNEY, CAL.—The Construction Division of the War Department, Washington, D. C., is considering an addition to Camp Kearney, consisting of barracks, mess halls, hospital, etc., to cost about $2,000,000.

LOS ANGELES, CAL.—Work has begun on the installation of machinery in the municipal power plant just below the Haiwee reservoir. The plant will have an output of 1600 hp. and will be tied into the Owens Valley power system, now supplying energy to Independence, Lone Pine and the mines and soda industries on the shores of Owens Lake. It is expected to have the plant in operation by Jan. 1, 1919.

ONTARIO, CAL.—Plans are being prepared for the erection of a power house in the San Antonio Canyon above Hogsback for the Ontario Power Company, to cost about $60,000. Glenn D. Smith is general manager.

SAN DIEGO, CAL.—Plans are under consideration by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for additional buildings at the Naval Air Station, to cost about $410,000 (Specification 3611).

STOCKTON, CAL.—Contract has been awarded by the Stockton Wool Scouring Company to the Western States & Electric Company for furnishing electricity to operate its plant. The contract is for a period of five years, and about 150 hp. in motors will be required. The company now uses steam power.

PHOENIX, ARIZ.—Plans are under consideration by the Salt Water Valley Users' Association of Phoenix for the installation of 60 electrically operated pumping plants in the Salt River Valley section. W. R. Elliott is manager.

WHITEFISH, MONT. — Contract has been awarded by the Great Northern Railway Company to the Mountain States Power Company of Big Fork for furnishing electricity to operate the turntable at its local roundhouse.

Canada

SYDNEY, N. S.—The Dominion Iron & Steel Company of Sydney has awarded contract for construction of engine house, to cost $80,000, to Chappell Brothers & Company, Brookland Street.

COLLINGWOOD, ONT. — The Hydro-Electric Commissioners are considering an extension of the hydroelectric transmission line to Nottowa and installing an electric lighting system there. H. A. Currie is chairman of the commission.

GREAT FALLS, ONT — The Great Northern Railway Company is considering improvements to its local yards, including the erection of new shops, to cost about $250,000. A. H. Hogeland of St. Paul, Minn., is chief engineer.

TRENTON, ONT.—The British Chemical Company is planning to rebuild its plant, recently destroyed by fire. The loss is estimated at about $175,000.

WAPELLA, SASK.—The construction of an electric light plant, to cost about $50,000, is under consideration. W. P. McDonald is reported interested in the project.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until Nov. 21 for machine-shop equipment, copper, yellow metal, bell metal, solder, tin, electrical supplies and fixtures, etc. Blanks and further information relating to this circular (1238) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York City; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal

Record of Electrical Patents

Notes on United States Patents

1,279,994. Transformer; Walter M. Dann, Wilkinsburg, Pa. App. filed Sept. 10, 1915. Means in shell-type transformer for ventilating core members by directing cooling air currents thereupon during operation.

1,279,997. Arrangement for Automatically Regulating the Advance of the Spark in Explosion Motors; Auguste Dutreux, Issy les Moulineaux, France. App. filed Dec. 6, 1916. Employment of exciting current of dynamo for controlling advance of spark enables centrifugal speed regulator ordinarily employed to be dispensed with.

1,280,007. Phase Converting and Balancing System; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed Sept. 28, 1917. When single-phase circuit is energized from polyphase circuit load is uniformly distributed over the different phases of polyphase circuit.

1,280,016. Sanitary Telephone Attachment; Gerhardt E. Grimm, Collingswood, N. J. App. filed Jan. 2, 1917. Cannot be accidentally knocked from position, and is provided with removable antiseptic diaphragm.

1,280,018. Electric Snap Switch; Monroe Guett, Hartford, Conn. App. filed Feb. 27, 1918. Toggle operates roller contact.

1,280,029. Anti-Overheating Device; John H. Hickey, San Francisco, Cal. App. filed Dec. 13, 1917. Excessive heat from coil of electric iron melts fusible connection and prevents burn-out.

1,280,034. Flasher; Fred Hotchner, San Francisco, Cal. App. filed Feb. 7, 1917. Can be set up in shop and tested, then dismounted and shipped without disturbing position of leads to fuse blocks within flasher box.

1,280,040. Induction Motor; Oliver S. Jennings, Wilkinsburg, Pa. App. filed June 30, 1915. Provides means whereby speed may be varied in simple and economical manner, with but few lead wires.

1,280,052. Therapeutic Instrument; Tiodolf Lidberg, Chicago, Ill. App. filed Dec. 18, 1916. Has a heat-responsive, current-controlling regulator and a graduated temperature indicator.

1,280,076. Multiple-Switch Starter; Alexander H. Olmsted, Bowden, and Lawrence Boothman, Stratford, England. App. filed Dec. 4, 1913. Each switch mechanically interlocked with next in such manner that switches cannot be closed except in predetermined sequence and will open only in inverse order.

1,280,096. Automatic-Telephone System; Alton E. Stevens, Providence, R. I. App. filed Jan. 17, 1916. Several stations may be electrically united for intercommunication, secrecy is secured, power may be supplied to entire system for communicating and ringing purposes by one common battery, and all stations may be automatically and simultaneously signaled from any station.

1,280,097. Automatic-Telephone Substation Mechanism; Alton E. Stevens, Providence, R. I. App. filed April 21, 1917. To reduce to minimum the manual movements required in making telephone connection to desired station, to compel the operator to use apparatus in way intended.

1,280,098. Locomotive; Norman W. Storer, Pittsburgh, Pa. App. filed May 25, 1914. Running gear embodies plurality of driving motors, field-magnet frames of which are rigidly secured between locomotive side frames to constitute permanent cross-ties, and armatures of which are carried in bearing housings which are detachably secured to side frames.

1,280,102. Interrupter and Spark Advancer for Internal-Combustion Engines; Auguste Dutreux, Issy les Moulineaux, France. App. filed Dec. 6, 1916. Applicable to all kinds of generators of electricity for ignition purposes or for ignition combined with lighting of vehicles or for starting internal-combustion motors.

1,280,105. Electric Igniter; Edmund J. Kane, Chicago, Ill. App. filed Feb. 2, 1910. To reduce wear and hammering of electrical make-and-break contacts and other parts of generator.

1,280,115. Casing for Pendent Switches and the Like; Charles J. Klein, Milwaukee, Wis. App. filed Aug. 26, 1912. Especially adapted for switch mechanism having a reciprocable operating member.

1,280,116. Rain Alarm; Louis T. Troiana, Port Washington, N. Y. App. filed Sept. 5, 1917. Pair of contacts spaced slightly apart and adapted to be bridged by adhesion of rain drops therebetween.

1,280,136. Rain Signal; Henry J. Blackmore, Indianapolis, Ind. App. filed Sept. 5, 1917. Balanced member adapted to receive rain water at one end thereof so that said end will be depressed to close an electric circuit and sound the alarm.

1,280,137. Rain Indicator; Henry J. Blackmore, Indianapolis, Ind. App. filed Aug. 7, 1917. Has means for draining water from water pocket after rainfall and cover-plate for device which in open position acts to increase flow of rain water into receptacle.

1,280,147. Combined Motor Starting and Releasing Mechanism for Alternating-Current Motors; Lynde Bradley and Harry L. Bradley, Milwaukee, Wis. App. filed Aug. 14, 1913. Adapted for use in connection with rheostat in controlling multiphase motors.

1,280,171. Secondary-Clock Mechanism; Charles M. Crook, Chicago, Ill. App. filed April 9, 1914. Minute hand locked so that it cannot move except when properly moved forward by clock mechanism.

1,280,172. Insulator Protector; Charles A. Culligan, Penniac, New Brunswick, Canada. App. filed Feb. 16, 1918. To protect mechanically insulators of aërial wires, while at same time insuring complete insulation of conductor to prevent loss of current.

1,280,213. Method of and Apparatus for Electroplating; Clarence A. Hach, Oak Park, Ill. App. filed Jan. 12, 1917. Hydrogen bubbles are carried away by air liberated in form of small bubbles directly under article being plated.

1,280,227. Safety Cut-Out for Incandescent Electric Lamps; Alfred W. Houchin, Kirkwood, N. J. App. filed April 29, 1917. When excessive current is supplied to lamp, circuit is cut out, thereby preventing filament of lamp from injury.

1,280,242. Circuit-Closer Device; Rudolph Kotkas, Portland, Ore. App. filed Nov. 20, 1917. For causing an alarm to be sounded should a person step upon floor under which alarm is placed.

1,280,249. Method of and Apparatus for Plating; George A. Landry, Chicago, Ill. App. filed Jan. 15, 1917. For controlling amount of metal deposited on different parts of surface of article being plated.

1,280,256. Ring-Back Arrangement for Telephone Party Lines; Fritz Lubberger, Chicago, Ill. App. filed Sept. 19, 1907. Relates to automatic or semi-automatic telephone-exchange systems in which plurality of subscribers' stations are located on one and the same line.

1,280,258. Call-Indicating System; Alben E. Lundell, New York, N. Y. App. filed Nov. 1, 1916. Means for informing final connecting operator of the number of wanted line by means of visual signals.

1,280,290. Electrical Heater for Carburetors; Thorwald B. Peterson, Omaha, Neb. App. filed Oct. 7, 1916. Readily attachable to bowl or float chamber of ordinary carburetor to heat quickly to boiling temperature oil contained in chamber, thereby facilitating starting engine in cold weather.

1,280,300. Flashlight Case; Adolph C. Recker, Oakville, Conn. App. filed March 6, 1918. Removable cap applied to inner end of case furnished with a glazed receptacle for reception of a game, photograph, compass, etc.

1,280,324. Automatic Telephone-Exchange System; Arthur B. Sperry, New York, N. Y. App. filed Nov. 26, 1917. Relates to trunking systems, and more particularly to two-way two-wire trunks.

1,280,370. Electric Pocket Lamp; Josef Beckmann, Frankfort-on-the-Main, Germany. App. filed Nov. 10, 1915. Light can be shaded or directed downward, so that it can be used to light the way or a map, etc., at same time preventing owner from being discovered.

1,280,374. Pencil-Lighting Attachment; Jerrell Bennett, Grapeville, Tex. App. filed March 23, 1917. Bulb is made to encircle pen, pencil or brush while pocket clip connects and disconnects battery and light.

1,280,380. Flashlight; Lester W. Borchert, Cleveland, Ohio. App. filed Jan. 26, 1918. Flat or boat-like member containing electric lamps and batteries and with transparent top portion through which light may pass in all directions for use at sea when launching lifeboats from a vessel to illuminate vicinity of vessel.

1,280,395. Universal Cord Circuits; Alva J. Carter, Chicago, Ill. App. filed June 6, 1914. Relates to telephone systems, in which universal cord circuits are provided for interconnecting telephone lines of different characters such as magneto and common-battery lines.

1,280,406. Ship's Navigating Apparatus; Edward W. Couchois, Mackinac Island, Mich. App. filed Dec. 29, 1916. Distance traveled by and course of ship is recorded and apparatus is under control of compass.

1,280,423. Synchronizing System; Amos Frederick, Newark, N. J. App. filed Nov. 2, 1914. Synchronism in multiplex telegraphy normally obtained by signal current reversals can be automatically maintained during non-signaling intervals.

1,280,431. Fuse-Clip Attachment; Alfred L. Eustice, Chicago, Ill. App. filed Sept. 9, 1914. Positive means for securing contact in preference to dependence upon resiliency of metal clips.

1,280,457. Hand Switch for Automobiles; Archer H. Harris, Barberton, Ohio. App filed Oct. 18, 1916. Headlights may be turned off or on by thumb of hand that switch is carried on.

1,280,471. Method of Apparatus for Treating Gases and Vapors Electrically; William T. Hoofnagle. Glen Ridge, N. J. App. filed Nov. 23, 1917. Intended particularly for treatment of air in production of nitrogen oxides.

1,280,478. Electrical Fuse; Bryson Horton, Detroit, Mich. App. filed June 9, 1914. Time taken for fuses to blow under overload conditions is determinate within close limits.

1,280,479. Combined Entrance Switch and Service Box; Bryson D. Horton, Detroit, Mich. App. filed Aug. 18, 1914. To insure proper metering and distribution of current without possibility of theft, by compact apparatus.

1,280,522. Combined Circuit Breaker and Alarm Switch; Gertrude B. Nixon, Bryn Mawr, and Harold L. Morris, Wayne, Pa. App. filed Jan. 8, 1918. Stops current flow in overheated appliance and rings alarm giving notice that attention is required.

1,280,547. Electric Switch; Arthur E. Read, New York, N. Y. App. filed July 21, 1917. Of one-push-button type; electrical contact is made and broken instantaneously with snap which obviates sparking and injury to terminals.

1,280,556. Telephonic Apparatus; Louis Scher, New York, N. Y. App. filed Nov. 7, 1916. Loud-speaking portable device which will enable persons with impaired hearing to use ordinary telephone.

1,280,560. Device for Treating Goiters; Henry L. Scholl, Watertown, Wis. App. filed Feb. 23, 1918. Ornamental necklace, chain, band, etc., generates voltaic currents in presence of mercurous iodide and calcium chloride, a saline or acid solution.

1,280,564. Protective Switch for Electric Flatirons; Samuel B. Shapiro, Newburgh, N. Y. App. filed Sept. 11, 1917. Will automatically cut off current when handle of iron or other devices is released by operator.

1,280,566. Apparatus for Transmitting Messages; John J. Sherry and John L. Du Frane, Oakland, Cal. App. filed Oct. 3, 1917. Repeats telegraphic or wireless message indefinitely after apparatus is set without human attention.

1,280,570. Telegraph or Like System; Sidney R. Smith, Liverpool, England. App. filed Feb. 7, 1916. Relates particularly to signal storing and transmitting apparatus for use, for example, in keyboard printing-telegraph systems.

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The World Unshackled

VICTORY has come to our armies and our ideals. The war against oppression and autocracy has been fought and won. It is well that we should shout and give full sway to our emotions, that we should glory in the result with exultation and great joy. But after the hoarseness has passed away and our ears have become attuned once more to normal sounds we should face the great problems of reconstruction and peace resolutely, soberly and patriotically. The world has been out of joint for so long that it will require all the skill that we possess to set it right again. There are governments to form, cities to build, wounds to heal and people to feed and clothe over there, while over here there are adjustments to make, labor to satisfy, industry to encourage, foreign trade to develop and returning soldiers to employ. Engineering skill devised the weapons of destruction, and the same skill can be employed to rear a better and more habitable abiding place out of the ruins. We have fought for ideals and conquered; let us now turn to their practical application.

The signing of the armistice Monday morning marks an epoch in history which will loom larger as the years pass by. We who have lived through the dark fifty months in which the very roots of civilization were threatened cannot yet realize how great is the day now dawning. We may well be proud of the splendid part which the United States, coming late on the stage, has played in the terrible drama. We can never forget that it was upon the rock of the American defense at Château-Thierry that the high water of the last great wave of Teutonic effort broke; yet we should be ungrateful indeed did we not remember the magnificent work which the American engineering forces did in the grim months that went before, and must still do, until the Rogues' March rings out over the unhallowed grave of ruthless autocracy. Their work in preparing the way for the great American field armies has not yet half been told, and they have been as ready with rifle as with axe and spade, for American engineers formed part of the forlorn hope, hastily gathered together, that stopped the gap in the Allied lines until Marshal Foch's reinforcements turned the tide.

The engineers have been in the forefront of the fighting, have built roads and railways under fire in the shell-torn fields, bridges in the face of hostile machine guns, and have followed the advance, building and fighting by turns, until the hour of victory. Nor is their work done, for in the tremendous task of reconstruction theirs will still be a conspicuous part. Save for the little force of regulars and marines sent over to carry the guidon of hope they were first in the field, and save for the Medical Corps they will probably be the last to leave. To those who return all honor is due; to those who have died on the field of glory no tribute is too high.

Unlike prophets, engineers are seemingly not without honor in their own country. Municipalities have named streets after their illustrious dead; but it remained for the Pacific Coast to call power houses after pioneers, engineers and designing geniuses, such as De Sabla, Drum and Wise. Now the government itself has added a hydroelectric plant in the Yosemite Valley and dedicated it to the memory of the late Henry Floy. What more fitting monument can an engineer ask?

Government Operation After the War

GOVERNMENT control of operation of the railroads, the telephone and the telegraph systems was intended to be essentially a war emergency measure. It was so recognized by Congress in the enabling legislation; it was so accepted by the responsible members of the President's Cabinet who are now administering these properties in connection with their regular duties. Under the act of Congress transferring control of the carriers to the government this status holds for twenty-two months after official declaration of peace. The control of the communication agencies lasts until formal ratification of peace. Unless, therefore, Congress should enact new legislation restoring these properties to their owners at an earlier day there will be a substantial interval during which the government departments will continue to operate them.

During the period, barely over, when the heightened activities of the nation were directed toward the one aim of righteous victory in the war every other public issue sank to relative insignificance. The Washington authorities let Congress and the country know that they felt that complete authority over railroad and wire communication facilities was essential to their successful conduct of the war, and promptly they were given what they asked. They have had the full benefit of the organization built up by the companies; they have had the loyalty which every good citizen gives unhesitatingly in the hour of his country's need in a right cause. In due time they will render to the public, by whose will they hold office, and to the owners and creditors whose properties they are managing a full account of their stewardship. From the fact that government control is to last so long after actual hostilities (unless Congress should decide otherwise) it is evident that the authorities will have abundant opportunity to try their hand under the simpler normal conditions of peace as well as under the feverish acceleration of war.

Efficiency is a question of management, of coöperation between forces. With the railroads the crucial test of efficiency under government operation centers on the thoroughness of coördination of all of the trackage, the motive power and the rolling stock and the economies thereby realized. Such coördination, to be really successful, should mean operation with better service for the same cost, operation with the same service for less cost, or operation with both better service and less cost than the railways operating independently of each other were able to or could achieve. It is less easy to point to the basic test of the value of government operation of communication lines, for the larger telephone facilities of the country were effectively welded into one harmonious whole under able private management. The telegraph facilities of course involved the element of competition between companies. Service and cost are, however, the determining factors.

As a fundamental national policy is involved it must be anticipated that the results of operation—financial, physical, public—of all of the properties put under government direction as a step in the mobilization of the national resources for war will be subjected to the closest scrutiny. If the problem is faced as an economic one, certainly politics merely for the sake of political advantage can have no just place in the consideration of this policy, personal ambitions or prejudices are unworthy elements, predetermined convictions as such are not valid evidence; it is what the facts reveal of success or failure under actual experience that is most likely to influence the future course of the country.

Whether there is or is not a shortage of electric power in the Philadelphia district is a determinable fact. In fairness and justice to the public utility, the city and the national government, this fact should be established by competent and unbiased authority and the controversy over the question ended. Crimination and recrimination ought not to be tolerated in the City of Brotherly Love.

An Engineer Defined

IN THE midst of the chaos of war engineers have been striving to establish professional order and system. The director of engineering for the United States Employment Service at Chicago has just braved tradition by defining anew the term "engineer." He offers for popular use a definition that is compact and apparently practicable: "An engineer is one who economically directs man power and by scientific design utilizes the forces and materials of nature for the benefit of mankind." In view of the confusion which exists as to the exact meaning of the term "engineer" and the attendant industrial and economic losses entailed by such confusion, the appearance of the new definition must be regarded as important. At any rate, it has the government's stamp of approval, and if it combines the scientific, artistic and professional ideals of the engineer, it deserves to stand.

Electrifying a State

IT IS very seldom that a deliberate effort is made to cover a large territory with a network for electrical transmission. Great systems as a rule do not grow up in an orderly way. They result from the pressure of necessity in linking together transmissions organized and developed independently. The time finally comes when united effort is desirable, and then by a similar process still other plants are linked to the growing system until a great stretch of territory is actually covered. A very excellent example of this process of growth is given in the account of the Connecticut transmission network, of which we present a map showing its present state. A glance shows that an immense deal has been accomplished, while still more remains to be done in the line of unification. The mode of development has left much to be desired in the matter of standard voltages. At present there is everything from low-voltage tie lines up to 66,000 volts, and sooner or later a voltage standard is due to arrive.

Connecticut transmission systems have their origin in the enterprise of the late A. C. Dunham of the Hartford Electric Light Company. That company grew and prospered and has become one of the very large utilities of the state. The United Illuminating Company, operating at Bridgeport and New Haven, is another important factor. The Connecticut Power Company, working from its hydroelectric plants in the northwestern highlands of the state, operates the only 66,000-volt transmission of the group. The Connecticut Light & Power Company in New Britain and Waterbury and the Shore Line Electric Railway Company make up the other chief elements, added to which are the distinctly electric railway systems of the Connecticut Company and the New York, New Haven & Hartford Railroad. These two last-mentioned plants are chiefly confined to their own particular work. In the northeastern section of the state a line crosses into Massachusetts and connects with the great system of the New England Power Company, while not far to the westward a connection from the Turners Falls Power & Electric Company reaches across the Connecticut line but is not yet tied in with the other systems. On the extreme east of the state is a connection with the Narragansett Electric Lighting Company of Providence, itself tied in with the New England Power Company to the northward.

A glance at the map shows the completeness of the linkage in the central part of the state, its wide ramifications to east and west and the places marked out by fate for further interconnection. The whole story is yet far from being told. The ultimate result must inevitably be further extension of the various lines into final electrical unity, enabling power to be passed around along the lines where it is most needed. This will imply extensions here and there, the tying together of existing lines at numerous places through frequency changers if need be, to take proper account of the railway plants, and finally a gradual standardization of the transmission voltages. The long main lines will work toward 66,000 volts; the lesser ones are likely ultimately to settle on a third or a half of this figure. There is no very general agreement as to the medium voltages most desirable to employ, while the higher ones are fairly well standardized. Voltage changes can be, and probably will be, made gradually, because it involves no great inconvenience to tie in through transformers of the necessary ratio, which sometimes serve a useful purpose as electrodynamic buffers in the distribution. It is a very instructive thing to look over the wealth of accomplishment thus shown in a single state and to speculate on how the whole network might look could it have been, with further foresight than is the common lot, developed from the start as a state-wide distributing network.

Small generating systems have more to gain through interconnection than many large central stations. In fact, the proverb "In union there is strength" is especially applicable to them. Super-stations, like strong nations, can usually stand alone. It is the weaker nations that seek alliances and support from their neighbors, and the added reliability of service secured by a tie line is of itself sufficient justification for the expense of joining two small stations together.

Treating Globes for Discoloration

THE brief paper by Alfred Herz in the current issue is of much more than passing interest since it involves, not cleansing in the ordinary sense, but remedial measures applied to a very curious result of ultra-violet radiation which happens to be of considerable importance in practice. This effect is the familiar discoloration of arc-lamp globes, especially those used on magnetite arcs, during service, resulting in a dull purplish tinge which is both objectionable in appearance and injurious to the light-transmitting power of the glass. Mr. Herz points out quite correctly the general conditions and their causes. All common glass is likely to be greenish owing to the presence of iron in the sand from which it is made. This iron has no useful function whatever and is tolerated in the glass simply because it is extremely difficult to find sand not discolored with iron, or white silica in any other form at any reasonable expense, so far at least as the coarser grades of glass are concerned. It has therefore been the practice for a long time past to correct or rather disguise this green coloration by the addition of manganese. Possibly Mr. Herz creates a slightly false impression by referring to the result as a thin black cloud. Generally speaking, there is no appearance of this kind perceptible, but the transmission coefficient of the glass is nevertheless reduced precisely as explained.

What actually happens is that the iron results in absorption in the green, to balance which more absorption is effected in the red and blue by the addition of the manganese. The glass appears perfectly clear, but slightly dull as compared with, for instance, a brilliantly clear piece of optical crown made in the first place from uncontaminated silica. Just how ultra-violet radiation acts upon the constituents of the glass is not fully understood, but it does bring out a perceptible discoloration such as that which might be produced by the manganese alone; in other words, it far over-compensates the green of the iron. This phenomenon is probably due to wave lengths less than about 310 $\mu\mu$. The magnetite-arc lamp, the commonest source of this discoloration, is very rich in such rays; the carbon arc, from which these effects were rarely obtained, is much less strong in this region, while sunlight is extremely weak here and produces the characteristic purplish color only after exposure under favorable conditions for many years. The discovery noted by Mr. Herz—heat treatment at 900 deg. to 1000 deg. C.—which removes this discoloration and restores the manganese compound to its original balance, is from a practical standpoint extremely important, for it saves otherwise perfectly good globes for a long-continued useful life. It seems likely that the discoloration is the more marked as the percentage of manganese added in compensation increases, and that some globes of recent manufacture are probably more susceptible to this sort of action than globes made when white sand was more easily obtainable. The whole story is a beautiful example of a peculiarly occult photo-chemical action and its reversal by a very simple and inexpensive heat treatment.

Experience seems to have sobered some of the leading men of the industry into that caution which is the parent of inaction. Receptiveness to new ideas and a welcome enthusiasm have ever been leading attributes of electrical men, and it is a tragic spectacle to witness how reluctantly some men adapt themselves to changed conditions. If materials are not to be had, substitutes ought to be found. Routine often prevents the exercise of that thought so essential to economy and progress.

Inspecting Electric Welds

THE rapidly increasing use of electric welding for all purposes is a striking recent development of engineering. In particular, the extensive use of welded joints in larger structural work promises to be of great importance. A welded joint when well made is extremely strong and reliable, but faults such as those which may be due to improper fusion, slag, porosity and crystallization are not obvious on the surface and make the inspection of such a joint a far more difficult matter, for example, than the critical examination of a riveted joint.

Among the various methods of inspecting them, O. S. Escholz in a recent article lays stress on careful visual examination backed up by chipping and calking trials as far as they can conveniently be applied, but he chiefly relies on the penetration tests with liquids. X-rays when very carefully worked give a good deal of valuable information, particularly on thin plates, but they are rather troublesome both to make and interpret. Tests of gas penetration are not easy to accomplish, but the liquid test appears to be a very easy and effective one, kerosene being the favorite medium, advantageously colored by oil soluble dyes. The oil goes rapidly into any capillary openings, and unless the weld is complete will almost invariably penetrate and stain the plate on the opposite side. Of course, isolated slag pockets or cavities cannot be run down in this simple way, which, however, gives in ordinary cases a most valuable and simple test of the perfection of the joint. Of the electrical tests Mr. Escholz has a rather poor opinion, owing to the extreme difficulty of conducting them which arises from the intrinsic difficulties of the experiments.

TO MEET THE LARGE REQUIREMENTS OF THE RECONSTRUCTION ERA, LABOR AND CAPITAL WILL HAVE TO CO-OPERATE WISELY

Electrical Industry in Reconstruction

Peace Means New Opportunities for Service in Different Branches of the Industry—Factors of Labor, Capital, Raw Materials and Markets, and Possibilities of Changes

WAR time has been a time of strain and trial in the different branches of the electrical industry, and peace is welcomed for business reasons after the glad rejoicing for humanitarian reasons. The essential characteristic of the industry as a whole is its steady progress under all conditions which can be expected to prevail normally, and the restoration of that predominant trait is confidently anticipated for the central stations with the return of peace and a settled status.

Whether or not there is to be an extended interval of uncertainty or serious hesitation time will give the best answer; but even in such an intermediate period electric service will be as indispensable as ever for light and power. Certainly the need that the world shall be reclothed and fed and otherwise generally provided for and given the opportunity to rebuild is a very keen one, reaching all quarters of the globe, and the orderly maintenance of industrial processes is required so that this end may be attained without social upheaval. Electric service has the adaptability that makes it the invaluable servant of all, and its power will energize the mighty forces of peace and reconstruction as it has skillfully accelerated those of war. No industry was more ready on the instant call to arms to divert its great strength of organization to the national interest; none is more ready to meet the new requirements which will come with peace. Even though this nation appears to lack the comprehensive governmental program which other countries have formulated for after-war problems, the central stations will fortunately be able to serve customers because their product is the same in all seasons and under all conditions.

What will be changed now or soon is the basic details of the system by which the service is furnished. There are four factors to deal with—labor, capital, raw materials, markets. With the first four of these the problem in all branches of the industry has been twofold, relating to both scarcity and cost. There has been no trouble about markets; the difficulty in most communities and companies was to produce enough energy and goods to meet the vociferous demands of customers. Freedom of markets has, however, been restricted somewhat by the war needs of the nation. Under the question of markets may also be placed the problems of rates or prices. That revisions are certain in these factors and in the resultant effect upon the various classes of properties in the electrical industry is as plain as that daylight follows the darkness of night.

Taking the central station as the accepted main barometer of the industry, the dispenser of the great volume of production whose steady increase means activity in all other branches, it can be seen that peace brings relief from heavy operating and managerial burdens. For the first time in the general history of the industry as a whole, the productive capacity of the central stations has been inadequate. And the companies, finding shortage of power supply imminent, have had to suspend solicitation of contracts, have abandoned or curtailed extensions, have in some cases given up their new-business departments altogether.

The war demand for power was greater than any peace-time demand since the industry was started. Never before this experience had the industry failed to anticipate with reasonable accuracy the development of the business of the communities about a year in advance. Not only did the urgent need for power for munitions and other national purposes call for new high levels of production, but the companies were also confronted by the fact that apparatus was scarce and carried an oppressive but inevitable war-time cost. Furthermore, they had to meet the condition that the government, having of course the first right to all manufacturing resources, had to divert those resources to the production of what it deemed to be in the paramount national interest and therefore purely local considerations had to be ignored. Under the conditions now developing the companies will be able to get apparatus and supplies to meet necessary requirements of expansion. Prices will be subject to readjustment as the world-wide economic situation justifies, lessened to some extent possibly by arbitrary price-fixing by the government.

The history of all commodity price movements teaches that after so great an advance as has been seen, stimulated by the stupendous needs of war machines, an inevitable reaction occurs. After so long a period as four years of high prices, however, some of the elements of high cost tend to become permanently stabilized, and in these circumstances, although some natural reaction takes place, it is less likely to go so far as to restore the old level. Without regard to the price level, it is evident that after the unparalleled destruction of property the entire world wants all possible mechanical helps to production. Since in the last analysis the human influence is definitely turned always to constructive policy, it cannot be doubted that the great needs which are to be filled will mean large-scale production in time. Whether that time is immediately or after the nations measure accurately the size of the stupendous task of reconstruction, this country is so vast in terms of raw materials and manufacturing resources that it is capable of continuing to render as fine service to a world recuperating from the wounds of war as it did by throwing its weight on the side of right and for humanity's welfare in the contest itself. We stand on the threshold of an era when apparatus, supplies, goods are insistently needed, although the price will have to be in keeping with the general level of commodity costs.

Having doubled their output in four years, having demonstrated to the public, to the authorities, to European engineers that their fundamental economic base of mass production is sound and still has enormous possibilities in application, the electric central stations are in excellent position to progress with the requirements of the industries which they serve. They will have to obtain capital, however, and if the drafts upon the world investment capital for war are found to have made funds too scarce and oppressively high in cost, they will welcome some form of government allocation of available money. Certainly their needs for legitimate community expansion, in view of their proved conservation of fuel and man power, are entitled to rank above indiscriminate uses of capital for purposes not directly connected with the real word requirements.

With attention centered on our uneconomic policy of recklessly spending coal reserves and wasting water-power supply, it can reasonably be forecast that hydroelectric development will be one of the significant features of the new era in the electrical industry. This development has long been retarded, but now the revelations of the war have shown the public of the folly of wasting resources.

Preparations of Manufacturers

BY A. W. BERRESFORD

President Associated Manufacturers of Electrical Supplies

POST-WAR problems are so enormous in possibilities and so varied in character that it is doubtful if they can be properly estimated. Certainly the making of definite plans or even attempting to prescribe future lines of effort would be futile at the moment, and it is distinctly to be regretted that up to the present no national arrangements have been completed for at least a study and general statement of these problems.

Some encouragement may be found, however, in the fact that certain matters of current interest and effort must be of value for the future whatever it may bring. The cordial coöperation of the various sections of the Associated Manufacturers of Electrical Supplies in the war service groups looking to conservation has resulted in a standardization, a reduction of duplication and a clearing of the lines of obsolete or obsolescent types which must produce an increased output and economy of manufacture that will put the industry on the best possible basis to deal with whatever may arise. Much had been done along these lines before our entrance into the war, but the pressure of the War Industries Board has greatly stimulated the process.

A further feature is the intelligent study of conditions of international trade which is being ably carried forward by our international trade committee under the chairmanship of J. J. Gibson. As originally constituted the function of this committee was the study of tariff matters, and this work is now being carried on under expert supervision and with the intent that when the time comes and its conclusions are placed before the Tariff Commission the needs of the industry will be presented in such manner as will insure intelligent appreciation and full consideration. It early became evident, however, that the matter of tariff was too closely bound up in questions of international trade to permit of its being considered without reference thereto, and the scope of the committee's work was correspondingly broadened.

These are but two instances, but the policy of the association will be to watch from day to day for the individual propositions which must be of advantage to its membership, whatever course the future may take, and to develop and perfect such propositions, confident that in the long run they must fit into the general scheme as experience evolves it.

Transmission Systems of Connecticut

Interconnection of Electric Utility Lines, Especially in the Industrial Territory of the State, Constitutes an Important Factor in the Conservation of Fuel—Description of the Work Completed and in Process of Construction

INTERCONNECTION of electric utility systems in Connecticut has reached an advanced stage, as the accompanying map indicates. Exclusive of the plants of the New York, New Haven & Hartford Railroad, the Connecticut Company and the Shore Line Electric Railway, the public utility stations in the state have a total rating of about 192,500 kw. and generate about 445,416,000 kw.-hr. per year. The individual stations range from 70 kw. to 36,000 kw. in capacity, and, including the railway plants of the companies above named, the total generating capacity of the utility plants in Connecticut is 252,500 kw. These figures include both steam and hydroelectric stations, although the former produce by far the greater part of the annual output. Through the tying together of systems in the central portion of the state and the interconnection of other properties lying along the border of Long Island Sound and extending into the northeastern area, reliability and efficiency of electrical production and distribution are being realized in an increasing degree. While much remains to be accomplished in extending the interconnection program, the existing development covers a large part of the industrial territory of the State and is an important factor in the conservation of fuel.

All the electric utility plants in the state were visited recently by E. Irvine Rudd, engineer, and A. E. Knowlton, power and illumination expert, of the Public Utilities Commission of the State of Connecticut, and they have compiled data as to the existing generating facilities, outputs, transmission systems, etc., and prepared the map upon which the accompanying illustration was based. The field work of this general inventory took over three weeks, and the information obtained will be of value to the Public Utilities Commission and to the Fuel Administration, besides giving a comprehensive idea of the state's electrical resources as at present developed. The Electrical World is much indebted to the commission and its engineers for the information here given and for the privilege of reproducing this map.

Connecticut's Large Electrical Utilitie

The larger electrical energy supply systems of Connecticut are those of the United Illuminating Company, with principal operating centers at Bridgeport and New Haven; Hartford Electric Light Company; Connecticut Light & Power Company, Waterbury and New Britain; Connecticut Power Company, Middletown and New London, and the Shore Line Electric Railway Company, Norwich. The Connecticut Company, operating the greater part of the street-railway service of the state, and the New York, New Haven & Hartford Railroad, operating an electric train service between New Haven and the New York suburban zone, complete the larger electrical systems. The New Haven road sells energy for central-station service at Greenwich and Norwalk, but the greater portion of its output is used in its transportation service. The Connecticut Company sells little if any energy for domestic or industrial use.

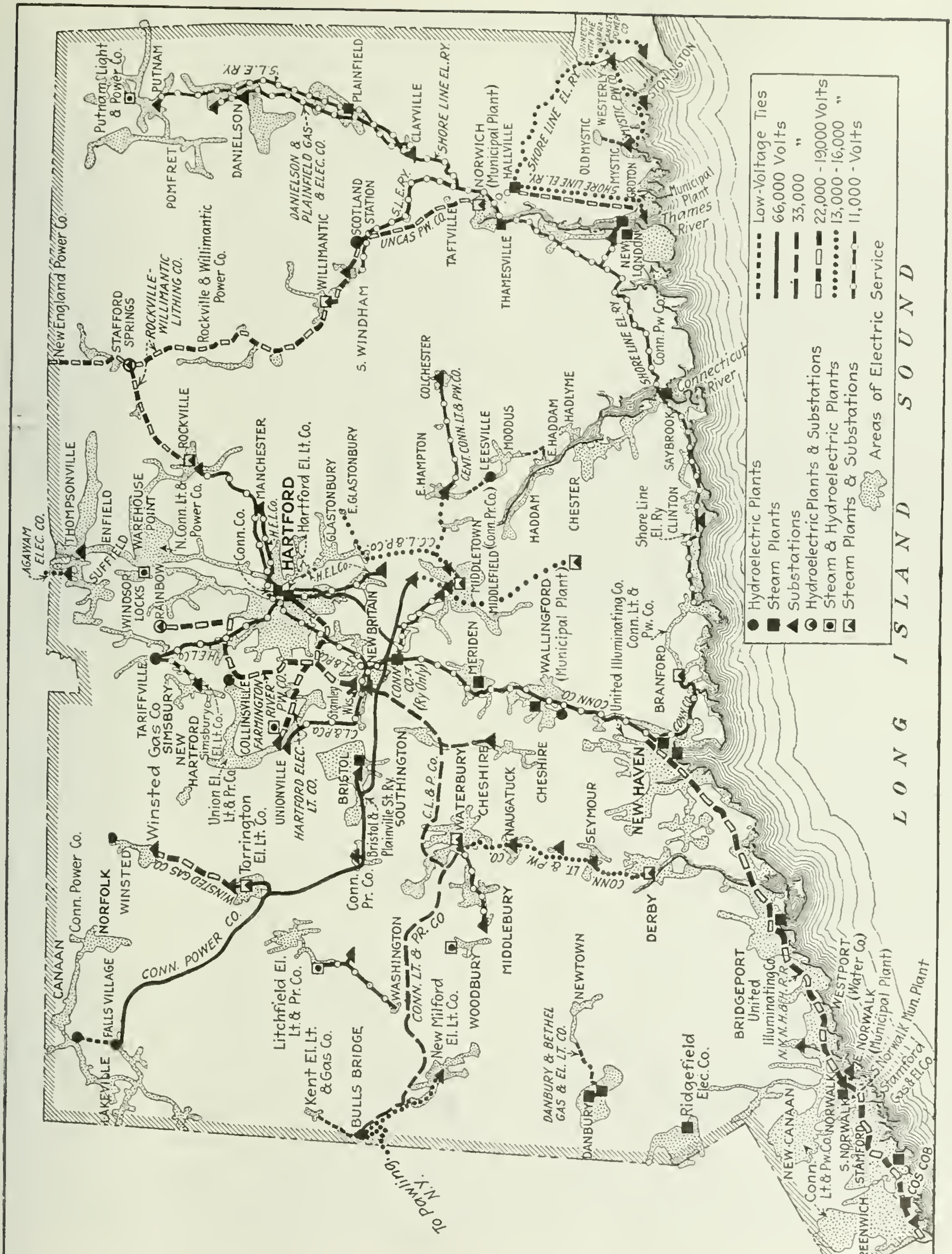
Lines over which energy is transmitted at 11,000 volts or more are included in the map of transmission systems. The highest voltage line in the state is the 66,000-volt transmission of the Connecticut Power Company, which runs from the Falls Village hydroelectric station in the northwestern area southeasterly through the middle industrial section of the state to the outskirts of Middletown, also connecting by branch lines or taps to substations in Torrington, Thomaston, Bristol, New Britain, Cromwell and Hartford. From the step-down transformer station outside Middletown energy is delivered at 13,200 volts to a distributing substation in the city. This is tied in with a local steam plant of the company situated on the bank of the Connecticut River. East of Middletown a connection is made through a step-up transformer station to the 13,000-volt lines of the Central Connecticut Power & Light Company, serving a territory in which the principal towns are Glastonbury, East Hampton, Haddam, Colchester, Moodus, Hadlyme and East Haddam.

Connecting Hydroelectric and Steam Plants

The Connecticut Light & Power Company operates a 33,000-volt transmission line extending from a hydroelectric plant at Bull's Bridge to Waterbury and thence through Southington to New Britain. Middlebury, Naugatuck and Seymour are supplied from this system, but at 11,000 and 13,000 volts. At Seymour a tie is effected with the system of the Derby Gas & Electric Company. An 11,000-volt tie line has been built between the Dutch Point station of the Hartford Electric Light Company and New Britain.

The interconnections in the central part of the state therefore make it possible for the hydroelectric plants at Falls Village, New Canaan and Bull's Bridge and the steam-driven central stations at Waterbury, Hartford, Derby and Middletown to feed a transmission network mutually or independently as the load conditions dictate, supplemented by smaller hydroelectric plants and by various steam stations in the local territory. The four principal stations, at Hartford, Waterbury, Bull's Bridge and Falls Village, have a combined rating of 76,500 kw. and an annual energy production of about 170,000,000 kw.-hr. The Hartford and Waterbury plants are respectively rated at 36,000 kw. and 25,500 kw. In round numbers, the total capacity of the plants interconnected in this central transmission network is 100,000 kw. and the annual output 200,000,000 kw.-hr. The tie connections now in force enable the Hartford company to interchange energy with the Connecticut Power Company and the Connecticut Light & Power Company through New Britain by two routes.

The Winsted Gas Company's system and that of the Torrington Electric Light Company are also tied into the Falls Village line, and the Bull's Bridge plant is



INTERCONNECTIONS WHICH HAVE BEEN MADE IN CONNECTICUT

It has been impossible in the space available on the map to indicate all the electric companies operating in each town; therefore only the most important have been included. The shaded areas indicate the portions of the state supplied with electric service.

connected with Pawling, N. Y., by an 11,000-volt circuit.

Near the Massachusetts boundary the system of the Northern Connecticut Light & Power Company is connected with the Agawam Electric Company by a 13,000-volt line. The latter company is one of the properties affiliated with the Turners Falls Power & Electric Company of Massachusetts, which operates an extensive hydroelectric and steam system in the middle Connecticut valley. Farther east the Rockville & Willimantic Power Company is connected with the New England Power Company by a 22,000-volt line crossing the Massachusetts border. The New England and Turners Falls systems are interconnected at an outdoor switching station at Leverett, Mass. At this writing these interstate interconnections represent only the beginning, probably, of a more comprehensive tying together of Connecticut and Massachusetts systems. Thus the Shore Line Electric Railway is building a new steam plant near Norwich, Conn., which is to be connected with the New England Power Company's system through a new transmission line not on the map.

Another interstate connection of interest is that of the Mystic Power Company with the tidewater steam plant of the Narragansett Electric Lighting Company at Providence, R. I. A transmission line running from the Providence district to Westerly provides for this. The Providence plant is interconnected with the New England Power system lines in southern Massachusetts.

The above are the more important interconnections now in force in the state. Along the Sound, the New Haven railroad transmission lines supply central-station service in Greenwich and Norwalk, but there are no important interconnections by which the supply of energy may be reversed on a large scale, as in the central part of the state. A tie line exists between the local systems of the Connecticut Light & Power Company in Norwalk and the municipal plants in South and East Norwalk. A low-voltage tie also exists between the Hartford Electric Light Company's system and the Glastonbury lines of the Central Connecticut Power & Light Company. An interconnection in Danbury between the plants of the local street railway and central stations is just about to be completed. A new hydroelectric station is under construction at Stevenson, on the Housatonic River, which will be tied into the transmission network of the Connecticut Light & Power Company.

Permanence in Outdoor Substations

Discussion of Standard Design Used in All Sizes from 300 Kva. to 2250 Kva. in Order to Eliminate the Fire Losses Prevalent in Modern Structures—Increase in Cost to Secure Permanence Held to Be Negligible

BY S. B. HOOD
Superintendent of Distribution, Northern States Power Company

"ONE of the great problems in high-tension transformer design is to get the leads out of the case," said a prominent engineer once in making an address before a branch of the American Institute of Electrical Engineers. The same problem has to be solved over again to get the leads out of a building in case the transformer is installed in one. This unnecessary complication has been one of the biggest spurs leading to the design and construction of a class of substation in which the entire equipment is out of doors. From a more or less crude assembly of equipment the outdoor substation has of late years developed to a state approaching absolute permanence. Not being hampered for room, the spacing between points of opposite polarity can be made adequate. Any damage resulting from failure of insulation is confined closely to the point of failure.

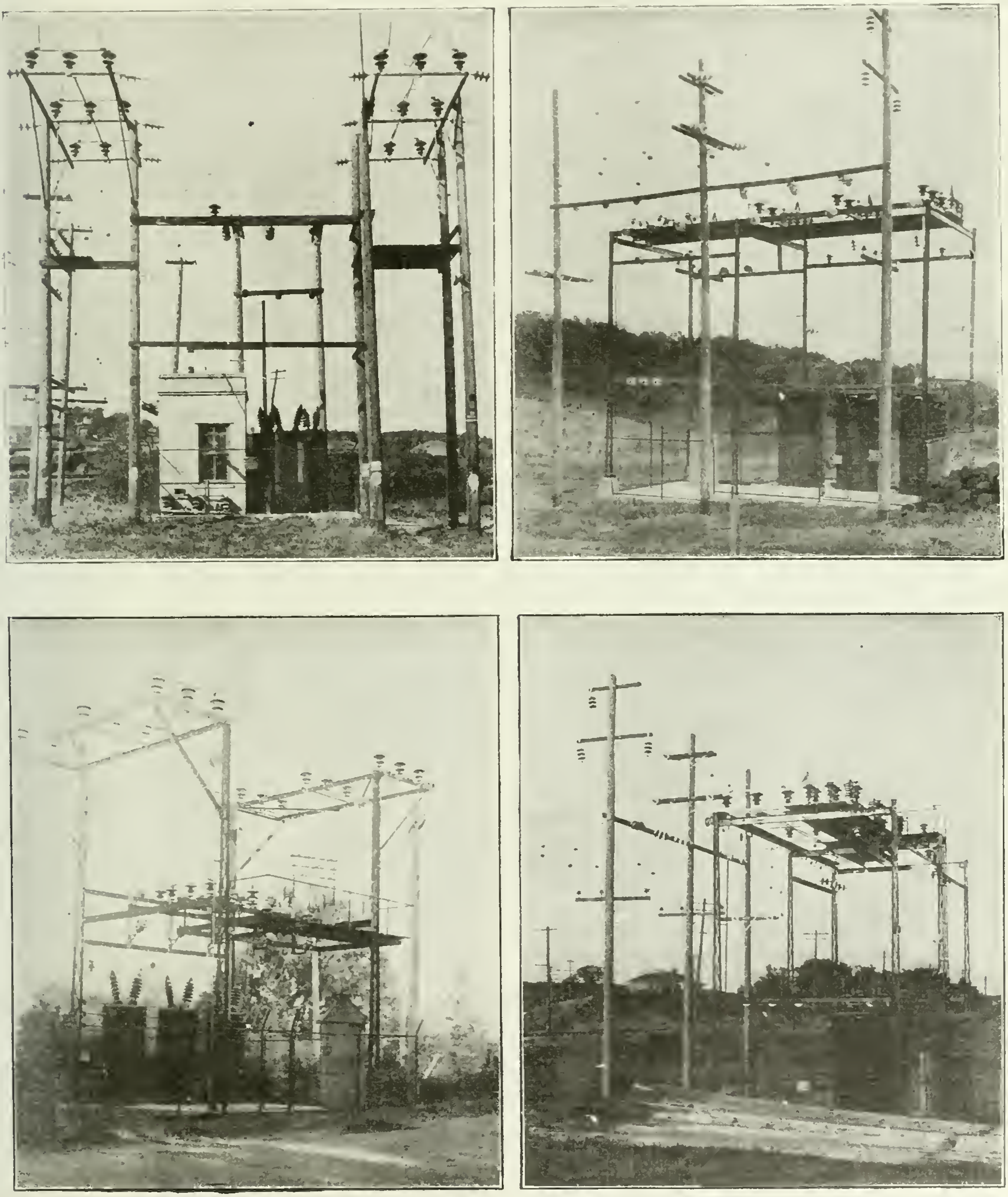
Some years ago a large Central Western utility company constructed a network of 34,000/60,000-volt lines serving a scattered community located within a radius of about 100 miles (160 km.) from the main source of power. At that time outdoor equipment was generally special, as a result of which a number of substation installations were housed in buildings constructed of wood frames sheathed with corrugated iron. Since then practically all of these buildings have been destroyed by fires starting from various causes.

When outdoor stations were first employed the supporting structure usually consisted of four standard wood poles set in the transmission line. The necessary pole-top switches were mounted on these with the local control switches, fuses, etc., placed on cross timbers between the poles. The transformers were placed on a platform of wood timbers bolted to the poles a few feet above the ground line. As most of these structures were erected along country highways, they were particularly subject to the hazard arising from grass fires.

The experience gained from the operation of both this type of outdoor substation and the indoor type in non-fireproof buildings has resulted in all new stations, except those of a most temporary character, being constructed of fireproof materials. Fig. 1 illustrates the older type of wood-pole structure on which the high-tension equipment is mounted. Originally the transformers and low-tension apparatus at this station was housed in a building which was destroyed by fire. The transformers were then placed outside and a small fireproof building constructed to house the local 2300-volt switching and metering equipment. Fig. 3 shows a modern outdoor fireproof substation for the same service as that shown in Fig. 1.

A one-line diagram of this station is shown in Fig. 5, which is also typical of most of the stations serving the towns on this netwook. The transmission lines are arranged in rings, making it possible to sectionalize in either direction without interrupting the service to any substation. The station tap is taken off between these two sectionalizing switches, leading through an outdoor air-break switch, choke coils and fuses to the transformers.

For lightning protection electrolytic arresters have been used at some points, where attendance was at hand for the daily charging. All the new stations have sufficient space on the platform to accommodate electrolytic or similar arresters if desired. In a number of cases several types of horn gap with series-resistance arresters have been tried out with varying degrees of success. At this date definite results as regards the protective value of these arresters is not available. About all that can be said is that "the patient has survived either with the aid of or in spite of the treat-

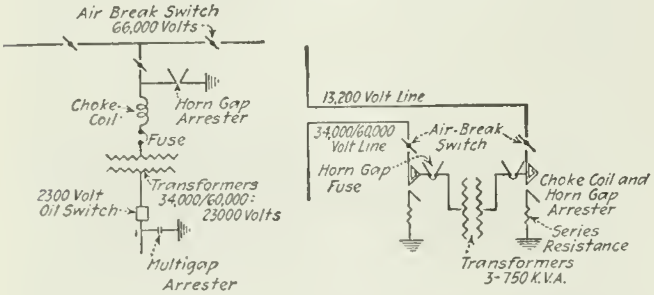


FIGS. 1 TO 4—OLD AND MODERN TYPE OUTDOOR SUBSTATION

Fig. 1 is a typical example of the old inflammable design once used, while the others are built after new fireproof designs.

ment administered." Under such conditions it may possibly be safely assumed that the arresters are doing some good; in any event they have done no harm and their installation does not involve a very heavy expenditure.

The equipment used in both the old-type and new-type stations is standard and interchangeable. Being carried in stock for all classes of construction, it becomes possible to assemble a new station without delay or the purchase of special apparatus. This feature is also of value when repairs are found necessary. To this extent there is no difference in cost between the new fireproof construction and the old with an infinitely greater fire hazard.



FIGS. 5 AND 6—ONE-LINE DIAGRAM OF TYPICAL STATION IN LOOPED NETWORK AND CONNECTIONS FOR ONE AT END OF HIGH-VOLTAGE LINE

In the new design the principal supporting members consist of standard 35-ft. (10.6-m.) expanded steel poles. These are set in concrete. The entire ground area of the station is covered with a heavy concrete blanket. Upon completion the station area is inclosed within a substantial woven-wire fence fitted with a gate and with barbed-wire top guards. Before laying the concrete blanket two or more 2-in. (5-cm.) pipes are driven and connected together and to each of the steel poles, insuring an effective ground connection. The transmission line ground wire is also connected to this structure.

The cross-beams, braces, etc., required to complete the structure are composed of light channels and angles, an assortment of which, together with the steel poles, forms part of the standard stock carried. These members are largely laid out and drilled or punched in the company's shop. Such work as must be done in the field is facilitated by a portable electrically driven drill press, emery grinders, etc.

Owing to the rapid fluctuation in unit prices of materials, it is not possible to give comparative costs between the all fireproof design and the older wood-frame type. It is safe to say, however, that the cost of the station shown in Fig. 3 did not exceed $500 over what would have been required for a wood-pole and timber structure. As the present capacity of the station is 600 kva. with room to increase to 1500 kva. without change in structure or equipment (other than the transformers) the increased cost per kilovolt-amperes is almost negligible. As to appearance, one has only to compare Fig. 3 with Fig. 1 in order to form his own conclusions. On the score of reliability and decreased maintenance the permanent design naturally leads.

A larger type of station, built along the same lines and using the same class of material, is illustrated in Fig. 2 and Fig. 4. This station serves to connect the high-tension line with the 13,200-volt feeder from the source of supply at one end of the loop. A single-line diagram of it is shown in Fig. 6.

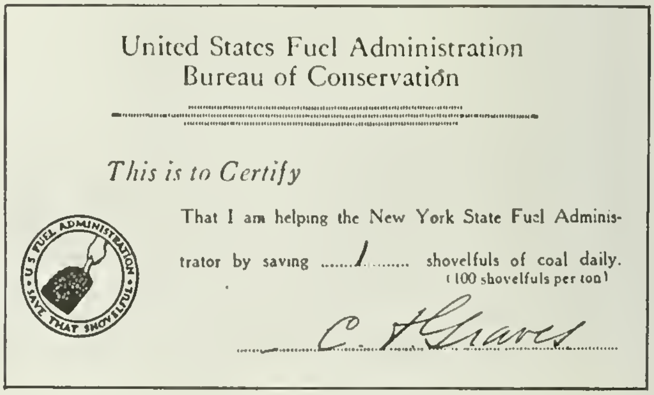
In the station mentioned, having a capacity at present of 2250 kva., six poles have been used for the main structure. The high-tension and low-tension leads enter from a spur lead from the main pole line. All the auxiliary equipment being located on the upper deck, there is no chance of an arc from the various horn gaps rising and flashing over to material above them. Access to these air-break switches and horn arresters can be had from a platform laid on their supporting beams. The platform is reached by an iron ladder in the rear of the structure. This platform is made of carbolineum-treated wood and is the only combustible part of the station other than the small standard portable telephone booth shown in one corner of both this and the station illustrated in Fig. 3.

The portable booth is made of sections bolted together, the floors and walls being of matched lumber (for insulating purposes). The roof is of galvanized sheet iron made up as a unit and set on like a candle snuffer. These are stock booths made up in lots as required, and in spare time, by the company's carpenter shop.

This station may appear to be unnecessarily high, which is accounted for by the poles being 35-ft. (10.6-m.) size. The extra height is no objection and may in the future be an advantage. Nothing could have been gained by cutting off the poles, and the angle of the leads between the station structure and the pole line would have been increased. The vacant space to the left of the main transformers is intended for future local equipment that will step down the pressure from 13,200 volts to 2300 volts to serve an adjacent town when requirements demand. When this is done an intermediate deck will be installed in this half of the structure, somewhat similar to that shown in Fig. 3.

Saving Coal by the Shovelful

The form here reproduced is that of a pledge which is used by C. A. Graves, administrative engineer for the United States Fuel Administration in New York, to encourage fuel saving. Even without the large war demand there is urgent necessity for coal conservation during the winter and it is desirable that public interest in fuel economy be stimulated by all possible means.



United States Fuel Administration
Bureau of Conservation

This is to Certify

That I am helping the New York State Fuel Administrator by saving ....1.... shovelfuls of coal daily.
(100 shovelfuls per ton)

C A Graves

FUEL-SAVING PLEDGE

Factors to Consider in Applying Relays

Determination of Short-Circuit Current Connections and Settings Suitable for Radial and Parallel-Feeder Systems—Protection Against High-Resistance Grounds on Balanced Systems

BY E. A. HESTER
Engineering Division Westinghouse Electric & Manufacturing Company

THE art of protecting transmission lines by means of relays has advanced very rapidly during the last few years. Although a great many types of relays have been produced, few have survived the acid test of service on modern power systems. The relay, though one of the most inconspicuous things in a power station, is nevertheless one of the most important items in its equipment. Figuratively speaking, relays constitute the nervous system of that wonderfully complete body, made up of generating stations, substations and transmission lines. It is the part of the relay to detect and locate anything which tends to prevent any of these members from performing its proper function. When the trouble has been detected, apparatus which will isolate the faulty member from the remainder until the trouble has been remedied must be set in motion. Thus the relay is called upon to display an almost human intelligence and must function with a speed which is scarcely within the power of man. These requirements have been complied with, and it is safe to say that as the art advances much improvement will be made.

Many schemes have been used, but, strange to say, the first one evolved has up to the present time given the most satisfactory service. In this scheme of protection an overload relay is used at the generating end of the feeder when applied to radial systems, while on systems which include sections of parallel feeders a reverse-power relay is used at the substation end in addition to the overload relay employed at the generating end.

At first overload relays only were necessary as feeders were not operated in parallel, a spare line being available in case the first one failed. Then the economy of having all the lines in service all the time was realized, and as the demand for continuity of service could not be disregarded, it became necessary to develop a reverse-power relay for use at the substation end and operate the feeders in parallel.

APPLICATION OF RELAYS UNDER DIFFERENT CONDITIONS

No set rules can be laid down to govern the application of relays. Each and every power system has its own peculiarities, and the choosing and setting relays must be governed by these. However, if a careful study is made of the system and the conditions existing on each section are thoroughly analyzed, no great difficulty should be encountered in securing entirely satisfactory protection on any power distribution system.

In laying out a protective scheme on any system a great many factors have to be taken into consideration. The characteristics of the line and each piece of apparatus—generating, switching, transforming and converting—should first be carefully studied, as this is what determines the amount of short-circuit current which may occur. In determining this short-circuit current it should always be considered as due to a solid metallic short circuit with minimum generating capacity.

One method of determining the possible short-circuit current is to observe the voltage drop between two stations at normal load. Then the short-circuit current = (normal voltage ÷ voltage drop) × load current. This is only approximate, however, and is very likely to give high results.

Another method is to determine the total impedance, including that of the generator, between any point where the short-circuit value is desired and the generator. Then the short-circuit current = star voltage ÷ impedance. This gives the instantaneous short circuit, however, and the sustained value is much less, usually about two or two and one-half times full load current.

Unless a special scheme is used for disconnecting a line on a high-resistance ground, as would be necessary in the case of a generator having its neutral ground through a comparatively high resistance, modern relays will not clear a high-resistance short circuit. This is no disadvantage, however, as a high-resistance short circuit will invariably develop into an arc before any damage is done, and since an arc has a very low resistance the effect of a metallic short circuit will be obtained and the relays will operate.

The various connections and combinations used on a system also deserve careful attention when laying out a protective scheme. First the number and location of the power sources should be taken into consideration. The main thing to be considered is whether or not there is more than one source. A layout which would be suitable for a system having one source of power might not be suitable for another having more than one source. Therefore the writer will consider systems having one source separately from those having more than one source of supply. It should be borne in mind that this discussion is limited to three-phase distribution as most modern systems are of this type.

SINGLE SOURCE OF POWER

*Radial Feeders**—Protective relays should be applied to radial-feeder systems with a single source of power in such a way that when trouble occurs on any feeder it is automatically cut off from the remainder of the system, leaving the others in service. This is accomplished by giving the relays a selective action—that is, giving them such current and time settings that owing to their operating characteristics they will always disconnect the feeder at the proper point before other relays on the unaffected sections can operate. On a radial system, such as is being considered, only overload relays are used. They are placed at the outgoing end of each section, except possibly on the ones most remote from the generating station, which may be protected by an instantaneous overload circuit breaker or by fuses.

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*A radial system, an example of which is shown in Fig. 1, consists of one or more feeders leaving the generator busbars, each of which may or may not be in turn subdivided into a number of smaller feeders.

From the full-load current values current settings are made so that the relay will not operate under normal conditions. From the short-circuit current values time settings are so chosen from the characteristic curve that each relay will operate in its order; that is, the ones at the greatest distance from the generating station will operate in the shortest time, the time element becoming larger as the generating station is approached. In Fig. 1 time settings for a typical radial system are shown, a half-second interval between the time of operation of each relay being chosen to allow for the operation of the circuit breaker.

The overload relays should be connected to the line as shown in Fig. 2. Two current transformers may be used on a system having an ungrounded neutral, but there are cases in which the relays will fail to operate, such as the occurrence of a ground on the unprotected phase and an accidental ground in the generator at the same time. Three current transformers will always give complete protection, and the insurance is worth the cost of an additional current transformer.

Parallel Feeders.—In a system composed of parallel feeders between the generating station and substation or between substations, an example of which is shown in Fig. 3, the best method of protection is to place an overhead relay at the outgoing end and a reserve-power relay at the incoming end of each feeder. Current settings are obtained in the same way as described for radial systems. The overload relays are given time settings with short intervals between, so as to secure selective action, while the reverse-power relays are all given the same short time setting, usually about one-tenth of a second. In Fig. 3 time settings for both overload and reverse-power relays on a typical parallel-feeder system are shown.

Typical Example of Operation

The operation in case of trouble can be seen from the following example:

Suppose trouble occurs on line No. 4 at *X*. Energy immediately begins to flow into the trouble from both ends of the line. It is evident that the overload relay on this line will operate before the overload relays on lines Nos. 5 and 6, because it gets approximately twice the current that flows in either No. 5 or No. 6. Also the reverse-power relay, in line No. 4 only, will operate because the power flow in this line only is reversed. Whether the overload or reverse power relay on No. 4 operates first will depend upon the point at which the trouble occurs. Thus the defective line is effectually isolated and the other lines are left in service without interruption.

Reverse-power relays are connected in the circuit as shown in Fig. 4. The current transformers are connected in star and the voltage transformers, of which two are used, are connected in open delta. It has been found that in order to secure the best action with reverse-power relays on low power factor, due to unbalanced short circuits, the voltage transformers should be so connected that at unity power factor the current in the current coils of the relay will lead the voltage by 30 deg. It has also been found that the most severe condition under which a relay must operate is when two conductors of a three-phase line are short-circuited. Numerous tests have shown that when connected with current 30 deg. in advance of the voltage reverse-power relays operate satisfactorily under this extreme condition. In order to obtain satisfactory results with this connection, however, it is necessary to take into account the direction of phase rotation as shown in Fig. 4.

The Ring System.—The main difference in the case of the ring system and in the case of two feeders supplying a substation is that each feeder is made to loop through a substation. Fig. 5 shows an example of the ring system and gives time settings for the relays. The operation of the relays is similar to that of straight parallel feeders, and when trouble occurs and the defective section is cut out the system becomes radial until this feeder is put into service again.

Systems with More than One Source

Parallel Feeders.—Lines operating in parallel where power is likely to flow in either direction can best be protected by using reverse-power relays differentially connected, as shown in Fig. 6. When the load is balanced it is evident that no current flows through any of the relays. However, when a short circuit occurs, say at *X*, the relays at both ends of the defective line operate to clear the line both because of the flow of the excess current and because the flow of power is away from the busbars.

Clear perception of this can be obtained readily by referring to the diagram, in which the arrows show the direction of flow of the current and power. It will be observed that in every case the flow is in the direction to operate the proper relay. When using this scheme it is necessary to have auxiliary switches on the circuit breaker to short-circuit the current transformer on the defective line when it goes out of service. When two lines only are operated in parallel, a reverse-power relay having double contacts on the voltage element may be used. These contacts operate in such a way that they always open the breaker on the defective line only and leave the other with straight overload protection.

This scheme is shown in Fig. 7. For simplicity both Figs. 6 and 7 are shown for one phase only, and in Fig. 6 voltage and tripping connections are omitted.

In both the schemes mentioned the line and current settings may be made very small, but it is usually best to make the current setting somewhat higher than is theoretically necessary in order to take care of any operating difficulties that are liable to occur. No advantage can be gained by setting the relays to operate on smaller currents than those normally obtained during times of short circuit.

The Ring Systems.—If in Fig. 5 another generating station be placed at point *B* difficulties would be encountered when it became necessary for this station to carry the entire load. Entire readjustment of the relay

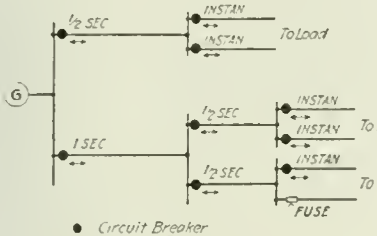


FIG. 1

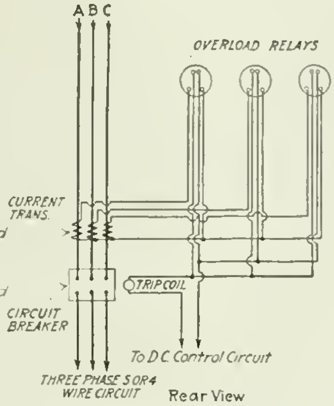


FIG. 2

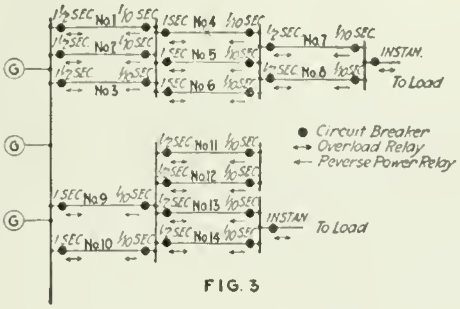


FIG. 3

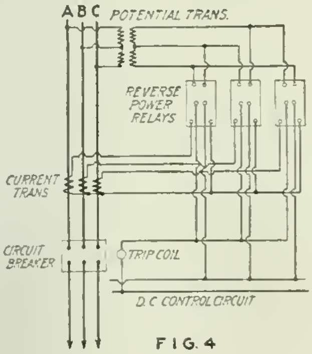


FIG. 4

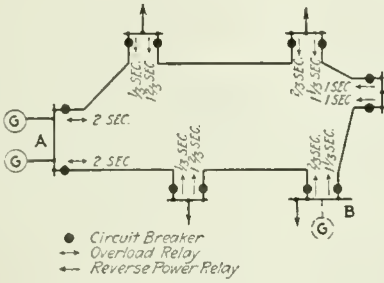


FIG. 5

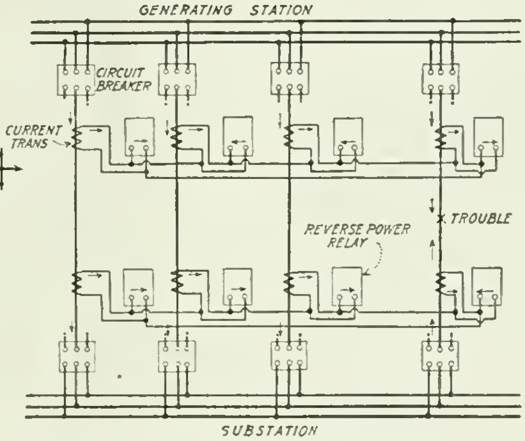


FIG. 6

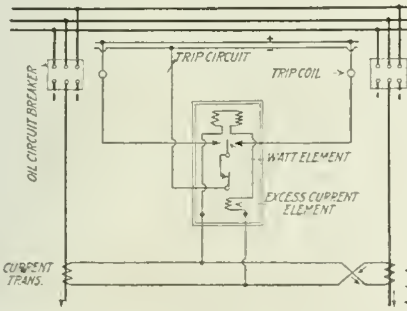


FIG. 7

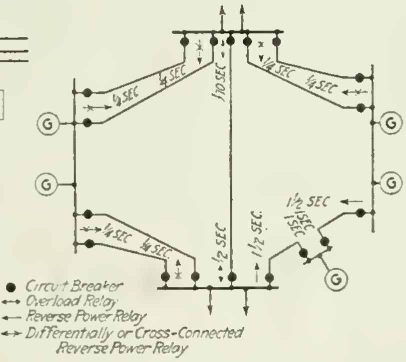


FIG. 8

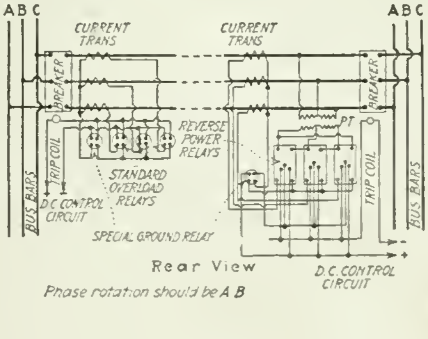


FIG. 9

DIAGRAMS THAT FACILITATE PROPER APPLICATION OF RELAYS

Fig. 1—Radial distribution system. Fig. 2—External connections for overload relays. Fig. 3—Parallel feeders supplied from one source of power. Fig. 4—External connections for reverse-power relays. Fig. 5—Ring distribution system. Fig. 6—Cross-connected reverse-power relays on parallel feeders. Fig. 7—Double-contact, reverse-power relay applied to duplicate feeders. Fig. 8—Network distribution system. Fig. 9—Special relay connections to protect against high-resistance grounds.

would be necessary, but with some types of relays this can be done in a short time with no very great inconvenience.

The Protection of Networks

A great many modern power systems are so connected that they form a more or less complicated network. Some sections of these networks can be most satisfactorily protected by the methods suggested for parallel feeders having more than one source of power. Other sections to which these cannot be applied must be protected by some other method using either reverse-power or overload relays or a combination of both. No example can be given which will cover all the problems encountered in actual practice. Each case must be studied and the method applied which is best suited to it.

An example of a network is shown in Fig. 8 in which reverse-power relays are shown connected differentially for protecting some of the sections. For other sections, where this method cannot be used, reverse-power and overload relays are applied as best suits each particular case. Time settings are shown which will give the best selective action. There will be cases in which the circuit breaker on a feeder which is not affected will be opened, and in most cases this does not matter. It sometimes happens that by having other circuit breakers than those on the line actually affected open the problem of sectionalizing may be somewhat simplified. This is, however, a question which must be decided for each individual application.

It is possible by carefully studying and analyzing the conditions to secure automatic sectionalizing on any network regardless of its complications.

Protection Against High-Resistance Grounds

Sometimes it happens that a system has its neutral grounded through a comparatively high resistance, and when a ground occurs conditions may be such that the trouble current is actually less than the full-load current. Such a ground cannot be cleared by reverse-power and overload relays connected to protect the system against short circuits. However, this difficulty may be overcome by using an overload relay, constructed to operate on low currents and connected in the neutral lead of the current transformers as shown in Fig. 9. Under normal conditions no current will flow through the neutral lead of the current transformer bank, but as soon as the ground occurs the unbalanced current flows through this lead, operating the ground relay, and the circuit breaker is opened.

When used with overload relays the ground relay contacts are connected in parallel with the overload relay contacts so that its operation opens the circuit breaker directly. When used with reverse-power relays, however, the ground relay contacts are used to short-circuit the contacts of the overload element of the reverse-power relays, thus leaving the watt elements to discriminate as to the direction of power flow. This is clearly shown in Fig. 9.

It should be borne in mind that this scheme can be used only on balanced systems. For unbalanced systems other schemes are used utilizing special relays, but since these do not come under the subject of this discussion they will not be mentioned.

THE RELATION BETWEEN LIGHT CURTAILMENT AND ACCIDENTS

It Is Estimated that the Services of 108,000 Men Are Lost Annually Because of Accidents Attributed to Poor Illumination

IN A PAPER dealing with the problem of light curtailment in its relation to the national man-power shortage, read before the recent convention of the Illuminating Engineering Society, R. E. Simpson estimated the actual loss to the industries due to accidents and showed that the daily casualty list on this side is about as great as that of our soldiers on the western front. Of these losses perhaps 18 per cent are due to inadequate illumination.

Presenting figures on this annual loss from accidents, Mr. Simpson said:

> The recently enacted law extending the ages for selective service will have the twofold effect of withdrawing more men from industrial pursuits and at the same time placing greater burdens on manufacturers of war materials. In order to alleviate the present labor shortage and the threatened future decrease in the supply of workers, a nation-wide labor adjustment must take place. In addition to this there must be a policy of conservation of labor and the elimination of wastes and leaks, in the following out of which accident prevention will be an important factor.
>
> The significance of the last statement will be readily appreciated if we consider the effect of accidents in terms of time lost. From the published statistics of a number of states, together with conservative estimates for the remainder, we find that approximately 25,000 persons are killed or permanently disabled, 500,000 seriously injured and 1,000,000 slightly injured each year. Translating these figures by means of the accident-severity rates, we have a total of 180,000,000 days of lost time. This is equivalent to the loss of the services of 600,000 men for a full year of 300 working days. This economic loss is distributed over the entire country during a period of one year, and for that reason its effects are not so keenly felt or its importance recognized. If, however, this loss were concentrated on any one of our basic war industries, as, for example, shipbuilding, steel making, munition manufacture or coal mining, it would be nothing short of a national calamity. Even distributing this loss among the four industries named would seriously cripple all of them, and its effects would shortly be reflected by conditions at the battle fronts. . . A large percentage of accidents may be classed as avoidable in the sense that the application of mechanical safeguards and the observance of safety rules will prevent them.

In pointing out the economic value of providing adequate industrial illumination Mr. Simpson said:

> The saving in coal by curtailment of industrial lighting would be negligible when compared with the ultimate economic loss. If, for example, the full year's labor of the 108,000 men that is lost annually because of poor illumination could be saved and applied to coal mining, 130,000,000 more tons of coal could be produced. To provide ample illumination for the safety of all these workers ten hours a day for a full year would require less than 10,000 tons of coal.

The author points out that attempts at economy are almost invariably made in places where reduced illumination is particularly hazardous. He says:

> Stairways, elevated gangways, passageways and storage spaces are generally inadequately lighted and are the first to suffer from a policy of light curtailment. The hazards associated with these poorly lighted sections of our industrial plants have been portrayed many times. Confirmation of these hazards has been given by the report of the British government survey of industrial accidents showing that 40 per cent more men are injured from falling and stumbling in the winter months than in the summer months.

Renovation of Discolored Arc-Lamp Globes

Glassware Used in Electric Street Lighting Units Deteriorates Owing to Discoloration—It Is Both Difficult and Expensive to Replace Globes, but a Method of Removing Stain by Heat Treatment Has Been Developed

BY ALFRED HERZ
Public Service Company of Northern Illinois

IT IS common knowledge that in certain cases after new glassware has been installed on street-lighting units a very obnoxious discoloration has occurred in a comparatively short time. Owing to the war conditions it has become increasingly difficult and expensive to replace this glassware. Experiments were therefore undertaken to recover the discolored but otherwise sound globes, and it was found that this could be done by a simple heat treatment.

The glassware which suffered the most was that subjected to the rays from arc lights rich in short ray lengths such as the magnetite arc. Some globes used on these lamps were rendered almost unusable, owing to this objectionable color, after four months' service. The lamp thus takes on the appearance of neglect of maintenance, so that objections to its use arose from the better residential districts.

FACTORS WHICH BRING ABOUT DISCOLORATION

The most common discoloration is purple and is only present where the artificial light strikes the glassware, such places as are shielded from the lamp rays being clear even after long use aside from coloring brought about by the rays of the sun. The amount of this discoloration depends on three factors: (1) The composition of the glass of which the particular ware is made; (2) the amount of violet and ultra-violet light present, either natural or artificial; (3) the length of time the glassware has been exposed to the influence of the light.

The glassware subject to this discoloration usually contains some form of iron, commonly Fe_2O_3 in some cases amounting to 6 per cent. This glass in its natural state is colored slightly green, and even common window glass has a greenish color, particularly when viewed from an edgewise position. The main reasons for using glass mixtures of this kind are (a) cost of material, (b) ease of blowing into the necessary shapes, and (c) toughness both mechanical and in resisting temperature changes. A bad feature of this glass, as just mentioned, is its greenish hue, especially when viewed in daylight, and various means have been tried for neutralizing this coloration.

Manganese compounds are found to be commercially most satisfactory for this purpose. Purple, the characteristic color of manganese, when added to the green in the original glass produces a very thin black cloud. Based on the three-color method, this action may be explained as follows: Green being white minus red and blue, purple being white minus green, the subtraction of green, blue and red leaves zero or black. The intensity of the black depends upon the amount of color present and upon the amount of neutralizing color necessary to balance this. Although the glass has the aspect of being clear and transparent, the thin black cloud formed as indicated nevertheless absorbs some of the light—usually from 10 to 15 per cent.

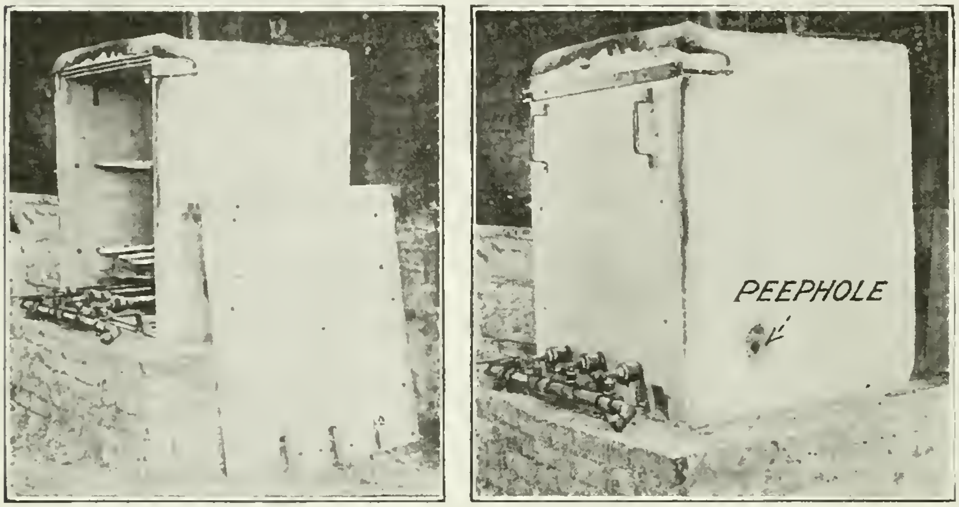
Under the action of certain light the purple manganese color itself becomes prominent, entirely overbalancing the green of the iron. The glass assumes at first a slightly heliotrope color and finally a very decisive purple. Since this purple color entirely penetrates the body of the gass, it at once became evident that a pickling or washing process would be useless. Having found that the color could be removed from pieces of broken globes by heating, further experiments were made, and it was found that these globes could be entirely cleared up by a careful heat treatment.

An annealing process carried out at a temperature of 900 deg. to 1000 deg. Fahr. (480 deg. to 540 deg. C.) was found to remove the color and at the same time to cause no softening or distortion of the glass globes. The annealing seemed to re-form the manganese compound into its original condition so that the glassware again became clear.

To measure the temperature existing within the oven a pyrometer was constructed out of discarded direct-current ammeter with suitable scale and operating from a double monel-copper couple with silver-soldered joints, the corresponding cold joints being remote from the annealing oven in a nearly constant temperature zone. The complete pyrometer was checked to within a few degrees of the working temperature by means of a high-reading mercury thermometer.

DESCRIPTION OF THE OVEN

In order to put the globe-reclaiming process into practice a gas-heated annealing oven was constructed. This oven was made of two layers of $\frac{1}{4}$-in. (6.3-mm.) asbestos board separated by $\frac{1}{4}$-in. (6.3-mm.) air space and an outer layer of $\frac{5}{16}$-in. (8-mm.) asbestos board, also separated from the inner boards by $\frac{1}{4}$-in. (6.3-cm.) air space. The front side was made removable and thus used as a door, suitable provisions being made to clamp this side onto the main part of the oven. The inside dimensions are 30 in. by 30 in. by 34 in. (76 cm. by 76 cm. by 86 cm.). The globes are slightly over 12 in. (30 cm.) in diameter and a little more than 12 in. (30 cm.) deep. A floor of iron rods spaced about 6 in. (15 cm.) apart is provided about $13\frac{1}{2}$ in. (34 cm.) from the top and a second similar floor at about the same distance below the first. Hence two levels are furnished for four globes each, and the oven thus holds eight globes at a time. The space below the lowest level provides the necessary room for three gas burners and baffles for them. The pyrometer couples are placed about 6 in. (15 cm.) from the top and off to one side so as not to interfere with the operation of inserting or removing the globes. A flue connection is provided at the top of the oven, the connection being indirect or through the air spaces between the asbestos boards, the inner boards being drilled with a series of 1-in. (2.5-cm.) holes near their outer edges and a flue connection being made to the air spaces. This tends to equalize the hot-air circulation within the oven and hence provide a more uniform heating. For the purpose of additional conservation of heat the outside of the oven was covered with a 1½-in. (3.8-cm.) layer of boiler covering.



ANNEALING OVEN FOR TREATING DISCOLORED GLOBES

Air spaces may be seen in oven walls where door is removed. Note peephole in side for observation of gas flame.

Although the process here described seems applicable to various forms of glass subject to this discoloration, it was, as stated, especially developed for the treatment of globes from magnetite-arc lamps. In these lamps, as is generally known, one copper electrode and one iron ore "magnetite" electrode are used, the latter being consumed at a much greater rate than the copper. The combustion in the arc is accompanied with the production of large amounts of fluffy brown powder and with a certain amount of spattering of red-hot iron particles. These iron particles burn themselves into the inner surface of the globes, and the brown powder forms a deposit on the glass which is not readily wiped out. It has been found that swabbing the globes with commercial muriatic acid and allowing this to remain on the surface for about a half hour before rinsing off and wiping will remove all the brown deposit and a considerable percentage of the embedded iron particles. This removal of the surface deposits precedes the annealing process.

The detailed method of procedure is as follows: The globes as removed from the line are treated with acid to remove the deposit, rinsed, dried and placed in the cold oven. The front of the oven is placed in position and clamped. The burners are lighted by means of pilot burners and the heating then proceeds, reaching the desired temperature in four or five hours. This high temperature is maintained for an hour. The burners are extinguished and the oven is allowed to cool for a matter of some twelve to fifteen hours. Care is taken not to open the oven before the interior temperature has reached about 120 deg. Fahr. (50 deg. C.) or less, otherwise cracked globes will result. The whole cycle can easily be gone through in twenty-four hours. The cool globes are then taken out of the oven and washed with soap and water inside and outside. An astonishing clearness and brilliance compared to the globes as removed from the line results, and the appearance of new globes is approached. Globes bent out of shape obviously indicate local overheating, due to poor heat distribution, or general overheating. On the other hand, globes with streaks of color probably result from insufficient heat or also from poor heat distribution.

Employing this process with room temperature approaching 0 deg. Fahr. (— 18 deg. C.) with the oven loaded with eight globes, one treatment took 900 cu.ft. (25 cu.m.) of 635 B.t.u. gas. Certainly the whole batch of eight globes were not perfectly renovated in every case, but assuming that six globes always come out commercially perfect, the gas consumption per globe would be 150 ft. (4.2 cu.m.) and would cost a matter of 15 cents when the price of gas is $1 per 1000 cu.ft. The total cost of the treatment per globe, allowing for labor, could be put at 35 cents at the outside, truly a nominal figure in view of the present cost of globes, approximately $2. This process also has the distinct advantage of avoiding the inconvenience due to uncertain delivery.

Certain variations of the glass composition have been noticed. Some globes become discolored more readily than others, and it has been observed that these globes are the easiest to renovate and also are more apt to be distorted because of overheating. Likewise those globes not so readily colored are also harder to renovate and are not so apt to lose their shape as are the other sort.

Although this scheme has been in use but six months and the oven has not been worked to capacity owing to lack of reserve globes in sufficient quantities to permit the removal of globes from the line for treatment, the experience obtained to date shows that the treated globes remain clear for at least 75 per cent or more of the time necessary to discolor new globes to the same density.

In case other ovens are constructed for this purpose it is strongly recommended that these be electrically heated since better distribution of the heat would then be obtained because of the absence of flue connection and air admittance for the burners, making it possible that all globes shall be fully heated and equally clear when removed from the oven. Minor changes from the present oven design could also be made to advantage.

TO THINK of cheapness in connection with foreign trade is just as wrong as trying to pin bargain tags on soldiers. Foreign markets are not going to be won or held by cheapened American workers or by bargain methods in American life.—*Edward N. Hurley, Chairman United States Shipping Board.*

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

GENERATOR FAULT THAT LONG EVADED DETECTION

Apparent by Ticking Sound, Fault Did Not Show Up on Ordinary Tests—Finally Located with Spark Coil

BY A. M. SEVERSON

In operating a second-hand generator that the writer was called upon to start up, a peculiar clicking noise was noticed that should not characterize a good machine. Having received the generator under a guarantee and tests having failed to disclose anything wrong with it, the writer was somewhat disturbed regarding the cause of the noise. Repeated tests were of no avail. Finally one day, after the load had been increased to a value greater than this machine had been carrying before (only one-quarter of its rating, however), two loud reports accompanied by blinding flashes put a climax to the suspicious action of the machine.

Upon close scrutiny no trace of a burn-out could be found, and voltmeter tests again failed to locate any fault. Since no galvanometers or delicate testing instruments were available, the writer decided to try a high-tension breakdown test, it being assumed that no more harm could be done than had already evidently been caused by the flashes. The apparatus used consisted of an ordinary spark coil, such as that used for automobile ignition, and eight dry cells. Testing from terminal to terminal produced no visible effect. However, when one terminal of the spark coil was applied to the body of the machine and the other to the commutator a flash occurred on the end of the armature which had manifested trouble when it was operating.

Close investigation revealed the fact that the bar winding was loose in the slot and the insulation had been worn away at the end of the armature where the conductor bar bends. The writer tried with his thumbs to force the bare spot on the bar into contact with the armature core, but it was too rigid and would spring back into the center of the slot. Evidently the magnetic force exerted on the bar at no load was not strong enough either to force it into contact with the core since the machine would generate full voltage without trouble until the load was increased beyond a certain point. When the machine was being operated under load the bar would flop from one side of the slot to the other, causing the clicking noise which has been previously mentioned.

Finding no other faults in the armature, the loose bar was wedged in the center of the slot by thin pieces of hard dry wood, there being no fiber available. Then the bare spot was cleaned with a toothbrush, thoroughly coated with rubber cement and allowed to dry over night. In this condition the generator has operated satisfactorily. It should be rewound to be permanently serviceable, but production depends on it, so the temporary repair will be relied on to carry it along until a dull business period.

OILING TEXTILE MOTORS IN LARGE MANUFACTORIES

Improper Oiling Detrimental to Machine as Well as to Fabrics—Ring Oilers and Ball Bearings and Their Care

BY L. E. WOOD

In large industrial establishments where numbers of small three-phase, 60-cycle, ½-hp. textile motors are used for driving looms the bearings and oiling of the motors must be carefully watched if stoppages are to be avoided. Oiling, having to be done after the day's work is over, is usually carried out in a very slipshod manner. One man will flood the bearing, allowing oil to get into windings and on the floor, where cotton lint siphons it onto the warp or cloth, resulting in trouble. Another oiler finds it too much trouble to remove the screws that hold dust-proof covers and pours some oil round the shaft, the result of which shows in due time in the form of a seized brass.

Opinion seems divided as to the use of ball bearings for this class of work. The writer's experience is as follows: The jar on the driving bearing of a gear-driven loom is tremendous, especially when the loom "bangs off." In the case of a ball bearing this jar in time makes itself manifest by wearing a groove in the rotor shaft. This wear allows the rotor to rub the stator at this end, and if not corrected in time will cause burn-out of the stator. The rotor must be taken out and the groove filled in with metal and afterward placed in a lathe and trued up. As this would only last a very short time, some other remedy must be looked for in order that ball bearings may be used to their full advantage.

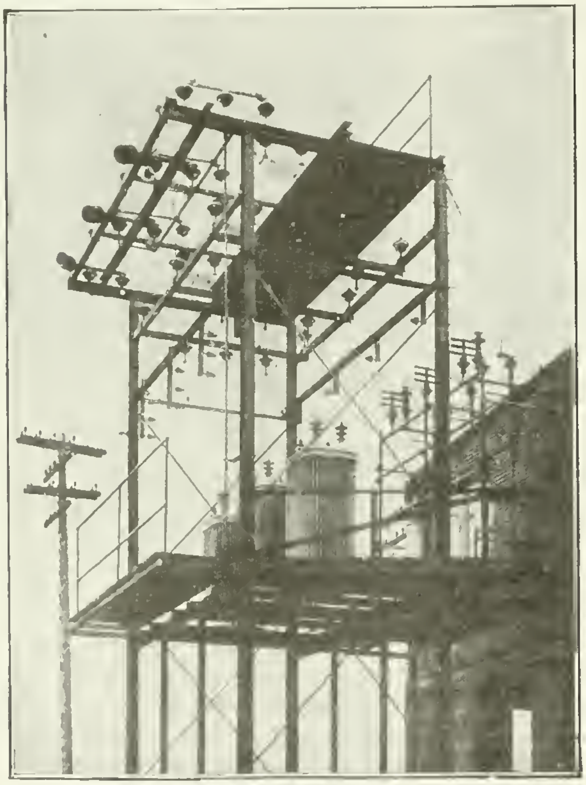
To the writer it seems that if designers would make the ball housing long enough to accommodate two bearings instead of one, and use a liberal size of shaft, the evil mentioned would be entirely eliminated. The double bearing need only be applied at the driving end. The ball bearings used on shafting for group driving are very satisfactory and permit a huge saving in oil and oilers' time, as they only need filling with grease every six months, but a ring oiler must be examined weekly.

A very satisfactory method of using a ring-oiler bearing without the ring is to employ a pad of tow or waste in place of the ring, the pad being kept saturated with oil. To prevent the bearing becoming flooded with oil a hole may be left open in the bottom of the well so that any surplus oil will run out, thus keeping the winding absolutely free.

OUTDOOR STATION SOLVES HIGH-WATER PROBLEMS

Even with Building Space Already Available, Indiana Company Chooses Outdoor-Type Substation for 600-Kva. Installation

When the Indiana Public Service Company of Aurora, Ind., contracted to take power from the Union Gas & Electric Company of Cincinnati, Ohio, over a 33,000-volt, three-phase, 60-cycle, 29-mile (46.6-km.) transmission line it was confronted with the question of providing a receiving substation. At the outset the load to be served amounted to only about 600 kva. Most of this was lighting. But an additional 300-hp. motor load was soon to be connected. Space was available in the old generating station for the receiving station equipment. An analysis of the situation showed, however, that it would be cheaper to erect an outdoor substation than to use the indoor space on account of the fact that the use of high-tension wall or roof bushings could be avoided and the outdoor bus structure and wiring would be less expensive. Moreover, by using a high structure out of doors it was seen to be possible to put the equipment well above the high-water mark of the Ohio River, which is near the plant. Another consideration was that future upkeep on the old station could be kept at a lower figure if the substation were placed out of doors than if it were housed in the already old structure.



OUTDOOR SUBSTATION OF INDIANA COMPANY

The station as it was installed is shown in the photograph. It consists of a steel-tower delta-star substation large enough to carry three 500-kva. transformers. A steel structure was chosen because in future appraisals it will be regarded as a permanent structure, while a wood-pole structure might be regarded as more or less temporary. At present the station is equipped with three 200-kva. Wagner transformers. To facilitate changing these units an I-beam heavy enough to carry a 500-kva. transformer has been made a part of the top structure of the station. The transformers sit on removable I-beams. To remove one of the units it is lifted about 1 in. (2.5 cm.) by means of a block and tackle attached to the heavy overhead I-beam and is then lowered after the supporting I-beams have been pushed aside.

As protective features the station is equipped with a high-tension three-pole remote-controlled air-break switch equipped with carbon-tetrachloride fuses and long-turn cylindrical choke coils mounted as a common unit. In addition to this apparatus the station is equipped with General Electric electrolytic lightning arresters so arranged that they can be isolated by opening disconnecting switches. The installation was made under the direction of R. C. Rockefeller, local manager for the Indiana Public Service Company.

SOLUTION OF METER-TESTING PROBLEM OF SMALL COMPANIES

Several Companies in Wisconsin Have Adopted a Group Plan to Provide Accurate Testing at 40 Cents per Meter

Arc-lamp trimmers, assistant firemen and linemen usually do the meter work for small companies in their spare time. As a result the meters get little if any expert attention. It would seem to be a better plan, says George W. Hewitt, foreman of the meter department of the Minneapolis General Electric Company, to hire a trained meter man to look after the meters and have him utilize his spare time working on the arc lamps or helping with wiring or assisting the linemen. By this scheme the central station would be able to give the meters the benefit of a trained man. By this is not necessarily meant a college graduate but rather a man who has learned how to test meters for some large company, or preferably a medium-sized company. A man from a large company might not work out so well, because in the larger concerns it is necessary to train a man to do one thing and do that quickly and well.

The testing problem of the small company will admit of any one of three solutions with a fair degree of satisfaction. First, some outside party may be called in to test the meters at given periods. The second plan is to hire a meter man and use him to test, repair, read and install the meters, and then utilize his spare time at other work. The third plan, and the one that seems to be giving general satisfaction all the way around, is for several plants to club together and operate a joint meter-testing department. These plants hire a good meter man and have him make the rounds testing all the meters, each company paying its prorated cost.

A group of plants is following the latter practice in Wisconsin with remarkably good results. The general average cost of operating this plan is about 40 cents per meter. This covers railroad expenses and hotel expenses, as well as other costs. As an approximate rule it may be figured that 1500 meters will keep one man busy where he tests, repairs, reads and installs the meters. A fairly good man ought to average from eleven to twelve meters per day.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

EFFECT OF DAYLIGHT SAVING ON CENTRAL-STATION INCOME

Not Only Is There a Decrease in Revenue from Lighting, but Also Rebate for Street Lamps Brings About Considerable Loss

The effect of daylight saving on the earnings of the Cambridge (Mass.) Electric Light Company was discussed by W. R. Eaton at the recent convention of the New England Section of the N. E. L. A. A comparison of the records of the Cambridge company for the past three years shows that for the months of April to August inclusive there was a very material reduction in energy sold to lighting customers for the year 1918 as compared with the two previous years. Long before daylight saving was put into effect in Cambridge, however, public meetings were held in that city to bring about fuel saving by cutting down the consumption of energy for lighting.

The increase in total business of 1916 over 1915 was 20.8 per cent, of 1917 over 1916, 16.2 per cent, and of 1918 over 1917, 21.3 per cent. While the single-phase or lighting feeders show an increase of 10.4 per cent for the first period and 23.1 per cent for the second, they show a decrease of 5.8 per cent for 1918; that is, an average annual increase of about 14 per cent became approximately a 6 per cent decrease for the entire period, in spite of the fact that the sales for power purposes had materially increased, and as a good proportion of this increase was due to night work, it should have increased the sales for lighting purposes.

Records of the amount sold to the town of Belmont give a better indication of what daylight saving has done for the small stations, whose load is principally residential and small store lighting. An average annual increase of 16 per cent has been in the case of this township changed to a 14 per cent decrease.

A comparison of income loss with the kilowatt-hour loss shows, as would naturally be expected, that the whole loss was at the maximum rate of 9 cents.

Another reduction of income which is closely related to the reduction because of daylight saving is the reduction in street-lighting income and the question of rebates to municipalities when the discontinuance of lamps and reduction of lighting hours are ordered by the conservation committee.

Last winter, when the restricted hours of street lighting were first enforced, the Cambridge company found that in rebating to the city the operating or running charge for all lamps shut out entirely and a pro-rata reduction of this same charge for the number of hours not burned on the other lamps, the loss in revenue was $5,000, while the most generous estimates showed an actual saving to the company which amounted only to about $2,100.

For this reason when the second orders for curtailment were received the company began to inquire of its neighbors just what their policy was in making these rebates. It was surprised to learn that some companies were rebating the whole price of the lamps for those shut out. This seems altogether too generous, the author maintained, when it is considered that in most cases these lamps are held in a readiness-to-serve condition and are only awaiting orders to have the service turned on.

While rebating the running charge only would seem a fair settlement under normal conditions, yet when it is remembered that any loss of revenue for this service must react to raise prices on other services to cover the abnormal increase in cost of fuel, it would seem that a fairer method would be to rebate pro rata the amount saved per lamp-hour.

CUSTOMERS' DEPOSITS DO NOT NECESSARILY PROTECT

Utility May Pay More in Interest Rates on Deposits than the Bills That Might Not Be Paid Would Amount To

Deposits made by customers as protection to the lighting company might, unless carefully handled, result in a loss to the utility greater than the amount that might be saved by preventing dishonest customers from defrauding the company. No strictly uniform practice exists regarding the size of deposits, from whom they shall be required, method of refunding or rate of interest allowed.

Interest as a rule is from 5 to 6 per cent. Not only is this rate of interest substantially higher than can be obtained as a rule from savings banks, but, what is more to the point, it is higher than the banks allow the utility on its bank deposits. If, therefore, a company has a strict rule of requiring say a five-dollar deposit from every customer not a householder and keeping that deposit as long as the customer continues to take service, then the company is paying from 25 to 30 cents per customer annually to protect itself against the few persons who might move without the formality of paying their bills.

A good many utilities have seen the error of paying more for protection than the value of that which they wish to protect. These companies have taken the position of not allowing a deposit where the customer is able to establish his credit. Besides this, if after some months of service the customer can establish his credit, the deposit is refunded. With many companies regularity in paying monthly bills will establish the customers' credit sufficiently to permit the refund of the deposit.

STAGGERED HOURS OFFER 15,000 KW. SAVING AT BOSTON

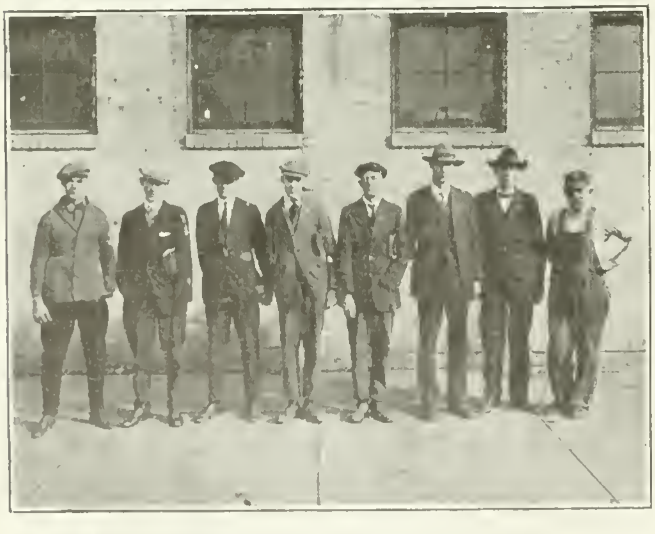
Investigation Shows that It Would be Necessary to Change Working Hours of About Thirty Industrial Establishments Only Abcut Thirty Minutes

If staggered working hours are adopted at Boston this winter, at least 15,000 kw. in generating capacity will be released on the system of the Edison Electric Illuminating Company for service in the peak period. At a recent meeting of the Boston Section of the A. I. E. E., L. L. Elden, electrical superintendent of the Boston company, said that to add the above rating to the existing plant capacity during forty-five winter days it would be necessary to change the working hours of about thirty industrial plants only about thirty minutes. The above saving represents about one-sixth of the total estimated peak load of the Boston system for the coming winter. To realize it the coöperation of large plants like the Hood Rubber Company, Watertown, the Watertown Arsenal, the Fore River and Squantum shipyards and others now on Edison service would be necessary. The comparatively small change in closing hours required to realize so substantial an increase in available station rating was something of a surprise to those investigating the possibilities.

ONE-ARMED MEN EMPLOYED BY DAYTON (OHIO) COMPANY

Several Men Injured by Industrial Accidents Successfully Used as Meter Readers, Meter Testers and Water Tenders

Among the effective employees of the Dayton (Ohio) Power & Light Company are a number of men who have lost one of their arms through industrial accidents. In the national emergency the government was unwilling to accept their services in its combatant forces, but the local central station afforded them an opportunity to do their bit by working at jobs that kept munition plants speeded up. One of the men in the photograph has been associated with the Dayton Power & Light Company since Jan. 19, 1916. He is employed as meter installer. Four of them are meter readers. These men have all been employed during the year 1918 to replace meter readers who are in military service. The remaining three are water tenders at the Third Street power plant of the company. They also are replacing men who have entered the service of the government.



ONE-ARMED METER READERS AND INSTALLERS AND WATER TENDERS EMPLOYED AT DAYTON

MAKING ELECTRIC RANGES STAY SOLD WHEN ONCE SOLD

Education of Employees, Speedy Installation and Accurate Voltage Check Make Possible 99 per Cent of Satisfied Customers

Before starting an electric range campaign in the summer of 1918, the Duluth (Minn.) Edison Electric Company held meetings to instruct its troublemen in the care of ranges. Moreover, meetings of a general educational character for all employees were conducted to familiarize them fully with the use of electric ranges and the advantages of cooking by electricity. The purpose of this was to enable any one in the company's organization to give an intelligent answer to questions about a range so that the public would understand that the electrical people had confidence in their product.

Public demonstrations were held daily for one month, during which extensive newspaper advertising was carried on and circulars were mailed to a selected list of prospective customers. As new "prospects" were gained from names recorded at the demonstrations, further literature and follow-up letters were sent. Previous to the advertising campaign four sets of circulars were sent to a list of very good "prospects," so that by the time the newspaper advertising came out these people were in a frame of mind to receive the company's advertising in good faith. During the demonstration salesmen followed up these hoped-for customers, devoting especial attention to those who had been to the demonstrations and those who had returned postal cards.

Upon receipt of an order for a range every effort was made to install it promptly. As soon as the range was installed a recording voltmeter was put on the circuit to find out if the proper potential was being obtained. As soon as the chart was completed it was scanned carefully to see if it showed low voltage. If it did, the line department was immediately notified and the trouble remedied. This eliminated complaints of ranges operating too slowly because of low voltage. Further complaints were forestalled by the demonstrators.

After the campaign was over a cooking bureau was established where the company conducted a cooking class once a week. Notices of this meeting were sent to range users and to those interested in electric ranges. A feature of this class was an offer of the company's demonstrator to try any recipes that might assist customers in food conservation.

A few more than 100 ranges were sold. Most of these were scattered around through the city, so that in every community there is a range to whose owner persons in that community can be referred. Ninety-nine per cent of the ranges sold have remained and the customers are very well satisfied. W. S. Heald, manager of the commercial service department, states his belief that the hardest work of all is to keep the ranges sold, but he feels that his company has been successful in this.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Magnetic Pull in Electric Machines.—E. ROSENBURG.—In this article a mathematical and graphical discussion of the effects of unbalanced pull on the design of electrical machinery is given. The author states that the mechanical parts of a multipolar machine, whether its winding is provided with equalizing connections or not, should be designed strong enough to withstand the pull produced if only one-half of the machine is magnetized to full saturation of the iron. Under normal working conditions a certain reduction of one air gap and an equal increase of the diametrically opposite air gap cause in multipolar machines a readily calculated unbalanced magnetic pull per square centimeter which has a maximum value for a comparatively low state of saturation. For higher saturation the unbalanced pull falls off. In bipolar machines the unbalanced pull has different values for displacement in the direction of the field axis and at right angles thereto, while in multipolar machines the total unbalanced pull for a given displacement of rotor and stator centers is independent of the rotor position. The magnetic pull caused by a displacement equal to the "gravity deflection" of the shaft must not exceed one-sixth of the rotor weight. The author also states that the critical speed is lowered by the unbalanced magnetic pull and varies with changes in excitation. For the greatest permissible value of unbalanced pull mentioned in the preceding rule the reduction of critical speed amounts to 18 per cent.—*Proceedings A. I. E. E.*, September, 1918.

Lamps and Lighting

Comparison of Lighting Units.—WARD HARRISON.—In the comparison of lighting equipment for offices, the writer states that open reflector units are not suitable for large general offices from the standpoint of brightness, specular reflection or shadow. A single direct-lighting unit, if of large area and low brilliancy, would be satisfactory for one person alone in an office if so placed as to bring the light over the left shoulder. It should be designed to illuminate the surroundings to a fair intensity. He states that semi-inclosing units are preferable to open-reflector units for office and drafting-room lighting. It is important that they be of large size and that the density of the glass bowl be such that they are satisfactory from a brightness standpoint. The legitimate field for light-density semi-indirect units as applied in office lighting is extremely limited, depending upon the condition of the ceiling and reflecting walls. Semi-indirect units of dense glass and totally indirect units are, in general, preferable to all others for office lighting where a ceiling of good reflecting power is obtainable. The author points out the importance of the proportions of the room to be lighted, the reflecting power of the ceiling and walls in the utilization and the necessity of keeping reflectors and bowls clean. In conclusion a table is given showing the coefficients of utilization for various types of reflector units and for walls and ceilings of different character.—*Central Station*, September, 1918.

Generation, Transmission and Distribution

Mercury-Vapor Rectifiers.—In this paper may be found an extensive discussion of the efficiency of rectifiers for two-phase, three-phase and six-phase installations. Curves show the variation of efficiency for different conditions of load. The fall of potential in various parts of the circuit is also calculated. Numerous oscillograms of current and voltage waves in different parts of the apparatus are shown. The rectifiers under test are illustrated but not described in detail.—*Schweizerische Bauzeitung*, Sept. 28, 1918.

Load Division Between Synchronous Frequency Changers Which Operate in Parallel—II.—QUENTIN GRAHAM.—Consideration is given to the conditions that must exist when two or more synchronous frequency changer sets are to operate in parallel from both ends. Parallel operation of machines having similar characteristics and those having dissimilar characteristics is discussed.—*Power*, Oct. 22, 1918.

Water-Power Development in France During the War.—HENRI CAHEN.—Report made by the author, who is the head of the Motor Power Service in the Ministry of Armament and War Manufactures, to a recent general congress of the Society of Civil Engineers of France. To the 750,000 hp. produced by water power before the war there has been added under government auspices 850,000 hp., in use or soon to be available, divided geographically as follows: Alps, 428,000 hp.; Pyrénées, 185,000 hp.; central plateau, 200,000 hp.; Jura and Vosges, 35,000 hp.; western district, 2000 hp. This power will be divided as regards its employment between transmitted energy, to which 308,000 hp. is allotted; electrochemistry, 216,000 hp., and electrometallurgy, 326,000 hp. The total capital investment is placed at 660,000,000 francs.—*Revue Générale de l'Electricité*, Sept. 14, 1918.

Sawmill Refuse as a Central-Station Fuel.—R. U. MUFFLEY.—The writer describes tests of furnaces using "hog" fuel, which consists of sawmill refuse after it has been put through a machine which shreds and grinds it. It is said that in plants in the Northwest using fir sawmill refuse boilers may be worked up to 100 per cent above rated capacity, and that such tests indicate the usefulness of the fuel for handling of peak loads. Curves are given showing comparative costs per horsepower-hour for coal, hog fuel and oil at various prices. A description of the furnaces and fuel-handling apparatus follows. The author points out that care should be taken to see that a constant supply of fuel is in reasonable prospect, since the output of the mill may fluctuate seriously from time to time.—*Stone & Webster Journal*, August, 1918.

Energy Losses in High-Tension Lines.—F. Hoppe.—The present necessity for economizing materials makes it necessary to permit greater energy loss in lines, notwithstanding the loss in commercial economy. Limitations will mainly be set by the permissible voltage drop and magnitude of the corona losses. The investigations have the object of determining what percentage energy losses should be allowed in transmission. Conductors are calculated for a definite maximum load. This sets a lower limit to the section of the wire if the heating of the conductors is not to become excessive. Sufficient tensile strength should be allowed, and the corona losses should not become too great. Moreover, an upper limit to the section of overhead wires is set by the practical difficulty of suspending wires above a given section. The greatest possible sections are 120 mm. to 150 mm. for copper or iron and 240 mm. to 310 mm. for aluminum. In many cases in which a transmission is required over distances not too great a saving of material can be effected by using cables instead of overhead wires, as smaller sections are then permissible.—*Science Abstracts, Section B*, Aug. 31, 1918. (Abstracted from *Elektrot. Zeits.*, 39, April 18, 1918.)

Installations, Systems and Appliances

Airplane Motor-Ignition Systems.—B. Z. Reiter.—This article deals with the ignition of airplane engines both by means of magneto and battery systems. It is somewhat simplified for the use of mechanics preparing to go into the government service. The paper is replete with well-chosen illustrations.—*American Machinist*, Oct. 17, 1918.

Electrophysics and Magnetism

Some Two-Dimensional Potential Problems Connected with the Circular Arc.—W. G. Bickley.—The velocity potential and stream functions for circulatory flow about an infinitely long lamina in the form of a circular arc and for the disturbance of a stream due to such a lamina were determined in a previous article. It is now proposed to give drawings of the stream lines in the latter case, to examine the case of rotation of the arc, and to give a brief discussion of the motion of the arc when free to move and acted upon by the consequent fluid pressures.—*Philosophical Magazine and Journal of Science*, September, 1918.

Electrochemistry and Batteries

Electrodes for Electric Furnaces.—Jean Escard.—This is the first of a series of articles translated from the French and originally published in *Le Génie Civil*, Vol. 71, Nos. 5, 6 and 7. In the first article there appears a discussion of the raw materials required for the manufacture of electrodes. The manufacturing process of making the electrodes and the physical requirements for successful use are given.—*General Electric Review*, October, 1918.

Aluminum and Its Light Alloys—V.—Paul D. Merica.—The composition of duralumin, a remarkable light alloy of aluminum, is given in this article. This alloy is said to respond readily to heat treatment. In its hardened condition the volume conductivity is said to be 35 per cent of that of copper and the melting point is about 650 deg. C. Data are presented showing the mechanical strength made possible by heat treatment. The resistance of the alloy to corrosion is said to be remarkable. Properties of other lighter alloys of aluminum are also discussed in this article.—*Chemical and Metallurgical Engineering*, Oct. 15, 1918.

Telegraphy, Telephony and Signals

Development of Police Signal Systems.—Jacob Grimm.—After tracing the development of telephone and telegraph signaling systems in considerable detail, this paper gives attention also to repair and maintenance of such systems and points out possible developments in the line of safeguarding the secrecy of this signaling.—Paper before convention of Municipal Electricians at Atlanta, Ga., September, 1918.

Radiotelegraphy.—L. W. Austin.—For the measurement of current of radio frequency the author proposes an arrangement of apparatus called "shunted contact detector." He says the sensibility of this arrangement is much greater than that of the best vacuum thermoelements of equivalent resistance.—*Journal Washington Academy of Sciences*, Oct. 19, 1918.

Miscellaneous

Electrical Developments After the War.—In a recent popular lecture C. H. Wordingham, president of the (British) Institution of Electrical Engineers, referred to the manufacturing side of the electrical industry after dealing with the problem of electricity supply. With the uniformity of pressure which a unified system such as that proposed would bring about there would come a greater standardization of apparatus. This would permit the British manufacturer to enter more readily into the competition for foreign trade. In his judgment, although there would be room for a few very large firms, Great Britain could get the best results if in addition to those large firms there was a combination among relatively small firms to get orders which would then be farmed out to the individual concerns.—London *Electrician*, Sept. 13, 1918.

Use of Electrical Current to Raise the Temperature of the Body in the Treatment of Disease.—E. P. Cumberbatch.—The author points out that if direct current penetrates the skin by way of an electrode 1 sq.in. (6.4 sq.cm.) in area the pain becomes unbearable with a current strength of 15 milliamperes. By the use of high-frequency current at a frequency of 50,000 alternations per second, however, there is no perceptible stimulation of the tissues. The density of the current can then be increased to a value which could not be tolerated in case of direct or low-frequency alternating current. A description of the apparatus for the production of this high-frequency current is given. An application to various diseases is described.—*Journal (British) Institution of Electrical Engineers*, June, 1918.

Electricity Supply of Archangel.—In this article the background surrounding the design and construction of an electric power station for Archangel is given. Although the city is one of 45,000 inhabitants, it is found that three three-phase turbo-electric generators of 500 kw. each suffice to carry the load.—London *Electrical Review*, Sept. 27, 1918.

Scientific and Industrial Research

(Printed in the Third Issue of Each Month)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Coöperative Work.

Conducted by Prof. Vladimir Karapetoff
Cornell University, Ithaca, N. Y.

RESEARCH COUNCIL WANTS TO GET INFORMATION ON LABORATORIES

It Is Desirous to Aid the Government and Further the Welfare of the World Through the Advancement of Industry and Science

The Engineering Foundation and National Research Council are coöperating in compiling information about the research laboratories of the country and in promoting industrial research. The purpose is to aid the government and the industries in war work and to further the welfare of the world through the advancement of American industry, engineering and science. To do this they request all laboratories which have not yet done so to send to the New York office of the Engineering Foundation, 33 West Thirty-ninth Street, a brief statement covering:

(a) *Equipment.*—Not a detailed list, but a summary indicating kinds and capacities in a general way and mentioning apparatus of unusual character or size.

(b) *Research Work.*—General kinds, with reference, if permissible, to special problems which would indicate the scope of the work which the laboratory can undertake.

(c) *Staff.*—Classes, such as chemists, physicists, engineers, assistants; number of each; name of person in charge, and research time—all, half, one-third or other approximation.

[Much of the information requested, in so far as electrical science and industry are concerned, has been published in the Research Section of the Electrical World, which has appeared in the third issue of each month, begining with the issue of March 17, 1917. It may be found under the headings of "Apparatus Available" and "Research in Progress." Any one interested, say, in "dielectrics" could easily locate this heading in the former issues and find out not only the places where research on this subject has lately been done but the names of the investigators as well. The items can be conveniently cut out and pasted on cards for ready reference.—Eds.]

Research in Progress or Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Technical Theory and Practice" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

ALUMINUM, RESISTIVITY.

A series of accurate measurements have been made on the resistivity and temperature cofficient of commercial aluminum. This investigation is part of the work undertaken by the International Electrotechnical Commission for the standardization of specifications on industrial aluminum.—*Laboratoire Central d'Electricite, Paris, France.*

CABLES, HEATING OF.

Our chief investigation has been on the heating of buried cables. This work is in a measure completed, and an interim report has been presented to the (British) Institution of Electrical Engineers, but not yet published. Meanwhile it has been decided to include in the inquiry a determination of the dielectric losses in the cables. The cables are laid direct in the ground, solid in bitumen, or drawn into a sixway duct of stoneware. The laid cables are heated by alternating currents, and the increase in the resistance of the conductors is measured by means of a Kelvin double bridge. To make the use of galvonometers possible, a small continuous current of about 20 amp. from a battery is superimposed upon the heavy alternating currents of 500 amp., the accumulators being put in series with the secondary winding of the transformer and with the cable by a double-pole change-over switch. For further details see London *Engineering* of August 2, 1918, page 122.—*S. W. Melsom, H. C. Booth and Miss V. Cockburn, National Physical Laboratory, Teddington, England.*

CAMERA FOR RAPID SUCCESSIVE EXPOSURES.

A camera with twenty-four lenses has been developed that will make twenty-four successive images at a maximum rate of 500 per second. The focal-plane shutter consists of a long curtain, and when operating it uncovers each lens in succession. An electrically actuated trigger for the setter starts it just before the phenomenon to be recorded begins. Numerous investigations of arcs have been made by means of this camera and have resulted in improvements in oil switches, circuit breakers, rotary converters, transformers, etc. The camera may also be readily adapted to the study of spark-gap discharges, insulator flashovers, cable breakdowns, transformer coil displacements, busbar movements, gas-engine operation, rifle and gun displacements, golf positions, etc.—*Capt. Chester Lichtenberg, Washington, D. C.*

COMMUTATOR MOTORS, POLYPHASE.

Some time ago the writer developed a kinematic device for imitating the performance of a polyphase series-wound commutator motor. The device has been named the "secomor" and described in the A. I. E. E. *Proceedings*, 1918, page 65. An addition to this device has been recently developed which permits taking into account the magnetizing current and the leakage impedance of the transformer through which current is supplied to the armature of the motor. At start and at speeds remote from synchronism the transformer affects the characteristics of the machine to quite an appreciable extent, and the addition of this attachment to the secomor was urged by practical designers of such machines.—*V. Karapetoff, Cornell University, Ithaca, N. Y.*

CONTACTORS, OXIDATION OF WORKING SURFACES.

During the past two years the standards committee of the A. I. E. E. has been endeavoring to fix the proper temperature rise for circuit breakers, contactors, switches, etc. The geneneral statement was made by the circuit-breaker engineers that after a circuit breaker had been in operation for several weeks the contacts tended to oxidize, which increased their temperature. This process being cumulative, excessive temperatures would be reached and the contacts injured. For this reason the circuit-breaker engineers recommended a low temperature rise. On the other hand, controllers are used ordinarily for intermittent duty, and therefore little or no trouble from oxidation has developed. The writer had some tests made to try to determine at what temperature oxidation had an active effect on the contacts. Owing to factory limitations, these tests did not exceed eight hours' duration, but some of the contact temperatures measured by a thermocouple reached from 200 deg. to 300 deg. C. No apparent effect from oxidation was observed. Several applications of controllers require a continuous operation for two or three months. A few tests on such applications showed no appreciable effect from oxidation, although the temperatures were considerably in excess of that recommended by circuit-breaker engineers.—*H. D. James, Pittsburgh, Pa.*

INSULATING MATERIALS FOR MAGNETO DISTRIBUTERS.

Important investigations have been made on some insulating materials with special reference to their use in magneto distributers. The insulation of these distributers has to be very durable, since brushes rub over the contact pieces embedded in the insulation. Ebonite and special insulating materials have been tested for mechanical and electrical properties, including tendency to carbonize with sparking. Mica condensers have been examined to test the effect of traces of air in the mica.—*National Physical Laboratory, Teddington, England.*

LAMPS, INCANDESCENT, TUNGSTEN.

A complete and almost universal substitute for carbon and "Gem" lamps would be provided if a tungsten filament very much more robust than the present product were available. It is understood that manufacturers are now actively at work on this problem, and the outlook for its solution seems hopeful. *—From a statement of incandescent lamp manufacturers to the United States Fuel Administration.*

LAMP SOCKETS, VENTILATED.

At the request of the engineering standards committee, measurements have been made of the temperature in ventilated and unventilated sockets of "Goliath" lamps and other lamps used in lanterns of the open and inclosed types. There is considerable heating in the sockets owing to the conduction of heat from the bulbs, and it was found that the temperature in the leading-in cables might rise to 140 deg. C. and that the existing arrangements for socket ventilation did not afford much relief.—*C. C. Paterson, A. Kinnes, J. W. T. Walsh and Dr. Norman Campbell, National Physical Laboratory, Teddington, England.*

MEASUREMENT OF VOLTAGE OF POTENTIOMETER PRINCIPLE.

A new instrument has been developed for measuring small voltages without the extraction of any current from the circuit being measured. The voltage to be measured is balanced against part of the drop of potential of a small battery. The zero point on the scale of a low-resistance voltmeter is used as a galvanometer. By a shift of circuits the source being measured is entirely disconnected and current from the battery flows through the voltmeter and deflects it to a point on the scale indicating the true voltage of the source at the moment of balance. This is possible because the current from the battery is caused to be the same before the shift of circuits, and this current is directly proportional to the voltage drop over which the balance is obtained.—*E. E. Northrup, Princeton University.*

PORCELAIN, STUDY OF MIXES.

While it is well-known that practically all wet process electrical porcelains in America are made from essentially the same elements in various proportions, frequent claims appear regarding some electrical porcelain of unusual characteristics. It was decided to explore a certain area of the triaxial diagram (flint, feldspar and clay) to see just what mixes would be best suited for high-tension electrical porcelain. The most important properties are dielectric strength, mechanical strength and resistance to temperature changes. Moreover, the body should not deteriorate under service conditions because of moisture absorption, etc. Comparative values of the characteristics—namely, workability in the wet state, translucency, color, vitreous fracture, dielectric strength, mechanical strength and resistance to local heat—were obtained from samples of these mixes. With mixes containing one kind of clay and within a certain range the workability in the wet state varies directly with the clay content, the translucency varies indirectly with the clay content, the color whitens with the decrease of the clay content. The vitreous fracture varies from a very conchoidal fracture to an irregular fracture with mixes of no flint to high flint content. The dielectric strength increases directly with the feldspar content. Mechanical strength increases directly with the flint content and the resistance to local heat increases directly with the clay content. In general, the maximum value of all three principal characteristics cannot be obtained in one body mix. However, a maximum value of any one or possibly two characteristics may be obtained. The problem, therefore, becomes one which should be based upon a consideration of the proportional importance of each characteristic in resisting deterioration of the commercial product. For the numerical data and triaxial diagrams see the *Electrical Journal, March,* 1918.—*Klinefelter and Gilchrest, Pittsburgh, Pa.*

PYROMETER, FOR MOLTEN STEEL.

Under the chairmanship of Dr. G. K. Burgess of the Bureau of Standards, a special committee of the National Research Council is being organized to develop a pyrometer for determining the temperature of the molten steel in the open-hearth and electric steel processes.—*G. E. Hale, Washington, D. C.*

STEEL, MAGNETIC.

Messrs. Thomas Firth & Sons of Sheffield have supplied a set of graded tungsten steels. The magnetic behavior of these steels showed discrepancies apparently due to their antecedent thermal and mechanical treatment. It is intended to prepare definite alloys from the pure materials in the electric furnaces of the laboratory and to examine them magnetically in the ingot and after forging and heat treatment.—*Dr. W. Rosenhain, National Physical Laboratory, Teddington, England.*

STEEL, THE INFLUENCE OF HEAT TREATMENT ON.

Experiments are in progress on the correlation of electric and thermal properties of steel in the light of the solution theory if accepted in the full sense of the term. Experimental evidence has been obtained to prove that total electrical resistivity is made of two components, that due to the solvent and that due to the carbides in solution, the effect of the latter being proportional to their concentration. Electrical conductance is almost entirely through the solvent, while frequently as much as 80 per cent of the total electrical resistivity is due to the solutes. Experiments were made on bars 6 mm. square by 15 cm. in length, carefully annealed, and also quenched under definite conditions. Electric resistivity was measured by the drop-of-potential method, thermal conductvity by means of copper-constantan thermocouples. The preliminary results show that the relationship of the two resistivities is approximately a straight line, although departing from the Wiedeman-Franz law for pure metals. Apart from its theoretical significance, the investigation promises to be of importance in the manufacture and testing of steel wire used for telegraph and electric power, transmission, conductor, rails, etc. The results are published from time to time in the *Journal* of the Iron and Steel Institute.—*E. D. Campbell, University of Michigan, Ann Arbor, Mich.*

TELEPHONE LINES, INDUCTIVE INTERFERENCE.

A theoretical study has been made of the effect of various arrangements of telephone wires on cross-talk and inductive interference from power circuits. The arrangement of the circuits in pairs, with the wires of each circuit at the opposite ends of the diagonals of a square, appears to afford a large reduction of these effects, with a simplification of the transposition system, especially in phantoms formed on these circuits. The idea is not new but seems to have a value in connection with the phantomed circuits which it did not have before these circuits were introduced. The disadvantages are the increased effect of irregularities in sag adjustment on the balance of the circuits and the slightly increased capacitance of the phantom circuits. While the initial cost of construction of a new line need not be higher than for standard practice, the cost of converting an existing standard line into the proposed form would be considerable. It is the intention to publish the complete results shortly.—*William W. Crawford, Department of Physics, Colorado College, Colorado Springs.*

WELDING, ELECTRIC, SPOT.

In view of the great importance of electric welding in shipbuilding, investigations were undertaken to answer the question whether spot welding could be successfully accomplished using steel plates 1 in. (25 mm.) thick. An experimental apparatus of large size was erected and put into operation, the results showing that no difficulty was encountered with 0.5-in., 0.75-in. and 1-in. (6-mm., 18-mm. and 25-mm.) steel plates. In fact, this experimental machine was successful in welding three thicknesses of 1-in. plate, a condition which far exceeds the requirements of merchant-ship construction. This operation has its historical significance in that this was the first time that any spot welding of this magnitude had been performed. The successful outcome of these experiments has led to the design and construction of large spot welders for use in the fabrication of ship sections. Further investigations are being made and designs are being worked out for special spot welders for use in the construction of bulkheads.—*H. A. Hornor in A. I. E. E. Proceedings,* 1918, *page* 1187.

WELDING, ELECTRICAL ARC PROCESS.

Extensive investigations, for use in building ships, are under way on electrically welded joints of 0.5-in., 0.75-in. and 1-in. (6-mm., 18-mm. and 25-mm.) steel plates, to determine their mechanical strength and the ability to withstand live loads and bending.—*H. A. Hornor, A. I. E. E. Proceedings,* 1918, *page* 1188.

Suggestions for Research

BRUSHES, CARBON AND COMMUTATOR WEAR.

Carbon manufacturers, as well as manufacturers of dynamo-electric machinery, have made numerous tests to determine contact resistances, friction losses, etc., of various grades of carbon brushes. Such tests, while of interest, contribute little toward the real practical need, namely, a carbon brush which can stand high current densities and high sparking voltages with small wear. In order to develop such carbons, it would seem essential first to make tests on how the carbon wear is affected by current density, sparking voltage and peripheral speed. Present indications are that with many commercial carbons quite considerable current densities can be used if there is no sparking voltage, while sparking voltages up to 15 volts or even 20 volts across the brush cause very little wear at certain speeds if the current density is low enough. More data on this subject would be of great benefit both to the carbon manufacturer and to the designing engineer.—*R. E. Hellmund, Pittsburgh, Pa.* [In usual tests with collector rings the brush is not operating under the conditions corresponding to a commutator with separate segments, and such essential factors as a non-uniform and fluctuating current density, sparking voltage, etc., are absent. On the other hand, tests on actual direct-current machines are of little value because the foregoing factors cannot be varied at will or accurately measured. What is needed is a new experimental arrangement that would enable one to obtain any desired combination of the important factors in measurable quantities and a rational theory of the phenomena in the short-circuited coils, including the brush contact.—*Editor.*]

CABLES, DIELECTRIC LOSSES IN.

A start has been made in the matter of preparing specifications covering dielectric losses in cables. Engineers of some of the principal cable manufacturers have agreed to coöperate. Before such specifications can be formulated, at least two fundamental points must be considered and agreed upon: First, data must be collected showing the limits of the losses; second, a standard method of making tests must be established. Very few even of the cable manufacturers are equipped for measuring dielectric losses, and probably no users of cables have facilities for properly making these measurements. Some very much simpler and more easily workable apparatus than is now available must be developed before commercial routine tests of this kind can be applied to the output of the cable factories. If a portable testing set for measuring dielectric loss were devised, it could be used to test newly installed cable as well as to secure experimental data on old feeder cables under various conditions of age, temperature, charred insulation, etc. —*A. I. E. E. Committee on Transmission and Distribution.*

COMMUTATOR MOTORS, POLYPHASE.

From the discussions on alternating-current commutator motors it appears that little is known about the possibilities of the polyphase commutator machine. The available literature in English is so meager and the methods of attack of the various writers are so radically different that some one who knows the subject and who also knows how to present it should work up the existing material into a comprehensive treatise for publication.—*A. I. E. E. Committee on Electrical Machinery.*

CORROSION, ELECTROLYTIC PROTECTION AGAINST.

Corrosion of steam condenser tubes, boilers, etc., is now considered to be due to an electrolytic action, and a reasonable degree of protection has been obtained by circulating an electric current in the right direction to counteract oxidation. Much remains to be done in this field of endeavor, both in obtaining accurate data and also in perfecting the mechanical details of the method, for use on a large scale and under various conditions of service.

HEATING OF REVOLVING PARTS.

Thermocouples and resistance thermometers are used for recording the temperature rise in stationary parts of electric machines, but it is desired to develop similar apparatus for recording at a distance the temperature rise in revolving parts, say in the field windings of a turbo-alternator. No slip rings or gliding contacts must be used, and any electric or magnetic action of the detector must be transmitted to the stationary leads by induction or some such means.

SKIN EFFECT IN BUSBARS.

As a general principle it might be presumed that all conductors of a certain proportionate shape and at a certain value of f/R will have a definite value of R'/R, where R is the direct-current resistance, R' is the alternating-current resistance, and f is the frequency. This is true of the tubular form, the skin effect of a tube of a certain ratio of thickness to diameter and of any size being given by a single curve. The principle has not been proved to be true for a thick strap, but it seems probable that it applies to that case also, and to built-up ventilated busbars. For approximate results only the outside dimensions of ventilated busbars would need to be considered, and the busbars would be treated like very thick rectangular conductors of low conductivity. The above principle could easily be verified experimentally, and, if true, it would greatly simplify the measurement of skin-effect values and the plotting of curves for practical use. A simple extension of existing curves for various proportionate thicknesses would then show the approximate skin effect of any isolated rectangular conductor, whether solid or ventilated, hot or cold, large or small, and whether copper or aluminum. Such a set of curves would be useful in designing heavy busbars and conductors, not placed close together[*].—*H. B. Dwight, Hamilton, Ontario.*

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[*] These statements were taken from Mr. Dwight's paper on "Skin Effect in Tubular and Flat Conductors," *A. I. E. E.*, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ELECTRIC MOTORS IN THE CEMENT INDUSTRY

Discussion at A. I. E. E. Meeting in New York Follows Plan of the Committee on Industrial and Domestic Power

In accordance with a plan chiefly credited to Capt. E. H. Martindale, formerly chairman of the committee on industrial and domestic power of the American Institute of Electrical Engineers, papers are to be presented from time to time, as a result of the activities of this committee, giving studies of the power requirements of specific industries.

On Nov. 8, at the three hundred and forty-third meeting of the A. I. E. E., held in New York City, such a paper was presented by R. B. Williamson of the Allis-Chalmers Company, entitled "Electric Drive in the Cement Industry." The processes of cement manufacture were outlined and data were presented to show sizes and types of motors required for driving the machinery.

Many prominent men, particularly from the manufacturing companies, were present to discuss the paper. Prof. C. A. Adams, president of the A. I. E. E., occupied the chair.

WIDER USE OF METRIC SYSTEM IS RECOMMENDED

International High Commission Seeks to Have Congress Make Use of This System Obligatory in United States

More extensive use of the metric system in the trade and commerce of the United States is recommended in a resolution adopted by the United States Section of the International High Commission, of which Secretary of the Treasury McAdoo is chairman. The resolution is as follows:

> The United States Section of the International High Commission, having in view the present efforts to bring about the exclusive use of the metric system of weights and measures within the jurisdiction of the United States, resolves:
>
> 1. That in the opinion of the section the adoption of that system would be productive of great advantage in the commercial relations of the United States with the other American republics.
>
> 2. That the secretary of the section be directed to communicate a copy of this resolution to the chairman of the proper committees of the Senate and the House of Representatives.

The United States Section of the International High Commission received legal recognition by act approved Feb. 7, 1916. Its chief function is to bring about greater uniformity and a more liberal spirit in the commercial law and administrative regulations in the American republics and more stable financial relations between Latin America and the United States.

It is, of course, unnecessary for the United States Section to recommend to the Latin-American Section of the commission anything in connection with the metric system, which is exclusively in use in Latin America. At present the use of the metric system is not obligatory in the United States, so that documentary uniformity is lacking. Of more importance than statistical and administrative questions, however, is the use of the metric system in trade. Of the great nations of the world only the English-speaking nations have still to adopt the metric system of weights and measures, and Great Britain seems to be giving serious consideration to the necessity of making a change. The subject has now assumed a most practical character in the minds of those who are planning for post-war trade expansion.

WATER-POWER DEVELOPMENT TO BE AN ISSUE IN MAINE

Public Policy Expected to Be at the Forefront in 1919 Session of the Legislature—Report on State's Resources

Water-power development as a public policy is expected to come to the front at the 1919 session of the Maine Legislature, following a quiescent period in the discussion of state policies.

An exhaustive report on the resources of the state with respect to hydroelectric and storage facilities is now approaching completion in the hands of the Public Utilities Commission under the direction of Paul L. Bean, chief engineer of the board. This volume, which is to cover over 600 pages of data and discussion of great technical, economic and legal interest, will set forth the physical facts regarding the water-power resources and possibilities of the principal rivers in Maine in one of the most comprehensive studies ever made in this field, and it is planned to have it on the desk of every legislator at the opening of the 1919 session.

The report will not deal with questions of policy, but will afford an engineering basis for any legislation which may be deemed necessary. The possibilities of interconnection will be indicated in the report on a map showing all the principal transmission systems and plant locations in the state. An important section will deal with the market for hydroelectric energy and the limitations of the latter as well as probable and actual costs of development for commercial use.

It is expected by those conversant with political conditions in Maine that the old question of state ownership and development of water powers will again be agitated in 1919, although nothing in the September election indicated strong sentiment against private ownership.

PROGRESS IN RECONSTRUCTION

LOOSENING of the restrictions of the War Industries Board on the manufacture of electrical supplies is reported on page 950 of this issue.

Dr. Garfield has modified the lighting restrictions. His order is printed on page 949.

The National Committee on Gas and Electric Service is still representing the utilities at the national capital. It has been suggested that this committee be continued during the reconstruction period or for such time as its contact with the Washington authorities is found to be in the interest of the companies and the public and of service to the government departments with which it maintains close contact.

A plan for the work of the electrical manufacturers' organizations in the reconstruction era is being considered carefully and it is expected that it will be matured at an early date.

OUTLOOK IN RECONSTRUCTION AS IT IS SEEN IN CHICAGO

Report from the Middle West on the Factors Which Will Probably Determine the Condition of the Industry

Even before rumors were received that the armistice was signed the Middle West had begun to ask itself, "What will be the effect on the industry?"

In the first place, it is apparent that the government will not be out of the market for capital until after next April. There will be another Liberty loan "to get the boys home." But after April there will be an opportunity to raise capital without competing with the government. In fact, in the fall there should be available a considerable amount of reasonably priced money. Americans have now been taught to save and to invest. So the latter half of 1919 ought to see a large amount of utility financing.

The necessity for it can almost be passed without discussion, for there are few companies that have kept their reserve line, substation and station capacity as far ahead of the demand as is customary. There are a few exceptions to this, of course, in cities where war work has necessitated extraordinary expansion. In the main, however, the period of the war has been a period of makeshifts. The whole effort has been to get along with whatever was on hand. These makeshifts will not endure long when peace is in sight. To do away with them and to get the plant capacity a safe distance ahead of the demand again will take capital. This work can hardly be expected to create anything in the nature of a boom, because, in some of the large cities especially, the usual rate of general growth of the utilities has not been maintained owing to curtailment of building. It should, however, be of generous proportions.

Getting the labor depends on the government's policy of demobilization and on the general policy of the large industries. War plants which have employed the highest-priced labor will no doubt release some of it. That will create a certain supply, but not a large one, and will tend to lower labor prices. Steel mills have enough orders on hand and in prospect to keep going at top speed for many months. The shipyards will continue with their program for producing enough tonnage to sustain an army of 5,000,000 men abroad. So it appears that until actual releasing of the army begins labor will not be in appreciable supply. Moreover, as long as food and clothing prices remain at present levels the wages of labor will not recede far. Common labor, however, will no doubt go back to $2.75 or $3 a day in a reasonable time.

How the demobilization will be handled has not been announced. It is safe to assume, however, that the United States will "play safe." She will probably maintain an army of millions abroad until peace negotiations have been actually completed. It will be remembered that during the late stages of the Philippines campaign troops were replaced with fresh contingents after they had spent six months in the islands. Following this policy again after the signing of an armistice would somewhat delay demobilization. On the other hand, immediate release of men in camps on this side of the water would create a labor supply quickly—too quickly perhaps. This is hardly to be expected. In any event it is believed that a reasonably adequate supply of labor will be available at prices within reach by the time capital can be secured to make use of it.

DEMOBILIZATION WILL GIVE THESE MEN BACK TO INDUSTRY

As to the trend of central-station loads, no fear is expressed. It is, of course, expected that there will be some lull in certain industrial plants. But the enthusiastic energy and resourcefulness of the American manufacturer can be relied upon to find ways and means of keeping the majority of the wheels turning. He has never yet been known to sit back in idleness simply because the immediate job he was doing had come to an end. Releasing restrictions on lighting will add to electric loads. Commercial effort on the long-neglected domestic appliance market will help. The beginning of manufacturing of new devices will start. Evidence of these in the electrical field are numerous. New lines which are ready for announcement are of all sorts. They include everything from sockets to steam turbines.

So, on the whole, the outlook for the utilities in the Middle West is bright. They have weathered a severe storm. Some have had assistance through higher rates. Some have "lived on their fat." None is prostrate. The outlook for the industry during the reconstruction period appears, therefore, to be entirely satisfactory.

Facing the Reconstruction Problems

As the Outlook Is Seen in Statements to the "Electrical World" by W. F. Wells, F. G. Sykes, Alex Dow and W. S. Barstow

Promote the Revival of Peace Industry

BY W. F. WELLS

President National Electric Light Association

THE enemy of civilization and liberty has given up his arms. He has been overpowered by the greatest armed force ever assembled on the seas, on the land and in the air. The result has been attained by the combined efforts of twenty-three million men, serving under the colors of twenty-four nations. The particular part accomplished by the members of the National Electric Light Association and the representatives of the electric light and power industry has been to maintain their service to the public and to supply the great industrial armies with the immense quantities of power required by the government for the construction of ships, docks and government works and the manufacture of arms, munitions, clothing and supplies for the navies and military armies in the field.

With the cessation of hostilities the demands on the industrial army were diminished, orders being issued from Washington on the day following the signing of the armistice to eliminate all Sunday and overtime work in government-owned or controlled plants or in plants producing war supplies. The men thus released from night work should be transferred without loss of time and product to other industries which will form part of the great work of reconstruction and readjustment of civilization.

During the months to come the armies now in the field will be demobilized and returned to their former homes. As this work progresses there must be also a progressive transfer from the industrial war army to the one of industrial peace. Men taken from farms and from industries which furnished comforts, conveniences and pleasures before the war must be reëstablished in their old pursuits, and parallel with this there must be provided ways and means for the returning soldiers to do their part in the army of civilization. Our comfort, our happiness and our well-ordered existence depend on the smoothness and quickness with which the men released from military and naval service and the supporting war industrial army are transferred to the great peace army of the future.

The work of our members is to plan and promote the revival of industry on a peace basis, and to do this in such a way as to maintain the orderly processes of a self-controlled government.

The Engineer Will Be Called Upon to Bear Great Responsibility

The closing of the world war has left the United States of America a leader among the nations of the earth, not only financially but industrially. Such a proud position carries with it a tremendous responsibility and calls for broad vision and organizing and executive ability of the very highest order. Science and exact methods will play a very important and ever-increasing part in the reconstruction work which is about to begin, and the engineer will be called upon more than ever to bear great responsibility. As yet the American engineer has not been found wanting, and he will not in the great work about to begin.

F. G. Sykes,
President American Power & Light Company.

Electrical Industry Should Take Its Place in Reconstruction

The necessity of reorganizing industry upon a war basis in order to furnish the foundation for military operations has brought about results which otherwise would have taken years to accomplish.

The demonstrated value of the engineer in war time has forced a sudden realization on the part of the public of the value of the same engineer in time of peace. Hereafter a large part in national life, in building up the industries of the country, must be taken by those technically trained in science and organization, and some definite steps should be started at this time to provide that the electrical industry take its place in reconstruction and in all future progress.

W. S. Barstow,
President W. S. Barstow & Company.

A Period of Readjustment

There will be a period of readjustment in the country at large. Although certain parts of the war activities will be stopped, it will be necessary to keep an army overseas and an army organization in this country for a year, perhaps more. Supplies will be required for these forces. More Liberty loans and taxes will be necessary, and they will call for economies. Certainly economies in food will be essential.

Detroit has not over-expanded in war work and has little manufacturing equipment, and no housing or labor, which cannot be converted quickly to peace-time production. The transition period in this city, in my opinion, will not last much longer than any of the several intervals of transition through which we passed in getting adjusted to war conditions.

Some people expect to see immediate reductions in wages. That forecast is not based on the lessons of history. The workingman's living standard will never return to the basis of, say, 1896, and in my judgment the level of wages will not be readjusted violently. On the contrary, it is my thought that efficient work will continue to command present wages, but the inefficient and overpaid men will have to readjust themselves to positions which they are fitted to occupy.

Alex Dow,
President Detroit Edison Company.

POLITICS AND RECONSTRUCTION GETTING MIXED IN WASHINGTON

Spirited Contest Developing in the National Capital Over Government Plans for Control of Reconstruction Measures

BY WINGROVE BATHON

Washington Representative "Electrical World"

Report has been made in these columns recently of the prospect of a great contest in Washington in connection with the reconstruction bills before Congress. Additional bills are being introduced, and the expected fight is developing rapidly, the signing of the armistice with Germany bringing it out into the open, on the ground, Senators say, that the war is over.

Under the circumstances it is perhaps advisable to make an explanation of what is said to be the true political background in Washington concerning the reconstruction measures, so that business men may understand the situation that confronts them in preparing to place industry upon a peace basis and may take such precautions in presenting their views to Congress as seem advisable.

In the first place, doubt has arisen during the past week in well-informed legislative circles in Washington as to whether the Senate will consent to confirm the appointment of Bernard M. Baruch, chairman of the War Industries Board, as a member of a Reconstruction Commission, in case the so-called administration plan of revamping the Overman bill, giving reconstruction powers and duties to the War Industries Board, is carried through, and in case Congress passes the bill, thus making the proposed commissioners its creatures. If a forced vote were obtained from the present Democratic Congress, it is doubtful if later on appropriations could be obtained if Mr. Baruch were to have a controlling voice in their expenditure.

* * *

Doubt is also being expressed in Washington that the Senate will permit the placing, under any bill which Congress passes, of reconstruction powers and duties in the hands of Vance McCormick, chairman of the War Trade Board, who is also chairman of the Democratic National Committee and who has been mentioned as a possible Presidential appointee upon a reconstruction commission. These doubts extend to the members and committees and machinery in part of the two bodies mentioned.

It should be pointed out that these doubts are not personal to the gentlemen mentioned or to their associates, and it should also be pointed out that Senators in many instances share the publicly expressed opinion of business men concerning the good work the war agencies under the direction of Mr. Baruch and Mr. McCormick have done in behalf of business, and also feel that a measure of control of industry immediately following the war will be necessary for a time, if some organizations in business are not to obtain all the coal, raw materials, transportation foreign shipping space, etc., they want, permitting others less fortunate to go without.

But, while these facts are recognized, a storm of opposition has been aroused in the Senate because Mr. Baruch issued a statement in Washington in the past week in which he said that reconstruction plans will possibly come forth in the near future "in the form of suggested legislation." Mr. Baruch is known, just prior to the issuance of this statement and just after a visit to the White House, to have told his colleagues in the War Industries Board that the members and committees of that board would play a leading part in reconstruction. Apparently a number of Senators were not taken into consideration and conference previously, and this has added to a state of mind which has become more and more disgruntled during the past months when Senators have been obliged to sink their personal views and vote in the way the White House has asked or be accused of impeding the prosecution of the war.

This talk is now coming out into the open, and Senators are saying that the war is over and that it shall come out in open debate on the floor of the Senate. That Mr. Baruch has made many enemies, some of them said to be very close to the Presidential Cabinet circle, is now common talk in Washington. This is a report long current among well-informed Washingtonians, and there is no use in mincing words about it, Senators say. On the other hand, equally well-informed Washingtonians are pointing out that some of the opposition—indeed, a very large proportion of it—to granting reconstruction powers to Mr. Baruch and Mr. McCormick arises not so much from opposition to these gentlemen and the war agencies with which they have been associated as from opposition to the President himself.

One of the astonishing points in this situation to non-residents of Washington is that a number of the older Democratic Senators are lining up with the Republicans in their opposition to Presidential plans for after the war, and Senator Martin of Virginia has been one of the first of these. He did not wait a moment beyond receiving assurances that the armistice with Germany would be signed before serving notice in a public statement that he would take no more "orders" as to legislation, that appropriations and taxes must be cut down, going so far as to say that unless the drafting of men and the sending of them unnecessarily to France were halted Congress would pass a resolution requiring the War Department to halt.

Senators are saying now that for more than four years, including the period during the war of a year and a half, and before it when the United States was on the edge of the volcano, Republicans and Democrats alike stood loyally by the President as the first American. But now, they say, the scene shifts, and Republicans as well as a number of Democrats are about to say to the President that the Senate will no longer brook interference, no longer accept orders.

* * *

This changing situation in Washington can best be illustrated by recalling the prediction made by the writer in these columns recently that there was little likelihood of an extra session of the new (Republican) Congress shortly after March 4 next because a Democratic President would probably not call a Republican Congress in extra session. That remains true, but the intimation has gone around now that the Republican Senators as well as the Democratic Senators who are now expected to come out in the open against the White House are very likely to force an extra session of Congress just after March 4 by holding up some of the big appropriation bills such as the Post

Office bill. As the country will still be on a war basis next spring it is said that no effort will be made to hold up either the War Department or the Navy Department bill, but there are many other bills which provide not the sinews of war but the sinews of peace which can be held up to force an extra session. It is pointed out that the President for the remaining two years of his term of office has no more patronage with which to coax, nor has he the war left as a means of whipping recalcitrants into line.

In these circumstances Senators now in Washington who are favorable to quick passage of necessary reconstruction measures so that the business interests of the country may be able to get back upon a peace basis without an interregnum believe that business men would do well to take an active interest in what is going on at Washington in this respect before the prospect of the passage of the bills gets so muddled that it is beyond straightening out. By the time this is published most of the members of the Senate and House will be back in Washington, and then, it is expected, there will be quickly laid plans to develop new ideas on reconstruction or, to take the more hopeful view, plans will be made to keep business standing on its feet.

LESSENED RESTRICTIONS ON "LIGHTLESS" NIGHTS

Text of Dr. Garfield's Modified Order Effective on Nov. 11—Application Different in Various Sections of the Country

New regulations partially removing the present restrictions on the use of light generated by the consumption of fuel, effective on Nov. 11 and superseding all previous orders on the subject, were issued on Nov. 8 by the United States Fuel Administration.

In New England, New York, Pennsylvania, New Jersey, Delaware, Maryland, District of Columbia, Michigan and Ohio the change from the previous order is with reference to the illumination of store or shop windows. Under the new order the store or shop window lighting is only restricted when the store is closed and then only on the "lightless nights" that are specified in the order.

Throughout the rest of the country practically all lighting restrictions are left to the discretion of the state fuel administrators.

The partial raising of restrictions in the East is due to an improvement in the supply of bituminous and steam anthracite coal, but caution must still be observed in that section because of the anthracite and power situation. In the West enforcement of the regulations is optional with the state fuel administrators.

AGAINST WASTEFUL USE OF LIGHT

The new order prohibits the wasteful use of light in streets, parks or other public places in any city, village or town. Its use for illuminating advertisements, announcements or signs, or for the external ornamentation of any building and for displaying any shop window when the shop is not open for business, on Monday, Tuesday, Wednesday and Thursday of each week in New England, Maryland and the District of Columbia must be entirely discontinued.

The order also provides for the entire discontinuance of such use of light Monday and Tuesday of each week in Michigan and Ohio and in any other state where the federal Fuel Administrator shall so order.

A complete copy of the order follows:

It appearing to the United States Fuel Administrator that it is essential, in furtherance of the national security and defense, to lessen and prevent the waste of fuel, and to secure an adequate supply and equitable distribution and prevent, locally and generally, scarcity thereof, and that to these ends it is necessary that the use of fuel shall be limited and restricted in the manner hereinafter set forth, the United States Fuel Administrator, acting under authority of an executive order of the President of the United States, dated Aug. 23, 1917, appointing said administrator, and of subsequent executive orders, and in furtherance of the purpose of said orders and of the act of Congress therein referred to and approved Aug. 10, 1917,

Hereby adjudges that the use of fuel or of light generated or produced by the use or consumption of fuel for any of the purposes hereinafter described, except as hereinafter provided, is wasteful, and that any person using fuel or light for such purposes except as aforesaid is engaging in a wasteful practice or device in handling or dealing with fuel, and that the use of fuel or light for such purposes except as aforesaid is prejudicial and injurious to the national security and defense and a cause of scarcity locally and generally; and said United States Fuel Administrator

Hereby orders that the order of the United States Fuel Administrator relating to the use of coal to generate electricity for the operation of illuminated advertisements, etc., dated Nov. 9, 1917, and the amendment thereto dated Dec. 14, 1917, and the order of said United States Fuel Administrator relating to the use and maintenance of lights in cities, villages and towns dated July 18, 1918, be, and the same hereby are, vacated and set aside as of the effective date of the regulation hereinafter established, and hereby makes and establishes the following regulation, effective Nov. 11, 1918, and until further or other order or regulation in the premises:

REGULATION RESTRICTING THE USE IN CITIES, VILLAGES AND TOWNS OF LIGHT GENERATED OR PRODUCED BY THE USE OF FUEL

Section 1. The extravagant or wasteful use of light generated or produced by the use or consumption of coal, oil, gas or other fuel for illuminating purposes in the streets, parks or other public places of any city, village or town, or for other out-door illumination, public or private, is hereby prohibited.

Section 2. The use of light generated or produced by the use or consumption of coal, oil, gas or other fuel for illuminating or displaying advertisements, announcements or signs on the exterior of any building, or on any billboard or other structure for the display of advertisements, announcements or signs, and the use of such light for the external ornamentation of any building or structure, or for illuminating or displaying any window in any shop or store, when such shop or store is not open for business, shall be entirely discontinued on Monday, Tuesday, Wednesday and Thursday of each week in New England and in the States of New York, Pennsylvania, New Jersey, Delaware and Maryland and in the District of Columbia, and shall be entirely discontinued on Monday and Tuesday of each week in the States of Michigan and Ohio, and in any state not hereinbefore mentioned, when the Federal Fuel Administrator for such state shall so order; provided, however, that nothing in this regulation shall be construed to prohibit the maintenance in any shop or store window of any lights required by a state law or a municipal ordinance, or for the purpose of safety.

Section 3. The Federal Fuel Administrator for each state is hereby authorized and directed to enforce this regulation within such state.

Any person violating or refusing to conform to this regulation will be liable to the penalties prescribed in the aforesaid act of Congress.

War Restrictions Loosened for Industry

Light and Power Utility Construction May Go On, Says War Industries Board—Expansion in Production of Electric Heating and Cooking Appliances, Washing Machines, Electric Vacuum Cleaners and Electric Fans (Including Motors)

THE chairman of the War Industries Board, B. M. Baruch, authorizes the following: The War Industries Board began to-day [Nov. 12] a modification of the restrictions whereby it has controlled American industry in the interest of the nation's war program.

As laid down by Chairman Baruch in a published announcement Nov. 8, it will be the policy of the board gradually to lift various restrictions and curtailments, with the view of bringing about as promptly as possible a return to normal conditions.

In the modification of the curtailments imposed on the manufacture of certain commodities the board has adopted the method of reversing the processes of the Priorities Committee, and there is announced a list of the commodities in respect to which the curtailments are to be modified.

Hearty approval has been given by the Council of National Defense to the modifications of the regulations governing non-war construction, and the council requested that immediate and widespread publicity be given them, so that to the extent now permitted building operations might be speedily resumed.

Following is the formal announcement made by E. B. Parker, chairman of the Priorities Division of the War Industries Board:

WAR INDUSTRIES BOARD—PRIORITIES DIVISION

Circular No. 57

All of the rules, regulations, restrictions and directions embodied in orders and circulars issued by the Priorities Division of the War Industries Board are continued in effect subject to the following modifications:

Section 1. Section 5 of Revised Circular No. 21, issued by this division as of date Oct. 15, 1918, dealing with nonwar construction, is hereby amended so as hereafter to read as follows:

"Section 5. *Construction projects not requiring permits or licenses from Non-War Construction Section.*—Construction projects falling within the following classifications are hereby approved, and no permits or licenses will be required therefor from the Non-War Construction Section:

"(1) Construction projects approved in writing by the facilities division of the War Industries Board.

"(2) All farm and ranch buildings, structures or improvements.

"(3) All buildings, structures, roadways, plant facilities or other construction projects of every nature whatsoever undertaken by the United States Railroad Administration, or by any rail or water transportation company, organization or utility (whether or not under the direction of such administration), or by the American Railway Express Company, or by the owner or operator of any telegraph or telephone line.

"(4) The construction, maintenance, improvement or development by federal, state or municipal authorities of highways, roads, boulevards, bridges, streets, parks and playgrounds.

"(5) The construction, extension, improvement, maintenance or repair of any public utility, including water-supply systems, sewer systems, light and power facilities and street and interurban railways.

"(6) The construction, extension or repair of all irrigation and drainage projects.

"(7) Construction projects connected with the extension, expansion or development of mines of every character whatsoever connected with the production and refining of mineral oils and of natural gas.

"(8) The construction, alterations or extensions of, or repairs or additions to, plants engaged principally in producing, milling, refining, preserving, refrigerating or storing foods and feeds.

"(9) The construction of new, or the alterations or extensions of existing, schoolhouses, churches, hospitals and federal, state or municipal buildings involving in the aggregate a cost not exceeding $25,000.

"(10) The construction of new buildings or structures not embraced in any of the foregoing classifications, or the repairs or additions to, or alterations or extensions of, existing buildings and structures, in either case involving in the aggregate a cost not exceeding $10,000.

"(11) The construction of new buildings or structures not embraced in any of the foregoing classifications, or the repairs or additions to, or alterations or extensions of, existing buildings or structures, in either case involving in the aggregate a cost not exceeding $25,000, when approved in writing by the State Council of Defense or its duly authorized representative.

"(12) Buildings begun prior to Sept. 3, 1918, where a substantial portion of the building has already been constructed."

Section 2. All limitations on the production of building materials, including brick, cement, lime, hollow tile and lumber, are hereby removed, and the materials so produced may be sold and delivered for use in connection with any building project for which no permit or license is required under revised Priority Circular No. 21, as further revised by Section 1 hereof, or to any project authorized by permits or licenses issued in pursuance of said circular. All limitations upon the production or use of lime or crushed or pulverized limestone in any form for agricultural uses are hereby removed.

Section 3. Restrictions upon industries and manufacturers in their production of, or in their consumption of materials for, commodities hereafter in this section enumerated, as such restrictions are expressed in orders and circulars issued by this division, are hereby so modified that such restrictions for the respective periods provided for in such several orders and circulars shall be less than the restrictions provided for in such orders and circulars to the extent of 50 per cent of such restrictions; that is to say, where the industry has been curtailed for a stated period a certain percentage of its production or in its consumption of materials, such curtailment for such period is hereby reduced to the extent of one-half of the curtailment expressed in such order or circular. To illustrate: Where an industry for the last four months of 1918 has been curtailed 25 per cent, such curtailment is hereby changed to 12½ per cent for such period; where it has been curtailed 40 per cent such curtailment is hereby changed to 20 per cent, and where it has been curtailed 50 per cent, such curtailment is hereby changed to 25 per cent. The commodities referred to are as follows:

1. Agricultural implements and farm operating equipment, including tractors.
2. Road machinery.
3. Coal, coke and wood-burning, cooking and heating stoves and ranges.
4. Gas ranges, water heaters, room heaters, hot plates and appliances.
5. Oil and gasoline heating and cooking devices.
6. Electrical heating and cooking devices and appliances.
7. Black galvanized and enameled ware and tinplate household utensils.
8. Refrigerators.
9. Ice-cream freezers.
10. Washing machines.
11. Clothes wringers.

12. Family sewing machines.
13. Electric vacuum cleaners.
14. Metal beds, cots, couches, bunks and metal springs for same.
15. Boilers and radiators.
16. Baby carriages.
17. Corsets.
18. Bicycles.
19. Electric fans (including motors).
20. Builders' hardware.
21. Padlocks.
22. Stepladders.
23. Scales and balances.
24. Rat and animal traps.
25. Talking machines (including motors and accessories).
26. Talking-machine needles.
27. Clock watches and clocks.
28. Watch movements and watchcases.
29. Hand stamping and marking devices.
30. Safes and vaults.
31. Lawn mowers.
32. Pottery.
33. Pocket knives and similar products.
34. Linoleum.
35. Rag-felt floor covering.
36. Sporting goods.
37. Glass bottles and glass jars.
38. Tinplate.
39. Pianos, including piano players, automatic pianos and parts.
40. Pneumatic automobile tires.
41. Passenger automobiles.
42. Cash registers.

Nothing herein contained shall be construed to release any industry or manufacturer from the strict observance of the rules and regulations of the Conservation Division of the War Industries Board as applicable to such industry or manufacturer.

Section 4. Dealers (wholesale and retail) in raw materials, semi-finished and finished products are hereby relieved from the obligation to give and require pledges relating to such commodities, notwithstanding any provision for pledges in any order or circular heretofore issued by the Priorities Division, and notwithstanding any stipulation in any pledge that they will require pledges from those who buy from them for resale; provided, however, that building materials and other products shall not be sold and delivered for use in connection with any non-war construction projects save those for which no permit or license is required under Priority Circular No. 21, as revised by Section 1 hereof, or those authorized by permits or licenses issued in pursuance of said circular; provided further, that manufacturers will continue to give pledges in accordance with the terms of orders and circulars heretofore issued and comply with all pledges heretofore or hereafter given, save that they are hereby relieved from the provisions in such pledges that require manufacturers to exact pledges from those who buy them for resale.

Section 5. The Priorities Division of the War Industries Board will, as far as practicable, assist industries in procuring materials, fuel, transportation and labor to enable them to increase their operations to normal limits as rapidly as conditions may warrant. Precedence must, however, be given to stimulate and increase the production of cargo ships and supply the requirements of the army and the navy of the United States, as well as to provide for this nation's proper proportion of the enormous volume of materials, equipment and supplies as shall be required for the reconstruction and rehabilitation of the devastated territories of Europe. Precedence must also be given to such activities as will tend to stimulate the production of foods and feeds, of coal, of natural gas, of oil and its products, of textiles and clothing, and of minerals, and to provide for deferred maintenance, additions, betterments and extensions of railroads, telegraph and telephone lines and other public utilities, and to permit and stimulate the intensive development of inland waterways.

The War Industries Board requests, and with confidence shall expect to receive, the continuance of that whole-hearted coöperation and support of the industries of this nation which it has heretofore enjoyed, and which will make possible the success of so much of the industrial adjustment program covering the period of transition from a war to a peace basis as it is called upon to administer.

In an earlier statement, indicating that as the demand for raw materials is lessened by the reduction of war requirements and the cancellation of war contracts the raw materials so made available will be released and allocated by the War Industries Board for use in supplying civilian and export demands, Mr. Baruch said also:

"The War Industries Board will continue to exercise its functions until the peace treaty is signed, to the end that the readjustment of the matters on which it has been acting may be made in as orderly a manner as possible.

"A committee named by the President has been and is now at work to devise the best mechanism of bringing about the adjustments from a war to a peace basis. The report of the committee may take the form of suggested legislation.

"The whole effect of the readjustment plans will be to the end of bringing about necessary changes with as little dislocation as possible and the full opportunity for all to benefit as in the past by individual ingenuity, vision and fair dealing."

PROGRAM OF THE TORONTO CONVENTION OF A. I. E. E.

Besides the Technical Sessions, an Opportunity to Visit Great Engineering Developments Will Be Given to Visitors

The three hundred and forty-fourth meeting of the American Institute of Electrical Engineers will be held in Toronto, Canada, Nov. 22-23, at the Engineers' Club. Members and guests will assemble at noon at the club, where an informal reception and registration will be held, followed by a luncheon of the reception committee and delegates.

The program follows:

Friday Noon—Reception and registration.

Friday, 1:30 p. m.—Technical session. Opening remarks by President C. A. Adams. "Electric Power Development in Ontario," by Arthur H. Hull, chairman of the Toronto Section and assistant engineer of the Hydroelectric Power Commission of Ontario.

Friday, 3:30 p. m.—Technical session. "Electrical Equipment of the Canadian Northern Tunnel in Montreal," by W. G. Gordon, transportation engineer of the Canadian General Electric Company.

Friday, 6:30 p. m.—Dinner of delegates and members at Engineers' Club. Address by Sir Robert Falconer.

Friday, 8 p. m.—Technical session.—"The 110,000-Volt Transmission Line Over the St. Lawrence River," by S. Svenningson, designing engineer Shawinigan Water & Power Company.

Saturday, 9:30 a. m.—Technical excursion (alternatives): (a) Leaside munition plant; (b) British Forgings Company electric steel plant; (c) hydroelectric laboratories and 110,000-volt substation.

Saturday, 12:30 p. m.—Luncheon of reception committee and delegates at rooms of the Toronto Board of Trade, Royal Bank Building roof.

Serious Drought Is Now at an End in Georgia

The severe drought from which the Georgia Railway & Power Company, Atlanta, has been suffering is broken. It was the most serious in the history of the company and it occurred when the demand for energy was greatly increased.

It is not expected that further shortage of water will be experienced before next summer, at least, unless winter rains are less than normal.

STATE COMMISSIONERS' MEETING IN WASHINGTON

Report of the Special War Committee Presented at Annual Convention of National Association of Railway and Utilities Commissioners

The National Association of Railway and Utilities Commissioners held its annual convention on Tuesday, Wednesday and Thursday of this week in the rooms of the Interstate Commerce Commission in Washington, D. C. The association includes in its membership the Interstate Commerce Commission and all the railroad and public utilities commissions of the country, forty-seven in all, Delaware being the only state without one. More than twenty-five commissions were represented at the meeting. The program consisted mainly of reports of standing committees, of which there are eighteen.

Winthrop M. Daniels, chairman of the Interstate Commerce Commission, made the address of welcome, following which were the report of the executive committee and the annual address of Charles E. Elmquist of Minnesota, acting president of the association.

The chief paper at Tuesday's session and the most important of the convention was the report of the special war committee, presented by Joseph B. Eastman of Massachusetts. In this it was pointed out that the state commissions have worked in harmony with the spirit and needs of the times. They have allowed and facilitated reductions of service needed for the conservation of labor and fuel by refraining from requirements reasonable under ordinary conditions but wasteful of capital and energy in time of war and by permitting without undue delay or controversy increases fairly demanded by the rapid advances of wages and prices and necessary to relieve utilities of more than their fair share of the burden of war conditions. They have also helped in the conservation and better use of electrical energy and of labor, provided transportation facilities for war industries, coöperated with the Fuel Administration and responded loyally to every call for assistance.

The report had much to say about the railroads and their operation. It drew attention to the fact that while federal control of railroads, which excludes local regulation, may perhaps be tolerable in war times, it is neither expedient nor wise in time of peace. In the opinion of the committee it is desirable in the public interest that the state commissions should possess under federal control substantially the same authority over service and rates and the same general powers of supervision and investigation which they have exercised under private ownership. The situation with reference to the express companies and the telephone and telegraph companies was treated in a similar manner.

As to the electric utilities, the committee stated that the war has demonstrated the need not only for better utilization of existing power plants by the construction of tie lines and similar means, but also that for the further development of water-power sites. Several commissions have made extensive investigations with a view to bringing about greater economy and efficiency of power production. The subject has also been taken up on broad lines by Congress, and it was urged that state commissions continue to give it attention.

The report of the committee on public ownership and operation was presented by P. J. Lucey of the Illinois commission. No recommendations were made, except for a continued study of the question, as the committee deemed it unwise, in view of the war situation as affecting governmental operation of railroads, to formulate any definite conclusions on the subject.

Reports were also made by C. C. McChord of the Interstate Commerce Commission on safety of operation of railroad companies, by R. T. Higgins of Connecticut on safety of operation of public utility companies, by H. H. Williams of New Mexico on railroad service accommodations and claims, and by O. B. P. Jacobson of Minnesota on car service and demurrage.

On Wednesday the association adopted resolutions declaring against the adoption of new schedules of mileage scales of standard class freight rates as proposed by the Director-General of Railroads until times become normal again; also declaring that any further increase of net income to express companies should be secured by a reduction in the percentage of express charges now paid to railroad companies for the transportation of express matter and declaring in favor of an immediate investigation of the cost of such transportation to the railroad companies. The report of the committee on railroad rates was presented by D. N. Lewis of Iowa.

Dr. E. B. Rosa of the Bureau of Standards delivered an address on the work of that bureau and its relation to the work of the state commissions.

Royal G. Dunn of Florida, chairman of the committee on express and other contract carriers by rail, presented the majority report of that committee, which favored the abolition of express companies and the performance of the express functions by the railroad companies. Thomas Yapp of Minnesota presented a minority report containing some arguments against the plan advocated by the majority but urging further investigation of the subject. The convention refused to go on record as favoring the majority report, and after some discussion voted that it be received and printed.

Frederick J. MacLeod of Massachusetts presented the report of the committee on publication of the commission's decisions. The convention adopted the resolution presented by this committee urging the state commissions to assist the publishers of the decisions of the various state commissions in continuing and making permanent such publication.

Judge C. A. Prouty, director of public service and accounting of the United States Railroad Administration, addressed the convention on Wednesday afternoon. Judge Prouty appeared at the request of Director-General W. G. McAdoo, but did not voice the views of the Director-General, only his own personal views. He spoke upon the conditions growing out of the war as regards the transportation lines and also upon valuation.

At the conclusion of his address Judge Prouty was asked several questions by commissioners from the different states in regard to the division of jurisdiction between the United States Railroad Administration and the several state commissions. He declared that the Director-General was anxious for the coöperation of the state commissions and desired to coöperate with them. He advised the state commissions, before making orders affecting railroads under government control, to submit to the Director-General the proposed order.

A. S. Burleson, Postmaster General, spoke on Thursday concerning the telephone and telegraph situation.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

A. I. E. E., Utah Section.—At the meeting of the Utah Section of the A. I. E. E. held Sept. 26 Prof. Orin Tugman of the University of Utah spoke on "Modern Theories of the Constitution of Matter."

Electric Club of Philadelphia.—At a meeting of the Electric Club of Philadelphia held Nov. 7 George L. Thompson of the General Electric Company addressed the members on "Why I Entered and Why I Remained a Member of the Electrical Industry."

I. E. S., New York Section.—Last Thursday evening, Nov. 14, the New York Section of the Illuminating Engineering Society held a meeting for the discussion of the topic "The 1917-1918 Report of the Committee on Automobile Headlight Specifications."

Engineers' Club of Philadelphia.—At its regular meeting of Nov. 19 the Engineers' Club of Philadelphia will be addressed by George W. Braden, former Y. M. C. A. director of athletics and recreation for the Italian army, the subject being "Overseas Experiences in Italy."

A. I. and S. E. S., Pittsburgh Section.—On Nov. 23 the Pittsburgh Section of the Association of Iron and Steel Electrical Engineers will hold an important meeting, at which J. E. Fries, electrical engineer Tennessee Coal, Iron & Railroad Company, will read a paper on "Sixty-Cycle Versus Twenty-five Cycle Power for Steel Mills."

A. S. C. E.-A. S. M. E.—Conservation of steel will be discussed at a joint meeting of the American Society of Mechanical Engineers and the American Society of Civil Engineers to be held in New York on Nov. 20. The present urgent demand for iron and steel and feasible methods of conserving the available supply will be considered.

A. I. E. E., Portland Section.—Two illustrated addresses were delivered before the Portland Section of the A. I. E. E. on Oct. 8, 1918. W. L. Finley, State biologist, described "Bird, Animal and Outdoor Life in Oregon." "Production of Spruce for Airplane Stock" was the title of the address by Major William A. Walsh, division engineer spruce production division.

Railway Electric Engineers.—The tenth annual convention of the Association of Railway Electrical Engineers at the Hotel La Salle, Chicago, Oct. 29 to 31, was especially well attended. The program included committee reports on data and information concerning illumination, electrical equipment and practice for ore and coal docks, electric head lamps, train-lighting equipment and practice, shop practice, electric welding, conservation of equipment and methods for increasing efficiency, layout for engine terminals, shop yards and classification yard lighting, the care and maintenance of railway stationary power plants and electrical organization. The following officers were elected for the ensuing year: President, J. E. Gardner, Chicago, Burlington & Quincy Railroad; secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railroad.

A. I. E. E., Ithaca Section.—The regular monthly meeting of the Ithaca Section of the A. I. E. E. was held Sept. 20 at Franklin Hall, Cornell University. The program was built around a symposium on "Electricity in the Navy" as follows: (1) "Steering and Range Finding," by R. G. Skinner; (2) "Propulsion of War Vessels," by T. J. Ryan; (3) "Wireless Equipment," by G. R. Rebman, Jr., and F. W. McDonnell; (4) "Searchlights," by G. Rees.

Annual Meeting, A. S. M. E.—The annual meeting of the American Society of Mechanical Engineers is planned for New York City on Dec. 3 to 6 inclusive. Tentative plans for the session of Dec. 4, which will be devoted to the general topic "Human Engineering," include the following papers: "Organization," "Standardization and Administration of Wages," "Non-Financial Incentives," "Incentive of Control in Industry," "Intensive Training" and "Human Relations in Industry." One session will be under the auspices of the gas power sub-committee, with papers on oil engines and cooling losses in combustion engines. Another session will be a joint session with the American Society of Refrigerating Engineers, which holds its annual convention simultaneously with the A. S. M. E.

Franklin Institute.—A program of lectures for the year 1918-1919 was lately announced by the Franklin Institute of Philadelphia which included the following: Nov. 7, "The Power Company," by William C. L. Eglin, a historical résumé in a semi-technical form showing graphically the development of the electric lighting and power industry; Jan. 9, 1919, "The Induction Electrical Furnace, with Special Reference to the Use of Induced Currents of High Frequency," by Guilliam H. Clamer, a history of the development of the induction furnace, describing the fluid motions in induction furnaces, the practical application of the vertical-ring induction furnace and practical application of induction furnaces using high-frequency currents; Feb. 6, "Industrial Lighting," by C. E. Clewell, dealing with the physical aspects of modern industrial lighting and emphasizing the outstanding features of good lighting. Reference will be made to existing codes of factory lighting, to the apparent needs in the state inspection departments if such codes are to be administered effectively and to some problems in industrial lighting added by the war.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

New Rates for California Company.—The Mountain Light & Water Company, which serves electricity in Brookdale, by a decision of the California Railroad Commission is permitted to charge new rates. Under the new schedule minimum annual payment is increased to $15 for electricity for residence and household use. Commercial lighting is fixed at 10 cents a kilowatt-hour, with a minimum of $50 a year for hotels and boarding houses of twenty-five rooms or over and $20 for under twenty-five rooms but over ten rooms. Commercial business places are charged $15 a year. There is also a flat rate of $10 a year for small cottages, optional with the public service company.

Metered Service Ordered for Small Pacific Coast Company.—The California Railroad Commission has authorized the Vacaville Water & Light Company to discontinue its flat-rate service for electricity and to put all consumers upon a metered schedule, effective on Nov. 5. The maximum lighting rate is 9 cents a kilowatt-hour. The minimum charge is $1 a meter a month. The maximum heating and cooking rate for the first 100 kw.-hr. a month is 4 cents a kilowatt-hour, with a minimum charge of $2.50 a meter a month. The general power rate is 4 cents a kilowatt-hour for the first 300 kw.-hr., graduating down to 2 cents a kilowatt-hour for all over 2500 kw.-hr. a month, with a minimum charge of $1 a month for each horsepower of connected load, and there is also an agricultural power rate fixed, with a minimum charge of $6 a year for each horsepower of connected load. The Vacaville company supplies electricity in and around Vacaville, Solano County, to about 500 consumers, 100 of them being charged flat rates, and purchases its entire supply of electric energy at wholesale from the Pacific Gas & Electric Company. The company's contract with the latter company has expired, and as the commission fixed higher rates for the Pacific company some time ago, the Vacaville company will pay increased rates for its electricity. The rates fixed will increase the Vacaville company's electric revenue $900 a year and will provide it with a net revenue of $3,040 a year, which is 8.90 per cent on the average capital for the current year for depreciation and return. The depreciation in electic properties such as the Vacaville company's amounts to 3 per cent a year, so that the actual return from the rates fixed is less than 6 per cent on the value of the company's electric properties.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Commission Orders Interconnection.—The Illinois Public Utilities Commission has issued an order directing the Central Illinois Light Company and the Canton (Ill.) Gas & Electric Company to erect and install such new construction as may be necessary to connect the 13,000-volt, two-phase circuits of the two companies within forty-five days.

Cleveland Municipal Plant Operations.—According to Light Commissioner Davis, the municipal plant at Cleveland, Ohio, will lose money if it is forced to pay taxes. If not, it will break about even. However, when the new addition to the plant is completed there will be a heavy loss unless money can be obtained with which to extend the lines. In 1915 the plant had 14,100 consumers, and this number had been increased to 21,000 up to this year.

Fuel Administration Suggests Interconnection.—The state fuel administrator of Illinois has addressed a letter to the Mayor of the city of Springfield, calling his attention to the fact that quite a saving could be made in fuel if the lines of the municipal plant were connected with the lines of the Springfield Gas & Electric Company. The Mayor has directed that a mass meeting be called to consider the matter. The fuel administrator will be represented.

Fuel-Oil Conservation Meeting.—About 300 representatives from fuel-oil and coal-burning plants in the Illinois district assembled recently at the request of Nelson G. Phelps, district engineer, Bureau of Oil Conservation. The object of the meeting was to arouse enthusiasm in the conservation of oil, to point out wasteful practice and to indicate where improvements might be made. Officials from the Fuel Administration at Washington were present to assist the local organization.

Pacific Gas & Electric Financing.—The California commission has authorized the Pacific Gas & Electric Company to issue $5,000,000 of its 5 per cent general and refunding mortgage bonds, or $5,000,000 of its 6 per cent first preferred stock, or portions of each aggregating $5,000,000, the bonds to be sold at 85 and the stock to be sold at not less than $82.50. The proceeds are to be used by the company to reimburse its treasury for capital expenditures made before May 31 last and to finance future construction work. The company showed that it has made capital expenditures of $3,504,255.57 against which no stocks or bonds have been issued, and it estimates new construction involving expenditures of $5,785,164, a total of $9,289,419.

Higher Electric Rates Authorized in Mobile.—The Alabama Utilities Commission has authorized the Mobile Electric Company to increase rates for electric light and power.

Rate Increase of Oklahoma Company.—Substantial increases in electric light and power rates charged by the Oklahoma Gas & Electric Company in Oklahoma City, Muskogee, Enid, El Reno, Drumright and other cities have been authorized by the Corporation Commission of Oklahoma. The new rates apply to the bills for service rendered on and after Nov. 1.

American Firm Applies for Use of Eight Enemy Patents.—The Draeger Oxygen Apparatus Company, Wilkinsburg, Pa., has applied to the Federal Trade Commission for license to use eight patents for respiratory, resuscitating and breathing apparatus devices and the trade mark "Pulmotor," which it claims is enemy-owned or controlled. The patents were issued originally to Johann Heinrich Dräger of Lubeck, Germany, and to other assigners to the firm of Drägerwerk Heinrich & Bernhard Dräger of Lubeck, Germany. The commission is considering the merits of the application.

New Work for Central-Station Institute.—The accounting section of the National Electric Light Association has, through the Central Station Institute of Chicago, established an elementary bookkeeping and accounting course for preliminary training and a highly specialized advance course, both of which are open to all employees of central-station companies who recognize this need and have an eye for the future. Both of these courses have been made available to the day worker by correspondence. The elementary course consists of seven lessons, beginning with the fundamentals of bookkeeping, going on through its ramifications as applied to a mercantile business and, at the finish, giving the student a glimpse at the enormous possibilities of the subject. This elementary course supplies the fundamental knowledge of accounting. It should prove not only attractive to the student who expects to make it his life work but to the one who wishes a firm foundation for other lines of effort. The advanced course consists of thirty-six lessons, mailed to the student as desired during two school years of nine months each. The student begins a special study of electric utility accounting, especially prepared by an expert and carefully edited by a committee made up of authorities on utility business. When he has finished he knows all there is to know of the subject. Then, too, the certificate he gets when he completes the course helps to remind him of the fact. These courses were prepared and written by a certified public accountant. Communications should be addressed to Fred R. Jenkins, Central Station Institute, Room 1647, Edison Building, Chicago.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Meter Charges Under Franchise Provisions.—Where a gas franchise was voted by people of a village and accepted by grantee, relation of parties was one of contract as to rates, etc., according to the Supreme Court of Michigan (168 N. W. 968). Under a village franchise to install and operate a gas plant, declaring that rates should not exceed a certain rate and authorizing removal of meter if no gas was used, unless 75 cents per month minimum charge was paid, company could only require of a customer retaining his meter either 75 cents a month in case no gas was used or payment for the amount of gas used per month, although such sum might be less than 75 cents.

Rights of Lineman Injured Through Negligence of Fellow Employee.—A duty rests upon a street-railway company to furnish its linemen with a reasonably safe place to work, and if, in accordance with its rules and the red-tag system of cutting out high-tension circuits, the foreman or other person delegated with authority to direct when the current should be on or off ordered the current on at some place where induced current might endanger the linemen, it could be found that the company had failed to perform its duty, the Supreme Court of Massachusetts held (120 N. E. 361). If high-tension wires of a street-railway company became alive by reason of the negligence of an operator, or some other person acting without authority, who was negligent in violating the company's rules, injury to a lineman resulted from the negligence of a fellow servant, a risk which the lineman assumed. If plaintiff employee was injured by the negligence of a fellow employee, he cannot recover under a count of his declaration alleging defective appliances. The burden was on the lineman suing the company for injuries to show that the pole and line on which he was working when the injury occurred became unsafe by the company's negligence. To recover the lineman must show that the cause which produced the injuries was one for which the company was liable. An experienced lineman was not entitled to a warning from the company against the negligence of a fellow employee in turning on current. If the company had knowledge that a current would be induced into telephone wires by turning power in high-tension wires at another point, the company was under personal duty to warn its lineman—a duty which could not be delegated to its superintendent.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

W. Jocelyn E. Dale has been relieved as chief engineer of power installations for the Matahambre Copper Mines and has been appointed superintendent of power with offices at Puerto de Santa Lucia, Pinar del Rio, Cuba, for the same firm.

H. E. Cox, formerly engineer for the Birmingham Railway, Light & Power Company, has become electrical engineer for the Birmingham Steel Corporation and not the Birmingham Steel Company, as was erroneously stated in the ELECTRICAL WORLD for Nov. 2.

Leavitt L. Edgar, superintendent of the field statistics department of the Edison Electric Illuminating Company of Boston, Mass., has been commissioned first lieutenant in the Quartermaster's Department, U. S. A. Lieutenant Edgar is now at Covington, Ky., supervising the construction of a 66,000-volt transmission line from the system of the Cincinnati Gas & Electric Company to a nitrate plant about 18 miles from the Ohio city. He is a son of Charles L. Edgar, president of the Boston company.

E. P. Peck has resigned as superintendent of operation, tests and repairs of the Georgia Railway & Power Company to become associated with the Bureau of Standards, Washington, D. C. Mr. Peck is particularly well known in the electrical engineering branch of the industry as an originator of test methods. He was born Aug. 13, 1882, at Atlanta, Ga., where he received his early education and in 1903 was graduated from the Georgia School of Technology. For two years he was engaged in electrical construction, maintenance and repair work and in August, 1905, started with the Georgia Railway & Electric Company in the repair shops. The following year he was transferred to the meter department, shortly afterward becoming foreman of that department, where he remained for two years, when he became assistant electrical engineer and foreman of the testing department. In the summer of 1915 he became superintendent of tests and repairs and two years later superintendent of operation in addition, which position he held until his resignation. Mr. Peck developed high-voltage frequency apparatus for insulator and other tests, standardized insulator tests, and was a pioneer in the development of a satisfactory lightning arrester for use on high-voltage telephone lines, besides developing an arrester for current transformer protection. He has developed a number of pieces of radio equipment, made detail studies of protective relay systems and prepared a series of curves for simplifying transmission-line calculations. He designed and built the company's new standardizing laboratory, testing laboratory, meter shop and laboratory, one of the best groups of central-station laboratories in the country. In addition to this he has done considerable development work in standardizing station operation. He has been a frequent contributor to the electrical press and has done much important work on engineering committees. For one year he served on the protective apparatus committee of the American Institute of Electrical Engineers, and for two years he was a member of the meter committee of the National Electric Light Association.

Cyrus A. Whipple has been appointed power-plant foreman of the United States Navy Yard on Puget Sound, at Bremerton, Wash., with charge of all electrical, hydraulic, air and other power utilized at the navy yard and auxiliary stations Mr. Whipple is a graduate of the University of Washington, 1899, and Cornell University, 1903, and has been engaged in engineering work on the Pacific Coast since 1903. He was one of the engineers on the construction of the Electron plant of the Puget Sound Traction, Light & Power Company, after which he worked out the consolidation of the navy yard power system which he is now operating. He was next engaged in building the Fraser Valley electric interurban system extending from Vancouver to Chilliwack, British Columbia. On completion of this he was superintendent of operation for the Mount Hood Railway, Light & Power Company of Portland, Ore., until it was sold to the Portland Light and Power Company, when he opened a private office in Portland. When the Southern Pacific company started electrification of its Willamette Valley system Mr. Whipple entered its service as chief assistant to the electrical engineer, which work he followed until construction was nearly completed. He was then appointed superintendent of light and water for the city of Eugene, Ore. He later became electrical and mechanical engineer for the Public Service Commission of Washington, in which capacity he was engaged in appraisal of all the large companies of the state. At the beginning of the war he entered work of the navy yard in connection with the large developments along shipbuilding lines at the yard, and he was recently appointed to take charge of the systems of power, telephones, water, etc., there.

Obituary

Ira H. Metzger was killed in the Brooklyn Rapid Transit catastrophe on the evening of Nov. 1. Mr. Metzger was twenty-nine years old at the time of his death and had already established a reputation as an able writer of technical advertising copy. For the last two years he had been in charge of the copy department of Rickard & Sloan, Inc., New York, and prior to that he was associated with the service department of *Industrial Management* and the *Electric Railway Journal*.

Charles O. Patterson, one of the pioneers in the electric lighting industry, died on Oct. 25 at East Newport, Me., at the age of fifty-nine years. In 1884 he took charge of the electric light plant at Jacksonville, Fla. In 1896, when the city of Jacksonville built a municipal plant, one of the first in the country, he was retained as superintendent and constructing engineer. He remained as superintendent for eight years, when he went into the electrical construction business.

Norman I. Moultrop of the electrical engineering department of the Boston (Mass.) Edison company, and only son of Irving E. Moultrop, assistant superintendent of the construction bureau of that organization, died recently of influenza at the United States Army General Hospital No. 1, Williamsbridge, N. Y. Mr. Moultrop was only twenty-nine years of age and would have received a commission as lieutenant in the Radio Air Service had be survived a few days longer. He enlisted in the aero service of the Signal Corps in December, 1917, with quarters at Fort Slocum. He was soon attached to a construction squad at Langley Field, Va., and was appointed first sergeant and placed in charge of all electrical work. The excellence of his work led to his recommendation by his commanding officer for transfer to the Air Service Radio School at Columbia University, New York, where he successfully completed the course and was awaiting orders to take up active duty when he was stricken. Widespread sympathy will be felt for Mr. Moultrop, Sr., as his loss becomes known.

Capt. Albert R. Thompson, formerly engineer of electric distribution for the San Francisco district of the Pacific Gas & Electric Company, met his death in France through an automobile accident that occurred on Sept. 17. Captain Thompson was born forty-one years ago in Rehoboth, Del., and upon graduation from New York University studied law and was later admitted to the New York State bar. Upon finding that the practice of law was not to his liking, he took up electrical engineering and entered the services of the New York Edison Company, from which he resigned in 1910 to go to California as engineer of electric distribution for the San Francisco district of the Pacific Gas & Electric Company. On Jan. 1, 1918, he entered the army and went to the Reserve Officers' Training Camp at Camp Lee, Va., where he was commissioned a captain. He was sent to Camp Devens, Mass., to serve with the Twenty-ninth Engineers and from there sailed for France on July 1. He was very much interested in employee organizations. He was the first chairman of the "Pacific Service" section of the National Electric Light Association, and when with the New York Edison Company he was president of the company's employee association.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

AFTER-WAR RESPONSIBILITY OF MANUFACTURER'S CREDIT MAN

Must Be Careful in Granting Credit to Jobbers with No Reserve to Absorb Losses Through Decline in Values

A greater responsibility will rest on the shoulders of the credit man in the months to come perhaps than ever before. That prices are going to come down must be admitted. That stocks purchased at high prices must not be carried at higher than the market is evident. That these stocks cannot be sold at more than the prevailing market price is certain. In other words, certain losses must be accepted just as certain unearned profits were taken on the advancing market.

Leading members of the electrical jobbing industry urged their fellow jobbers to lay aside from their unearned profits a reserve fund to be used in absorbing the losses that are bound to come when the tide of prices turns. Some of the prudent ones have naturally followed this course. It is not known to what extent this has been done, but there are no reasons for suspecting that those who have not set up a reserve are few in number.

The manufacturer's credit man, therefore, must look into this situation and find out to what extent his customers have taken steps to protect themselves. To those who have not so done the credit man must be very careful in granting credit and demanding collections. The credit man more than ever must be a student of conditions. He must be able to gage fairly closely the trend that prices are to follow so long as the market tends downward, not only as regards the goods of his own concern but also those of other concerns from which his customers purchase. This must be done in order that credit may be granted only to the extent that the customer will have to take the minimum loss. In fact, if the credit man is reasonably well posted and acts judiciously, he may by insisting on smaller stocks and therefore more rapid turnover turn the jobber's probable loss into a profit.

The manufacturer cannot leave the jobber to work out his own salvation. The manufacturer has an asset in the jobber that he cannot afford to lose—not only the immediate asset of bills payable, but also the asset of a well-founded distributer of goods. If jobbers for want of intelligent assistance from manufacturers are allowed, merely because they have not prudently laid by a reserve, to go under, the industry will not only lose from uncollectible accounts but also will be handicapped by having to create new distributers.

TRADE RESTRICTIONS ARE BEING LIFTED GRADUALLY

Greater Production of Appliances Allowed—Market Bare and Demand Undiminished—Modification of Building Restrictions Helpful

By Wednesday of this week supply conditions in the electrical field began to clear perceptibly. The trade has been anxiously awaiting some word from Washington as to how long before limitations would be removed from production.

It is now apparent that all of the restrictions will not be removed at once but gradually. Industry in this way will be able to get on a peace basis with less trouble than if all restrictions were removed immediately. Thus electric heating appliances, washing machines, sewing machines, vacuum cleaners and fans have their curtailments reduced by one-half. In other words, if the output of one of these has been curtailed 40 per cent, it can now manufacture up to 80 per cent of what it produced during the year of 1917.

With the stocks of the country practically swept bare of the above-mentioned materials, except perhaps fans, the new ruling will be welcomed by both producers and distributers. Of fans there is probably a better stock than was anticipated at the end of the fan season. So many orders were delayed and deliveries were so long that in not a few instances fans reached distributers and local warehouses too late to figure in the current year's sales. Moreover, the demand for the smaller sizes of fans was not so brisk as had been expected. Most of the demand had been in the larger size oscillators.

No halt is noticed in the consumer demand for appliances, and greater production will be necessary if this demand is to be filled even without stimulating sales. So great has this demand been that in many places distributers were allowed shipments of only a limited part of what they had ordered.

Another ruling from Washington that is of considerable interest to the trade is the modification of the new building restrictions reported elsewhere in this issue. This opens the possibility of trading in the old channels and of increased business by the electrical contractors. This character of work has fallen off to a minimum, although formerly it was considered to be the foundation load work of the trade in every place.

LARGE PRODUCTION AFTER WAR IS CONFIDENTLY ANTICIPATED

Output in Volume, However, Not Likely to Be Maintained Unless Buying Is Stimulated by Lower Prices

Speculation concerning the effect of peace on business is widespread. Will business be stimulated once the war restrictions are removed, or will buyers, feeling that prices will decline, hesitate to place orders? This and the question of what course prices will pursue are being given no small place in the thoughts of business men in every section of the country. The war presented many aspects of unknown character, but the period of reconstruction seems more baffling at present than the war period.

Many men of prominence in the business world have in the past few days expressed opinions on these questions, and there seems to be a unanimity of belief. That trade will fall off immediately upon the declaration of peace is pretty well held. Buyers will not have had time to adjust themselves to new conditions, and some time will be necessary for them to decide to enter the market. This condition, however, is everywhere expected to be but temporary, lasting anywhere from one to six months, the time to depend largely on the ability of the individual manufacturer to adjust his plant to the fabrication of products for commercial use. As soon as this temporary depression is over business is expected to leap again to peak levels and to continue so for some time.

The dearth of new building is pointed out as one reason for expecting business expansion. The building program alone, if reports can be believed, would be almost sufficient to keep things going at top speed for many months. Besides there is the rehabilitation of steam railroads, for which huge quantities of supplies and labor will be required, probably very soon.

If these prognostications then are true, it is doubtful if any sharp break in prices will come. Of course, in any event there may be timid ones here and there who will liquidate their stocks a trifle under the market, fearing that prices may tumble.

While it is undoubtedly true that there is a large amount of new construction awaiting the placing of contracts, manufacturers and jobbers, in making any preparations in anticipation, must not lose sight of the fact that the ability to finance such work at prices which will not be prohibitive in the years to come has always been a considerable factor in the past.

There is no doubt anywhere that prices will eventually be considerably lower than they are to-day—perhaps not so low as they were in 1914, but still sufficiently lower than they are now to make the difference appreciable. Granting the truth of this general impression, then, it is highly doubtful if all of the projected new construction, and particularly that pertaining to light and power utilities, to telephone systems and to street railway companies, will be considered at prevailing prices and cost of financing after being deferred by these very things for so long a time.

In other words, it hardly seems likely that production will be stimulated over a long period after the war at prices that now exist. A rapid drop in prices would only serve to scare away business and, if general, bring about a panic. It does seem logical, however, to expect a gradual lowering of all prices according to generally recognized laws of economics. While there is undoubtedly sufficient unplaced business to keep production going at top speed for a long time, still events of the last few years indicate that factories will have to stimulate production by making lower prices.

METAL MARKET CONDITIONS

Everything Quiet Following Armistice Signing; Buyers Awaiting Developments

Immediately following the news of the signing of the armistice on Monday, absolute quiet prevailed in the metal market. Buyers with government contracts have decided to wait a little to see what news will come out of Washington.

That there are large stocks in the hands of manufacturers for fabrication into government orders is well understood. There seems to be some indication that some of these stocks may find their way to the market.

NEW YORK METAL MARKET PRICES

	Nov. 4	Nov. 12
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26 00
Casting	Govt. price 26 00	Govt. price 26.00
Wire base	28 75	28 75
Lead, trust price	8 05	8.05
Antimony	10 50	9.25
Nickel, ingot	40.00	40 00
Sheet zinc, f.o.b. smelter	15.00	15.00
Spelter, spot	9.00	8 75
Tin, Chinese *	No quotations	No quotations
Aluminum, 98 to 99 per cent	Govt. price 33.10	Govt. price 33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	22.75 to 23.25	22 50 to 23.00
Brass, heavy	13.00 to 13.50	12 00 to 12 50
Brass, light	11.00 to 11.25	10.50 to 11 00
Lead, heavy	7.50 to 7.75	7 25 to 7 50
Zinc, old scrap	6.25 to 6.50	6.00 to 6 25

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*No Straits offering.

THE WEEK
IN TRADE

HOSTILITIES are over and reconstruction is now uppermost. This is the greatest news of the week. The sales of the week will undoubtedly show a falling off. Monday was a holiday, and since then many contracts have been canceled and the buying has shown some falling off—not everywhere but sufficiently to show that buyers are not altogether inclined to place contracts when things are so uncertain.

The government has announced that it is not disposed to cancel its contracts with producers so long as there remains a supply of raw materials accumulated for the carrying out of those contracts. Restrictions on the production of electrical appliances are being removed gradually, and better shipments can be expected soon.

Labor is beginning to drift away from munitions plants back to those plants which are expected to be strong in the reconstruction period.

Prices are remaining very steady, and there are no indications at the present time of any immediate change. In fact, in a few lines there were advances announced this week.

NEW YORK

Monday's good news stopped everything in the way of business. New York went wild with joy, and the people thronged the streets from early morning until late at night rejoicing. Some attempts were made to carry on business in the morning, but nowhere did they meet with any success.

Since then business has been good, bad and indifferent. Some houses report an unusually large amount of new business, largely government orders, and others report things as being very quiet. Some orders have been canceled as a result of the news, but this condition is met with only here and there.

The removal of restrictions on new building under $10,000 private and $25,000 industrial was expected on Thursday. No anticipatory orders, however, were reported early in the week.

Stocks are low, but the easing up on allocation of raw materials by the War Industries Board is expected to help this condition shortly.

Labor is beginning to drift back from purely war plants to commercial manufacturing plants, and in this movement electrical plants will undoubtedly benefit.

WIRE.—Manufacturers are continuing to produce and ship in undiminished quantities the outpost wire ordered by the government. Manufacturers at this writing expect to continue on this order until it is completed, which will be some months from now. The wire, which is No. 19 B. & S. two-conductor twisted, while ordered for field telephone and signal purposes, can be used to a great extent in reconstruction and in the policing of central Europe that will have to be done by the Allies. If this order is to be fully completed, there will continue to be a shortage of small-size wire. In some places stocks are virtually negligible. It might be noted that the insulated wire contract with the government contains a sixty-day notice cancellation clause.

LAMPS.—A quicker movement is noticeable. Stocks are good. One large concern has increased its warehouse space to take care of the anticipated big demands. Withdrawal of lightless night orders is expected, and with it the lamp market should be further accelerated.

INSULATORS.—High-tension insulators are in good demand, and the supplies on hand, according to one of the larger manufacturers, are ample. Low-voltage types are in fair supply.

MOTORS.—The largest distributers in the local market state that they have felt no reduction in the volume of orders as a result of the end of hostilities. Supplies are limited.

APPLIANCES.—One of the largest producers advanced prices this week from 10 to 20 per cent. Another producer, anticipating such action perhaps, began this week to notify customers that all orders are taken subject to prices as of date of shipment. There has been no increase in the Marsh patent schedule, however, since that which went into effect on Aug. 10.

CONDUIT.—Some jobbers are finding a little freer movement in incoming stock, but on the whole the situation is unchanged. So far as could be learned, no stock replenishment shipments for general purposes are yet being made.

MOTOR-GENERATOR SETS.—The Emerson Electric Manufacturing Company is reducing about one-third the prices of small motor-generator sets used for battery charging owing to the accumulation of an overstock.

CHICAGO

The feature of last week has been the half day's holiday occasioned by the rumor of an armistice on Thursday. Practically no business was done in the city during that afternoon owing to the fact that the workers left their places at noon and, joining the celebration, failed to return. Jobbers report that the rumor had a temporary effect on a few large contracts but that nothing serious has resulted, since the buyers placed the orders on the succeeding day when it was learned that the rumor was not confirmed. The celebration has had the effect, however, of stimulating some intensive thinking in regard to the future. Well-informed sources seem to believe that the latter half of 1919 will see a considerable amount of public utility financing in the Middle West.

There have been no price changes. News of war construction still continues to abound. The War Department has authorized the construction division to proceed with a new cantonment at Fort Benjamin Harrison, Ind., to cost $2,632,257, and five vehicle storage buildings at the Rock Island Arsenal, to cost over $500,000.

The general volume of business continues satisfactory. More attention is being paid to export trade. The expected wave of railroad buying under government control has not materialized, the roads continuing to buy from hand to mouth as they have heretofore.

INDUSTRIAL LIGHTING.—Business is especially good at this season of the year and has been stimulated somewhat by the shift in the clock.

COPPER WIRE.—Trouble appears to be ahead for the jobbers in securing the smaller sizes of wire. Now that the factories which are taking up government work have secured the copper on which to go ahead with these orders, they are notifying their domestic customers that it will probably be three or four months before they can do anything for them.

CONDUIT.—The situation is improving somewhat, one factory recently notifying its Chicago distributers that it will begin to ship on B-1 and B-2 priorities where it has heretofore been shipping only in Class A.

ELECTRIC RANGES.—Some of the manufacturers see an opportunity to advertise to central stations that stand to lose temporarily some of the industrial load created by the war.

CABLE.—The Commonwealth Edison Company is again in a position where it must buy cable for its immediate needs. Until recent months it has been able to get along with the cable on hand and contracted for.

FARM-LIGHTING PLANTS. — The Farm Power and Light Manufacturers' Association has collected data which it is now ready to submit to the War Industries Board at Washington to secure its classification as to priorities.

CEDAR POLES.—The market for cedar poles is improving.

EXPORT ELECTRICAL APPLIANCES.—The export branch of the electrical appliance business is engaging the attention of many Middle Western manufacturers. This is true even with some of the smaller concerns. It is the experience of these manufacturers that people in Italy, England, Norway, Holland and Australia are crying for electrical goods of American manufacture. They are ordering in large quantities and are sending cablegram after cablegram to New York banks arranging for payment of the shipments they desire.

HYDROELECTRIC APPARATUS.—Plans have been approved for the following dams in Wisconsin: Clintonville Power Company on the Embarrass River at Clintonville, West Bend Woolen Mills on the Milwaukee River at West Bend, Barton Rolling Mills on the Milwaukee River at Barton, Badger Rolling Mills on the Milwaukee River at Grafton, Peninsular Power Company on the Brule River near Florence, Lake Wingra Lock & Spillway on Lake Wingra, Madison. Applications for permits to build dams have been made by the Jackson Milling Company, Stevens Point; the Peninsular Power Company, Florence; the Clintonville Power Company; the Ironwood & Bessemer Railway & Light Company, Montreal River, and the Union Falls Manufacturing Company at Oconto Falls.

BOSTON

The victorious conclusion of hostilities Monday was celebrated by a two days' vacation in the electrical industry in New England. A new era has begun and trade conditions already forecast it. The volume of business has been decreasing materially of late from week to week, especially in industrial power equipment lines. The sale of appliances has been much below normal, though commensurate with the available supply. Some accumulation of stocks has been noted, especially in motors and lamps. About four weeks ago it became apparent that the end of the war could not be far off, and the realization of this was the signal for a decided curtailment in inquiries. Cancellation of many government contracts appears to be inevitable, and a readjustment period is believed to be upon the industry. The feeling is very widespread, however, that conditions are fundamentally sound and that the transition to a peace basis will be sufficiently gradual to enable most of the shocks to the trade to be absorbed without lasting injury.

With the passing of many government orders, of which New England holds an enormous total, markets long withheld are expected soon to be available. Building construction for non-war purposes has been at a standstill for about two years. The market for civilian goods clamors for relief through the production and distribution of an immense variety of staples, and with the coming of peace the opportunity for development work comes again to the front as a prime factor in trade expansion. Central stations must meet a long list of accumulated applications for service. A large amount of wiring and installation work must be done by the contractors as restrictions upon building are removed. The textile and shoe factories of New England must fill the demands of the citizen buyer as well as the requirements of our overseas guard forces. Shipbuilding, it is learned from reliable sources, will be pushed hard in this territory, and a considerable amount of betterment work impossible in the rush of war conditions is slated to be performed as soon as may be. Reconstruction work in the war zones appears certain to draw heavily upon the resources of electrical New England as conditions abroad become more and more settled.

At this writing prices have held firmly, although a tendency toward lower quotations in motor sales under close competition is to be seen. An early drop in prices is anticipated along many lines, now that hostilities have ceased. The retention of women in industry seems likely to be a factor in labor competition which will make for lower costs. The accumulation of stocks will also tend toward cuts in quotations. Some movement is to be seen just now in portable lamps, and the new Edison portable lamp is receiving favorable patronage. The demand for industrial electric trucks and other labor-saving equipment continues excellent, with deliveries varying more or less from week to week according to type. The retail market for electric radiators has not been exhausted, despite the shortage reported by jobbers. The lessening of the federal restrictions upon display lighting is leading to an increased consumption of moderate-powered units. Washing machines maintain their reputation as quick sellers and the demand for these will unquestionably be stimulated as raw materials are gradually released from purely war requirements. The demand for motor-driven coal-loading machinery is very active.

ATLANTA

The general volume of business is holding up well. This includes the total transacted for both government account and commercial lines. Manufacturers report that shipments on the whole are improving and that factory facilities are in better shape now than in a long time. Then, too, there are not in sight at this time the possibilities of such future large orders for equipment and material as existed a year ago.

The new ruling of the War Industries Board barring the construction of churches, schools, hotels, office buildings, apartment houses and twelve other types of buildings will further tend to curtail the demand for schedule material, flexible conduit and fixtures. Although the sale of schedule material and conduit for this class of construction was curtailed before this order went into effect, the volume of fixture business has been good considering the circumstances. This is owing to the fact that buildings that have been started were permitted to be completed, which maintained the demand for fixtures of all types. The Selden-Breck Construction Company, St. Louis, Mo., has been awarded the contract for Camp Benning, Columbus, Ga. Plans include 1200 buildings, 500 barracks, 45 storehouses and 14 warehouses. There are also to be an electric laundry, costing $250,000, and waterworks. Lockwood & Greene Company, Atlanta, Ga., are engineers.

CREDITS AND COLLECTIONS.—A survey of the field from the manufacturers' viewpoint indicates that immediate collections are fair but certainly not up to expectancy nor equal to percentages obtained in 1917. Further investigation reveals the fact that, while comparatively small accounts are being cleared up as anticipated, the great variation in percentage of available collections or accounts receivable is due to the large accounts with public utilities and industrials, which are somewhat behind. Collections prior to the fourth Liberty loan were classed as good, but present indications point to slowness. The collection of tax money by municipalities is reflected in their accounts, which are being cleared up very satisfactorily. A tighter rein is being held on this class of accounts by the manufacturers, however, as they expect tardiness again when tax funds have been distributed. During the summer and early fall months the manufacturers held a large amount of jobbers' and distributers' paper, owing to the placing of large stocks for the following six to eight months, but the amount of outstanding acceptances and other classes of paper show a decided decrease compared with the summer months, and collections from these sources may rightly be classed as of an excellent character.

RECTIFIERS.—Sales, especially of the resistance type, are breaking all records, and the only difficulty is delivery. Jobbers report a heavy and insistent demand that cannot be supplied. Shipments are now running from eight to ten weeks. There is no such thing as a stock any more, as most of the equipment is sold in transit. Prices remain steady under the pressure.

WIRING DEVICES.—Following the recent advance in price, a slowing up in this line has been noted. This is only a temporary lull, however.

SEATTLE—PORTLAND

Seattle jobbers and dealers report the volume of sales during last week more or less interrupted owing to the premature announcement of the signing of the armistice, and the continued closing order brought about by the influenza epidemic. Jobbers' sales to shipyards and industrials show little decrease. When the authorized announcement of the signing of the armistice on Monday came, Seattle and other Northwest cities took a full holiday.

The influenza situation is showing a steady improvement, and it is believed that the ban on public gatherings and full-length business days will be lifted by the end of the current week. Portland jobbers report that the changed hours for business due to influenza have been very disconcerting and that the shortening of business days and premature rumors of peace have had a tendency to hold up sales of considerable importance which were expected to materialize this week. However, electrical jobbers report business about the same as for the past several months.

Stocks apparently are in about the same shape. The usual shortage in steel exists. There is a temporary shortage in certain sizes of lamps, particularly the 100-watt and 150-watt type C "Mazdas." Jobbers and manufacturers report collections as good. Electrical contractors state that business is slightly better than usual, being affected very little by influenza or early closing and report collections on current bills to be in very good shape. However, they are experiencing considerable difficulty in making collections of old accounts. Notice has just been received of an advance of from 25 to 35 per cent on electrical utensils. Such a marked increase comes as somewhat of a surprise at this time, although some increase was naturally not unexpected. The conduit situation remains unchanged, with the demand heavier than supply.

Lamp replacements and renewals continue in heavy demand. Washing machines are still the leader in domestic appliance sales and are becoming increasingly difficult to secure. All other labor-saving devices are moving well and are fairly easy to obtain. The building campaign to construct homes for war workers is creating real demand for wiring devices and fixtures. The campaign is proceeding satisfactorily despite labor shortage and difficulty in securing materials and authority to proceed with work.

Motor sales to shipyards and industrials show no marked change, although the volume is well sustained. Several orders of considerable magnitude are pending, the most important being from the Portland territory. Deliveries have not shown any improvement and stocks are very low, shipments being absorbed as soon as received. Seattle and Tacoma report collections very good. No new credits of any importance were placed during the past week.

SAN FRANCISCO

Signs of industrial adjustment are evident. Unskilled labor is being eliminated from the shipyards and steel works, and all overtime work has ceased. The government, however, shows no diminution in its construction schedule. Six warehouses for the San Francisco Presidio and new barracks for Camp Kearney, to cost $2,000,000, are scheduled. Miscellaneous construction recorded includes a huge concrete storehouse near Sacramento for the Northern California Milk Producers' Association and a six-hundred-thousand-dollar cement plant for Porterville.

LAMP GUARDS.—"Hold-Fast" guards have advanced 10 per cent. A local agent reports that sales of his guards have doubled over last year and that a recent 100-gross order from the Northwest has set a new factory record. A very drastic test is now required by certain shipyards, namely, that crumpled guards must be capable of being rebent to their original shape with their protection powers unimpaired.

BOXES AND COVERS.—Galvanized boxes and covers have advanced 10 per cent. Pacific Coast jobbers no longer list the plain pieces, as they are banned by local and national regulations.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71 00
No. 10 solid	90 00
No. 8 solid	106 00
No. 6 solid	145 00
No. 10 stranded	95 00
No. 8 stranded	115 00
No. 6 stranded	160 00
No. 4 stranded	205 00
No. 2 stranded	266 00
No. 1 stranded	315 00

Twin-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	104 00
No. 12 solid	135 00
No. 10 solid	185.00
No. 8 stranded	235 00
No. 6 stranded	370 00
No. 4 stranded	575 00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	6%-10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	6%-10%

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	6%-10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	6%-10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+30% to $73 20
Coil to 1000 ft	List

	No. 12 Solid
Less than coil	+30% to $85 20
Coil to 1000 ft	List

Twin-Conductor

	No. 14 Solid
Less than coil	$115.00
Coil to 1000 ft	100.00

	No. 12 Solid
Less than coil	+20% to $162 00
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250

DISCOUNT—NEW YORK

Less than 1 5 std pkg	+20%
1 5 to std. pkg	List
Std pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1 5 std. pkg	+30% to 12%
1 5 to std. pkg	+5% to 20%
Std. pkg	18% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 45—$0 46	$0 45—$0.47
2 to 50	40	40— .41
50 to barrel	35— 36	36— .37
Barrel lots	32— 329	33— .339

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.	$0 40 to $0 45	$0.40 to $0 45
12 to 50	.35 to .39	.35 to .39
50 to barrel	.319 to .362	.329 to 382
Barrel lots	289 to .332	.299 to 342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5 00
3/8	250	7 50
1/2	100	10 00
3/4	50	13 00
1	50	21 00
1¼	50	26 00
1½	25–50	35 00
2	25–50	45 00
2½	25–50	52 00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75 00	$63 75— 69 75
3/8-in. double strip	75 00— 82 50	72.00— 75 00
1/2-in. single strip	100 00	85 00— 93 00
1/2-in. double strip	100.00—110 00	96.00—100 00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75 00	$63 25 to $64 25
3/8-in. double strip	78 25 to $90 00	71.25 to 75 00
1/2-in. single strip	100 00	75 00 to 85 00
1/2-in. double strip	105.00 to 120 00	93.00 to 100 00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0.05½	1	$0 25
1/4	06	1¼	33
3/8	.09	1½	40
1/2	12	1¾	47
5/8	.15	2	55
3/4	.18	2¼	65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$25 00-51 70	$24 00-35 20	$23 00-30 25
1/4-in.—	30 00-56.40	28.00-38.40	26 00-33.00

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$44 00-60 00	$30 00-33 00	$26 50-29 15
1/4-in.—	48.00-65.00	33 50-36 00	29.00-31.80

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
1/4	$0.08½
3/8	08½
1/2	.08½
3/4	.11½
1	.17
1¼	.23
1½	27½
2	37½
2½	58½
3	76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
1/4	$0 05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	10	.25
1	.13	.37
1¼	.17	.45
1½	.21	50
2	.28	1 10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	7% to 7 1%	9% to 9 1%
2500 to 5000 lb.	10% to 10 1%	12% to 12 1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+5.5% to 3.5%	+3.5% to +1.5%
2500 to 5000 lb.	+2.5% to +0.5%	+5% to 1.5%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$6.00 to $7 00
Discount	20% to 30%

CHICAGO

List price	$6 00 to $7.00
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp	100	$0.25
35-amp. to 60-amp	100	.35
65-amp. to 100-amp	50	.90
110-amp. to 200-amp	25	2.00
225-amp. to 400-amp	25	3.60
450-amp. to 600-amp	10	5.50
600-Volt		
3-amp. to 30-amp	100	$0.40
35-amp. to 60-amp	100	.60
65-amp. to 100-amp	50	1.50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5 50
450-amp. to 600-amp	10	8 00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41% to 45%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30% to 31%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$6 00 to $9 37
1/5 to std. pkg.	5 25 to 7 00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8 00
1/5 to std. pkg	7 00

Standard packages, 500. List, each, $0 07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

	Std. Pkg.	List, Each
Regular, Clear:		
10 to 40-watt—B.	100	$0 35
60-watt—B.	100	40
100-watt—B.	24	85
75-watt—C	50	70
100-watt—C	24	1 10
200-watt—C	24	2 20
300-watt—C	24	3 25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4⅜-in., Frosted:		
100-watt—G 35	24	1 15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30 47—$40 77
Coil to 1000 ft	27 42— 30 22

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$38 00
Coil to 1000 ft	28.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24 00

CHICAGO

Net per 100	$23 93 to $30 00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30 00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30 00
103—C.A., 9, 4R, B 1½	25 00
106—F.A., 7, C.S., 1½, 3 R	20 00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%	20%
$10.00 to $50.00 list	36%	31%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list.	20%	10%
$10.00 to $50.00 list	30%	20%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	5%
1/5 to std. pkg	15%
Std. pkg	25%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$21.00 to $34 00
1/5 to std. pkg	17 85 to 28 90

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$16 80–24 15
1/5 to std. pkg.	15 80–21 00

Standard package, 2200. List per 1000, $20.00–21.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.—Solid Nail-it	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg	$16 00 to $22 00	$32 00
1/5 to std. pkg	13.60 to 18 70	27 20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid Nail-it	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg	$11.70–$18 40	$33.85–$36 80
1/5 to std. pkg.	10.15– 16 00	26 60– 32 00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets.	500	$0 33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List
1/5 std. pkg.	10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0 80
60-amp. S. P. S. T	1 20
100-amp. S. P. S. T	2 25
200-amp. S. P. S. T	3 48
300-amp. S. P. S. T	5 34
30-amp. D. P. S. T	1 20
60-amp. D. P. S. T	1 78
100-amp. D. P. S. T	3 38
200-amp. D. P. S. T	5 20
300-amp. D. P. S. T	8 00
30-amp. 3 P. S. T	1 80
60-amp. 3 P. S. T	2 68
100-amp. 3 P. S. T	5 08
200-amp. 3 P. S. T	7 80
300-amp. 3 P. S. T	12 00
Low Grade:	
30-amp. S. P. S. T.	$0 42
60-amp. S. P. S. T	74
100-amp. S. P. S. T	1 50
200-amp. S. P. S. T	2 70
30-amp. D. P. S. T	68
60-amp. D. P. S. T	1 22
100-amp. D. P. S. T	2 50
200-amp. D. P. S. T	4 50
30-amp. 3 P. S. T	1 02
60-amp. 3 P. S. T	1 84
100-amp. 3 P. S. T	3 76
200-amp. 3 P. S. T	6 76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15% to +10%
$10 to $25 list.	+10% to 2%
$25 to $50 list.	5%
	Low Grade
Less than $10 list	+5% to list
$10 to $25 list.	List to 8%
$25 to $50 list.	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 15%
$10 to $25 list	List to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15% to 16%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind	250	32
10-amp. single-pole	100	.48
10-amp. single-pole, ind	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P	100	.60

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0 45
10-amp. three-way	50	70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to 10%
1/5 to std. pkg	+5% to 16⅔%
Std. pkg	18% to 25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0 34
No. 160	60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list.	Net to 30%	Net
$2.00 to $10.00 list.	10% to 35%	5%
$10.00 to $50.00 list.	20% to 37%	10%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 50%

TOASTERS, UPRIGHT

NEW YORK

List price	$6 00 to 6.50
Discount	20% to 30%

CHICAGO

List price	$6 00 to $7 00
Discount	20% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.54–$0 66
No. 18, full spools	.52– .56

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0 65 to $0 72
No. 18, full spools	.55 to 605

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$20 00–$25 00	$15 00 $17 00	$15 00–$15 75
12	23 58– 27 09	21 62– 29 09	17 68– 23 22
10	30 20– 37 80	27 45– 32 40	23 47– 32 40
8	42 74– 53 34	38 85– 45 72	33 21– 45 72
6	61 50– 84 42	55 35– 72 36	52 58– 55.48

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$25 00	$18 00–$25 00	$15 50
12	$29 46– 31 44	29 46– 31 44	$25 54– 31 44
10	41 10– 43 84	41 10– 43 84	34 62– 38 36
8	57 00– 61 76	57 90– 61 76	50 18– 54 04
6	85 31– 97 68	85 31– 85.47	77 21– 85 47

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$39 75 to $44 00
25 to 50 lb	39 75 to 42 00
50 to 100 lb	38 75 to 40 00

CHICAGO

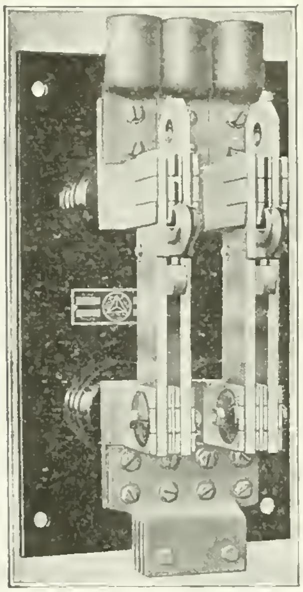
	Per 100 Lb. Net
Less than 25 lb	$41 00 to $41 76
25 to 50 lb	39 75 to 40 76
50 to 100 lb	38 75 to 39 76

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Locked-Type Unit Disconnecting Switch

Frequently high-ampere-capacity single-element disconnecting switches are objectionable because of the considerable manual effort necessary to open and close the blades. What is said to be an easily operated locked-type unit switch is being manufactured by the Delta-Star Electric Company, 2433 Fulton Street, Chicago. The 4000-amp., 6600-volt type illustrated consists of two 2000-amp. elements mounted on common contacts, each unit being independently operated and also provided with safety locks.



LITTLE EXERTION NECESSARY IN OPENING AND CLOSING

Farm-Lighting Generators with Ball Bearings

Farm-lighting generators, either shunt-wound or compound-wound, have just been placed upon the market by the Hendricks Magneto & Electric Company of Indianapolis. Two sizes of these generators are obtainable—the 30-40 volt, 1½-kw. size furnishing current for seventy-five 20-watt lights or their equivalent, while the 30-40 volt, 3-kw. type supplies electricity for 150 20-watt lights. Ball bearings are an important feature of the generator construction and the manufacturers say that the brush area and the windings of both field and armature are of generous proportions. Pulley and base rail are furnished along with the generator.

Notice to Electrical Manufacturers

The Post Office Department has promulgated a new ruling which will affect the New Apparatus and Appliances Section of the ELECTRICAL WORLD. According to the official instructions, no device can be described in our editorial columns unless it is actually new and has not been previously described in the editorial or advertising pages of any periodical. It is explicitly stated that no editorial mention may be given an article advertised in the same issue of the magazine. Moreover, no editorial mention may be written so as to constitute a "puff." Only important features of the article may be described.

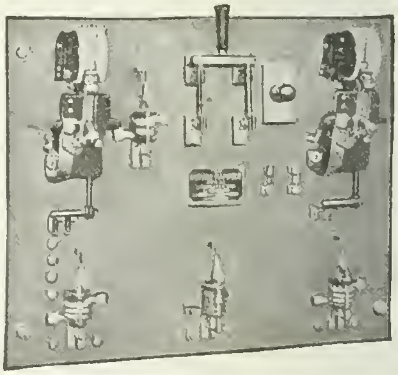
While it has been our policy to describe as new any apparatus which was new to our editorial columns, it now becomes necessary to ask the manufacturers to get such news into our hands before giving their new products any publicity. This policy on the part of manufacturers is, in fact, prerequisite to any editorial mention whatsoever. It is hardly necessary for us to request that only material be sent us which will bear the light of impartial criticism since extravagant claims and all irrelevant matter must be eliminated. Attention should be given those features which differentiate a device from similar apparatus already on the market. It is needless for us to call attention to the fact that the ELECTRICAL WORLD has always been more than willing to inform its readers of all new devices brought out. We feel this service is just as obligatory as any other service which the paper renders its readers, and we have therefore sought to keep the New Apparatus Section up to the same high standard as the rest of the paper.

We would appreciate it very much if we could count on your cooperation in supplying us with descriptions of new devices in conformity with the rules promulgated by the Post Office Department. The editorial department of the ELECTRICAL WORLD has never heretofore stopped to consider whether a device was advertised in its pages or not, the sole criterion being whether it possessed merit and was new. The Post Office Department requires us to be more drastic and to exclude from our columns descriptions of any apparatus which has been advertised at all.

Safety First for Crane and Operator

The average crane cab built a few years ago, before the advent of safety first ideas, and even some cabs now manufactured, give practically no protection to the motors and actually present hazards to the operator. By simply removing the dangerous open switchboard and installing in its place a crane protective panel mounted in a steel cabinet all danger is obviated.

These panels take the place of the various circuit breakers, knife switches, fuses, etc., previously mounted in the crane cab, giving a complete switchboard on which are arranged all the necessary protective devices and safety features. No-voltage and overload protection is provided for each motor supplied through the panel, a thing hardly possible with the usual equipment. The control of the panel is obtained through a push-button station. To start the crane the operator merely depresses the "start" button for an instant before manipulating the motor controllers, requiring far less time than closing numerous circuit breakers and fuses. To shut off the power from all circuits he touches the "stop" button. If he wishes to inspect any motor or leave the crane temporarily in an inoperative condition, he can withdraw the safety plug and take it with him. As a further preventive against starting the crane when it is stopped for any repairs, both the electrician and the crane operator can be provided with separate locks which when inserted in hinged clips of the main-line knife switch prevent it from being closed.



ALTERNATING-CURRENT PANEL FOR MANUALLY CONTROLLED CRANES

The protecting panels described here are made by the Cutler-Hammer Manufacturing Company of Milwaukee for cranes with alternating or direct-current motors of from 50 hp. to 400 hp.

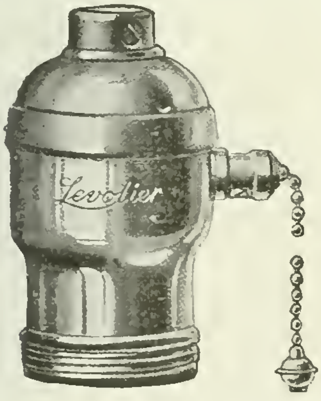
Vertical-Break Horn-Gap Switch

A new design of horn-gap switch of the vertical-break type has been developed by the Railway & Industrial Engineering Company, Pittsburgh, Pa., and can be had for all voltages up to 150,000. Operation is accomplished by rotating the center insulator. On top of this is mounted a circular gear rack which meshes with a segment gear to which the switch arm is attached. In this way a rotary motion of the insulator raises and lowers the switch arm.

It is pointed out that there is no danger of the switch becoming inoperative because of sleet or winter storms since every point where freezing may occur is guarded. The main contact is of the laminated-brush type covered by a sleet hood of the same general construction as that used in the Burke horn-gap switch. Operation is said to be positive under all weather conditions. Prevention of the main contact burning is provided for by auxiliary arcing horns which make contact before and break after the main contact. The insulators, which are of the sectional type bolted together, provide for replacement of damaged units.

New-Principle Pull Sockets

With the advent of high-wattage heating devices and appliances, it has become necessary to develop a 660-watt, 250-volt pull socket. The Despard & Gordon Company of Chicago has developed a simple and unique quick make-and-break mechanism, with a wide breaking distance. The movement has an oscillating contact arm actuated by an oscillating pawl with an extension or spring connecting both. The contact arm itself has fiber-insulating bearings at each end and a fiber-insulating connector at the end for the spring which insulates the entire mechanism from the contact arm.

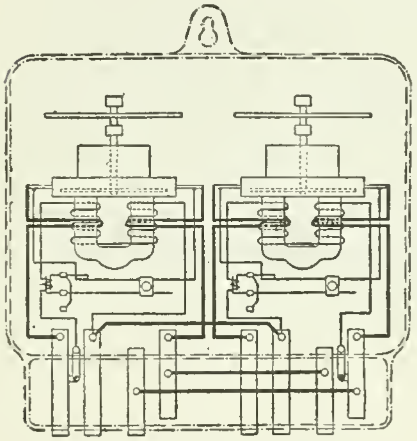


MAY BE USED WITH OR WITHOUT CHAIN

The lever that actuates the mechanism is said to be a step forward in lever construction. It can be pulled in any direction or straight out, riding around a fulcrum. When the lever is pulled in any direction it rights itself quickly and is ready for another pull. The lever and chain can be removed readily for refinishing. Leaving the chain off, the lever can be operated with a slight pressure of the thumb. This is a natural way to manipulate a socket without a chain. The cap and shell were designed to give a positive gripping surface around their entire circumference, allowing at the same time the ready removal of the cap when desired.

Accurate Three-Wire Direct-Current Meter

A three-wire, direct-current service-type meter which will record accurately the load on either side of a three-wire distributing system, regardless of whether the other side of the line is energized or not, is being placed on the market by the Sangamo Electric Company, Springfield, Ill. This meter consists simply of two standard two-wire elements placed side by side on a common base and registering kilowatt-hours on a common recording train so that the sum of the revolutions of the two elements will be properly added and indicated on the kilowatt-hour dial of the meter. This is effected by means of a very simple but ingenious differential gearing within the recording train, so that no matter what load there may be on one element as compared with the other, the total revolutions of the two elements will be accurately added and recorded. Even with one element fully loaded and the other one without load, the registration is as accurate as though each element were recording on a separate train.

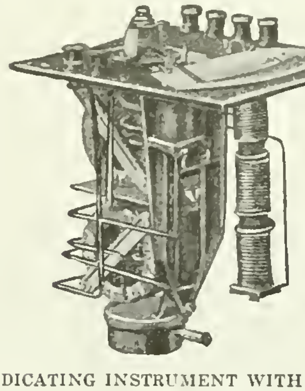


INTERNAL ARRANGEMENT AND CONNECTIONS OF METER

Each element of the new three-wire meter includes the light-load adjustment, the damping magnets, and in the case of meters over 10-amp. rating, the internal or external shunts. The elements are so connected through an interchange of connections within the terminal box itself that the load wires from and to the line pass in and out of the meter in regular succession. No crossing over or interchanging of leads is required. In calibrating, each element is considered and tested as a standard two-wire meter without respect to the other element.

Combination Indicating Instruments

Instruments sufficiently accurate for all general testing and so constructed as to withstand the rough usage to which instruments of this character must necessarily be subjected without damaging the internal mechanism or affecting their accuracy are being manufactured by the Esterline Company, Indianapolis, Ind. These instruments are known as the Type "W" indicating instruments. In order to eliminate the necessity of carrying an extra instrument for such testing, a combination has been effected so that a voltmeter and an ammeter, a single-phase wattmeter and voltmeter, a single-phase wattmeter and ammeter, or a polyphase instrument may be inclosed in a single case. This construction makes available two meters in one case, a very convenient arrangement in general testing and trouble duty.



INDICATING INSTRUMENT WITH UNUSUAL FEATURES

A number of features not heretofore found in portable instruments are included in this line. These features are the elimination of jewels, pivots and hair springs; the use of a steel suspension for supporting the moving elements, which acts also as the restraining medium, and the use of a machined cast-aluminum frame and top plates with a movement frame molded entirely from bakelite.

The instrument is exceptionally light in weight and measures 8½ in. by 8 1/16 in. by 11⅝ in. It weighs approximately 10 lb.

Combined Electric and Hand-Power Dishwasher

For all classes of institutions having a large number of dishes to wash, Redmon, Edgar & Redmon of Cedar Rapdis, Iowa, have developed a combined electric and hand-power dishwasher known as the "E-Z-Way No. 12." It has a capacity of 5000 dishes per hour and occupies a floor space independent of receiving and drying tables of approximately 2 ft. by 3 ft. (61 cm. by 91 cm.). It has attachments for hot water, sewer and gas or live steam where steam is available. The rotary motion of the basket containers for dishes and silverware is supplied by a belt and gear drive with a ¼-hp. motor.

Trade Notes

FEMALE EMPLOYMENT.—Under the title "Factory Equipment, Housekeeping and Supervision," the Industrial Commission of Wisconsin, women's department, has issued a handbook for employers of women containing the provisions of the statutes regarding labor standards, with suggestions regarding safety, sanitation, equipment and housekeeping and supervision.

WESTINGHOUSE ACQUIRES FRANKLIN "MAZDA."—The Westinghouse Lamp Company purchased a few days ago all of the outstanding capital stock of the Franklin Electric Manufacturing Company, Hartford, Conn., the smallest of the "Mazda" group of lamp manufacturers. The Franklin company was organized in 1900. It has two factories, one in Hartford and the other in Middletown, Conn. General offices are in Hartford, and branch offices are located in New York, Philadelphia, Pittsburgh, Chicago, Elkhart, St. Louis, Los Angeles and San Francisco.

ANNUAL DINNER OF THE AMERICAN APPLIANCE COMPANY AT HOTEL McALPIN, NEW YORK CITY

ONE DINNER HOUR FOR JOBBERS.—The Lewis Electrical Supply Company of Boston announces that it has established an effective plan of closing daily, except on Saturdays, between 12 and 1 o'clock as a regular dinner hour. This custom, it is understood, is now being followed by a number of electrical supply jobbers in place of allowing the usual lunch hours and relays, which results in abbreviated service for an hour before and two hours after noon.

AVOIDING DISAGREEMENTS ON EXPERIMENTAL WORK.—A Boston electrical manufacturer who does a large amount of experimental and special work finds the following businesslike policy helpful in preventing errors and safeguarding the financial return for services performed: On experimental or special work a cash deposit is required before work is begun, a certain agreed amount being paid weekly and the balance at the completion of the job. All orders left must be in writing and signed by the person responsible for the payments. Otherwise the manufacturing company will not be responsible for errors. No estimate is considered official for the customer's use unless it is in writing and countersigned by the manager of the establishment asked to bid upon the work.

BRITISH ATTENTION TO KEY INDUSTRIES.—The Key Industries Exhibition held in London on Oct. 8 to 18 under the auspices of the Tariff Reform League is a striking illustration of what Great Britain has accomplished during the war in manufacturing essential commodities which were formerly almost completely controlled by Germany. These key industries, while not necessarily large in themselves, are of vital importance, since upon their existence that of other greater industries depends. England, formerly an importing nation of many commodities, including a large variety of electrical goods, has since the war begun taking steps to establish her own manufacturing plants in these industries, and with the end of the war she expects not only to be able to satisfy the domestic consumption but also to be able to enter into foreign trade.

ELECTRICAL SUPPLIES FOR AUSTRALIA.—A conference of electrical engineers was held in Melbourne, Australia, on July 17 last to deal with the problem of insuring during the next two years the maximum supply of electrical goods from foreign sources. The engineers were attached to central stations all over Australia. It was shown how difficult it is to obtain electrical goods from England and the United States owing to the manufacturers being engaged almost exclusively in war work. An ever-increasing demand for power in Australia requires an increased output and therefore more machinery. The immediate object of the meeting was to get the representative of every central station to compile a schedule of the electrical goods that will be needed during the next two years. These needs, it is understood, will be grouped together and bulk orders given to foreign firms through the Department of Munitions, which, it is reported, will draw the attention of the Munitions Department in London to the needs of Australia. It is anticipated that this grouping and advice of the Australian Munition Department will do much to insure greater and more adequate supply. When completed the result will be reported to the Director of Munitions.

GREATER FACILITIES FOR OHIO BRASS.—The Ohio Brass Company, Mansfield, Ohio, is constructing a service building which will be devoted almost entirely to the comfort and convenience of employees of its factory. The new building stands across the street from the present factory buildings. It has a separate entrance for employees, directly opposite the main entrance of the factory. Immediately inside this entrance is a room 60 ft. by 120 ft. which will be used as a locker room. This room will be fitted with lockers as soon as conditions become more normal and steel is available. In connection with the locker room will be a marble, inclosed shower room and also a plentiful equipment of improved-type lavatories. On the second floor, above the locker room, is a room of the same size which will be used as a lunch room in addition to the company's restaurant, where full meals are served at cost. The new building is constructed entirely of reinforced concrete with a brick facing. Later on there will probably be provided additional facilities for relaxation and recreation. It is planned to improve the grounds around the buildings. While the new service building is primarily for the employees, some of the space will be used for the present for offices in order to relieve congestion in the existing buildings. Space is being turned over to manufacturing purposes as rapidly as possible. In addition to the service building the company has had to add a number of factory buildings in order to handle the extra large amount of business in essential war materials. There is now being completed a 60-ft. by 120-ft. extension to one of the factory buildings and an entirely new steel building 60 ft. by 140 ft. The added space secured by these buildings, together with new manufacturing equipment, will be a material aid in the efforts the company has made and is making, to bring its production up to customers' requirements.

LAMP MEN MEET AT AMERICAN APPLIANCE DINNER.—The second annual dinner given by the American Appliance Company, prominent lamp jobber, 366 West Fifteenth Street, New York City, and Indianapolis, Ind., was held on Nov. 9 at the Hotel McAlpin in New York. In the invitation the company stated that this gathering of its friends in the incandescent-lamp world was "in the nature of an expression of thanks to them for their loyalty and hearty coöperation with us in many ways during the preceding year." Good fellowship was the keynote of the evening, and there was no discussion of business matters. Members of the lamp industry were present from many parts of the country. The guests included the following: Charles Ablett, Charles Ablett & Company; Harry Annin, Federal Division; J. R. Baker, General Electric Company; Frank R. Blaewelt; Ernest S. Blum; E W. Boyce, New York Lamp Company; James C. Brower; L. R. Claflin, Independent Lamp & Wire Company; Agar Cook; R. K. Dana, Independent Lamp & Wire Company; Dan Delaney, Liberty Lamp Works; E. E. Dorting; Ben F. Erskine, Novelty Incandescent Lamp Company; William H. Evans, William H. Evans & Company; W. D. Fitzpatrick, American Appliance Company; Otto Foell, Lux Manufacturing Company; Arthur Freund, Federal Division; Ben Goldman, Pacific Lamp Company; A. Gordon; George K. Hamblin, Acton Electric Company; H. D. Harding, American Appliance Company; Harvey Harper, Miniature Incandescent Lamp Company; P. H. Harrison, Miniature Incandescent Lamp Company; Frank Haskell; Theodore Haubner; R. K. Herschman, H. J. Jaeger Company; W. F. Herzog, W. F. Herzog & Company; E. G. Hines, "Electrical World"; H. J. Jaeger, H. J. Jaeger Company; G. M. Jost, American Appliance Company; Charles Kane; Charles Levy, Weehawken Tungsten Lamp Company; Dr A J. Liehman, Incandescent Lamp & Wire Company; A. C. Mannweiler, A. C. Mannweiler & Company; Frank Marsh, Consolidated Electric Lamp Company; Fred Mays, Lux Manufacturing Company; W. M. Mullaney,, Renew Lamp Company; Charles Munder, M. & W. Company; W. B. Paulscraft; C. T. Pfaltz, Duhrsen & Pfaltz; L. L Pierce; H. R. Potter; William Roller; F. J. Rooney, F. J. Rooney Lamp Company; M. H. Rosenberg, Liberty Lamp Works; F. D. Rusling, American Appliance Company; A. P Sass, Incandescent Lamp & Wire Company; Roy Schaulin, Franklin Electric Manufacturing Company; Doherty Sheerin, American Appliance Company; Edward Simon, Triumph Lamp Company; John Simon, Carbon Company; George Smith, Renew Lamp Company; E. A. Tighe, Consolidated Electric Lamp Company; John P. Todd; T. P. Vilaghy; F. A. Vosburgh, Vosburgh Miniature Lamp Company; C. F. Wall; E. S. Walsh, Acton Electric Company; F. Walter, Domestic Tungsten Lamp Company; Ray Warman; Frank Watts, Hart Manufacturing Company; John Weiser, American Appliance Company; E. Weingarter; Frank Weller, Vosburgh Miniature Lamp Company; Alfons Wile; Irwin Wile; Oscar J. Wile; A. E. Weist, American Appliance Company; G. V. Williams, Guy V. Williams Company.

T. R. DUBOIS, formerly of the Bijur Motor Lighting Company, Hoboken, N. J., is now associated with the United States Light & Heating Corporation, Niagara Falls, N. Y.

J. A. MURPHY, new-business manager of the Wheeling (W. Va.) Electric Company, has resigned to take the managership of the Wheeling branch of the Hoover Suction Sweeper Company, with offices in the Rex Theater Building.

G. A. BINZ, sales manager for the Yarnall-Waring Company, Philadelphia, has transferred his headquarters to the company's New York office at 90 West Street and will in future devote his whole time to the interests of "Yarway" specialties in that area.

THE BOONTON (N. J.) RUBBER MANUFACTURING COMPANY, making composite insulation, has been investigated by A. Mitchell Palmer, Alien Property Custodian, who will offer for sale on Dec. 23, 5001 shares of the capital stock of the company, par value $100.

THE UNDERFEED STOKER COMPANY of America announces that E. L. Beckwith has been placed in charge of the Cincinnati office, 926-927 Union Central Building, taking the place of S. A. Williamson, who has been transferred to Minneapolis, with offices at 637 Plymouth Building.

T. K. STEVENSON, formerly sales manager for the Western Electric Company at St. Louis, has been transferred to the company's government department at New York, where he will do special work. George Corrao, who replaces Mr. Stevenson at St. Louis, has been appointed assistant sales manager at that house.

THE MONARCH REFILLABLE FUSE COMPANY, Buffalo, N. Y., announces the appointment of L. I. Geyer of Buffalo as assistant manager of the company. Frank H. Kaiser, who has been connected with the company since its organization, has disposed of his interests and is no longer connected with this concern. The Monarch company has also engaged the services of Prof. J. F. Putnam, of the electrical laboratories of Cornell University, as consulting engineer.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has announced that for many reasons it is impossible to determine prices and selling plans for 1919. The company has usually been in a position to state next season's plans for the wholesalers by the first of November, but it will probably be several weeks after that date before the 1919 plans are ready, the company says. It will issue notice of the plans at the earliest practicable moment.

F. Y. STEWART has been appointed manager of the tape department of the United States Rubber Company, with headquarters at the main office of the company in New York. Mr. Stewart was manager of the Walpole Tire & Rubber Company from the time it was bought until it was finally absorbed by the United States Rubber Company about three years ago. The Walpole friction tape is now manufactured, sold and distributed by the various branches of the United States Rubber Company in the chief cities of the United States.

THE MILLIKEN BROTHERS MANUFACTURING COMPANY, Inc., Woolworth Building, New York, recently organized to succeed Milliken Brothers, Inc., has acquired the plant of the James H Young Stone Company, One Hundred and Thirty-sixth Street and East River, New York City, for a new steel-fabricating plant. The structure is of mill-building type and provides about 40,000 sq.ft. of manufacturing area. The plant is provided with an overhead electric traveling crane and other modern handling equipment and will have a complete allotment of machinery and apparatus for the manufacture of the different steel specialties of the company, including transmission and radio towers and steel poles. An adjoining piece of land has also been purchased, making an aggregate of about two acres of property, with rail and water facilities available for the new works. On this latter site it is planned to build a modern galvanizing plant with complete equipment to handle steel transmission and radio towers as well as other work.

THE SCIENTIFIC PRODUCTS COMPANY, manufacturer of heating pads, Steubenville, Ohio, has gone into bankruptcy, and John A. Huston has filed his first report as trustee. This report will be examined and passed upon on Nov. 18 at Steubenville. At this time the first dividend will be declared.

ELECTRICS, LIMITED, has opened offices at 22 St. John Street, Montreal, Canada, with the following officers: Stephen H. Wiggett, president; Andrew C. Hersey, vice-president; G. H. Rainville, managing director. The firm is wholesale distributer for Westinghouse "Mazda" lamps, and also for motors, generators and other electrical equipment manufactured by the Westinghouse Electric & Manufacturing Company of the United States.

E. E. STRONG entered the electric supply business on Nov. 1 with Henry I. Shiefer & Company, district engineering and sales representatives in central New York for the Sangamo Electric Company, Delta Star Electric Company, G. & W. Electric Specialty Company, Condit Electrical Manufacturing Company and Moloney Electric Company, in addition to being local representative for Western Electric power apparatus. Mr. Strong's office will be in Rochester. He has been superintendent of transportation of the New York State Railways, Rochester lines, for the past five years or more, and since his graduation from the Syracuse University in 1908 has been connected in different capacities with the electric railway industry in the State of New York.

E. E. STRONG

Trade Publications

FIREBRICK LINING.—Plastic firebrick lining for boiler use is the subject of a folder from the Betson Plastic Fire Brick Company of Rome, N. Y.

LIQUID HEATER.—An electric heater for medicinal solutions is illustrated and described with directions for use in a leaflet of the William H. Dalton Company at Salem, Mass.

BUFFING AND GRINDING MOTORS.—Specifications, descriptions and illustrations of both pedestal and bench-type buffing and grinding motors make up a leaflet from the U. S. Electrical Manufacturing Company of Los Angeles, Cal.

INDICES.—An index to the October, 1918, descriptive bulletins and sheets, and another of the October, 1918, supply parts bulletins of the General Electric Company, have just been published by the publication bureau of the company at Schenectady, N. Y.

WASHING MACHINES.—The "Almetal" household steam laundry, which is gas-heated and electrically operated, is dealt with in a two-color leaflet prepared by the Manufacturers' Distributing Company, 400 Fullerton Building, St. Louis, and entitled "If Men Had to Do the Washing?"

LIGHTING GENERATORS.—Lighting generators for automobile, motorboat and large and small farm-lighting outfits form the subject of a new booklet being distributed by the Hendricks Magneto & Electric Company, Indianapolis, Ind.

POSTER STAMPS.—Dealers are urged by the Benjamin Electrical Manufacturing Company of 806 West Washington Boulevard, Chicago, to use Benjamin two-way plug "posterettes" on letters, bills, packages and signs. A mailing card issued contains a return postal card for obtaining a supply.

CUT-OUT BASES.—"Noark" main-line and branch cut-out bases for National Electrical Code standard fuses form the subject of a seventeen-page booklet recently issued by the H. W. Johns-Manville Company, Madison Avenue and Forty-first Street, New York City. Prices are included.

POWER-PLANT APPLIANCES.—Eleven different bulletins of the Sims Company, Erie, Pa., have been issued bound together. They describe with illustrations feed-water heaters, hot-water generators and converters, steam-tube storage heaters, gas-engine economizers, garbage burner, steam separators, exhaust heads, oil extractors, oil filters and tanks.

VULCANIZED FIBER.—Two new sixteen-page illustrated booklets have been published by the American Vulcanized Fibre Company of Wilmington, Del., descriptive of their product. The titles are "Vul-Cot Fiber—the Material with a Million Uses," and "Vul-Cot Fiber—Special Catalog of Parts for Electrical, Mechanical, Automobile and Railroad Uses."

PROJECTOR LIGHTING.—The important part being played by outdoor floodlighting for night work and protective purposes is explained in a new booklet published by the National X-Ray Reflector Company, 235 West Jackson Boulevard, Chicago. Thre new projectors and several new silver-mirrored reflectors for projectors are featured in this bulletin.

STORAGE BATTERIES.—Revised editions of two illustrated catalog sections, A and B and V, describing respectively the "chloride accumulator" and the "Tudor accumulator," with parts and accessories, and the "Exide," "Hycap-Exide" and "Thin-Exide" batteries for electric vehicles, have been got out by the Electric Storage Battery Company of Philadelphia. Price lists may be obtained with these catalogs.

New Incorporations

THE PENNSYLVANIA ELECTRIC REPAIR COMPANY of Pittsburgh, Pa., has been chartered with a capital stock of $25,000 by Alexander McLean and others.

THE CHAMBLEE (GA.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $50,000 by L. C. Van Ornum, H. J. Plade and Emil Baretch.

THE AUBURN (WASH.) BATTERY & ELECTRIC COMPANY has been incorporated with a capital stock of $5,000 by F. M. Russell, C. C. Hayes and A. F. Anderson.

THE BRANFORD ELECTRIC COMPANY of New York, N. Y., has been incorporated by E. L. Bell, D. Sprague and M. J. Conklin. The company is capitalized at $10,000 and proposes to manufacture electrical specialties.

THE PORTER ELECTRIC LINE COMPANY has filed articles of incorporation with a capital stock of $6,000 for the purpose of supplying electricity in the vicinity of Porter and Evansville, Wis. The incorporators are: Joseph E. Porter, F. F. Miller and J. K. Porter.

THE HOME ELECTRIC COMPANY of Eureka Springs, Ark., has been organized by B. H. Blockson, F. A. Butt, C. A. Fuller and others. The new company will take over the property of the Eureka Springs Electric Company, including the electric light plant and ice factory.

H. W. BARTLETT, INC., of New York, N. Y., has filed articles of incorporation with a capital stock of $10,000 for the purpose of doing a general electrical engineering business. The incorporators are: H. W. Bartlett, C. J. Beck and C. W. Bedell, 23 Mercer Street, New York City.

THE INTERSTATE POWER COMPANY of Lancaster, Wis., has been organized by C. E. Blake, W. J. P. Aberg and C. H. Beyer of Maidson, Wis. The company is capitalized at $1,000,000 and proposes to furnish electricity for lamps and motors in Grant, Crawford and Richland Counties in Wisconsin and in five counties in Iowa.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

PORTLAND, ME.—Owing to the settling of the drawbridge between Portland and South Portland, the Cumberland County Light & Power Company has decided to relay its submarine cables between Portland and South Portland, increasing the length 760 ft. Two new cables for 4-0, 2300-volt service will be installed.

PORTSMOUTH, N. H.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 18 for installing one 35-ton and one 15-ton electric traveling crane in machine shop extension at Portsmouth, under Specification 3502. The cost is estimated at about $35,000

BONDSVILLE, MASS.—The Boston Dock Company has acquired the water power and the real estate connected with it at Barrett's Junction from the estate of Daniel B. Wesson of Springfield The company, it is expected, will establish a power plant there in the near future. Two power plants are already operated by the Boston Duck Company.

CHATHAM, MASS.—Plans have been prepared by the Navy Department, Washington, D. C., for the installation of a new boiler plant at the local naval station, to cost about $30,000.

HINGHAM, MASS.—The United States government is contemplating the construction of a T.N.T. plant at Hingham, to cost about $150,000.

SOMERVILLE, MASS.—The American Woolen Company, 245 State Street, Boston, is contemplating the construction of a mill, 100 ft. by 270 ft., in Somerville, to cost about $200,000.

NORWICH, CONN.—The Shore Electric Railway Company of Norwich has petitioned the War Department for permission to erect a high-tension electric transmission line across Winthrop Cove and the railroad bridge.

WATERBURY, CONN.—The Connecticut Light & Power Company has petitioned the Superior Court to appoint a committee to proceed with condemnation proceedings to obtain land in Newtown in connection with the construction of a large dam on the Housatonic River in Newtown.

Middle Atlantic States

BUFFALO, N. Y.—Plans have been prepared by the Star Electrode Company, Buffalo Avenue, for the construction of a new two-story service building, about 80 ft. by 80 ft.

FLUSHING, N. Y.—The New York & Queens Electric Light & Power Company has acquired property having a frontage of 150 ft. on Lawrence Street, Flushing, near Flushing Creek.

FORT LAFAYETTE, N. Y.—Plans are under consideration by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the installation of a new lighting system, to cost about $6,000, at Fort Lafayette.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 25 for an electrically operated traveling crane for the structural shop at the local navy yard, under Specification 3438, to cost about $40,000.

PORT RICHMOND, N. Y.—Plans have been prepared by H. L. Harding, architect, 52 Vanderbilt Avenue, New York City, for a marine terminal for the Port Richmond Terminal Company at Port Richmond. The project will involve an expenditure of about $2,500,000 and will include two steel sheds, four warehouses, tracks between sheds and water front, etc.

RICHMONDVILLE, N. Y.—The Public Service Commission has authorized the Great Bear Light & Power Company of East Worcester to transfer to the village of Richmondville its entire lighting system and plant east of the Otsego County line and the rights and franchises heretofore granted to it by the town and village of Richmondville.

SCHENECTADY, N. Y.—Plans are being prepared by the General Electric Company for extensive additions and repairs to its plant in Schenectady. Among the improvements are included the installation of a new sewage pumping plant in building 212 and a new substation for power for building 95-B. The substation will be 111 ft. by 49 ft. and will cost about $30,000.

NEWARK, N. J.—The General Lead Batteries Company, 4 Lister Street, has leased the building at Central Avenue and Lock Street, about 50 ft. by 150 ft., to provide for proposed extensions.

FARRELL, PA.—The new power plant of the American Sheet & Tinplate Company, which will furnish electricity to operate both the tin plate and sheet mills, has been placed in operation. The equipment includes two 1200-kw. Westinghouse generators. Power service has been provided by the Carnegie Steel Company for a number of years. The power plant represents an expenditure of about $1,000,000.

PHILADELPHIA, PA.—Bids will soon be asked by the Ordnance Department, Washington, D. C., for the construction of a woodworking and carpenter shop at the Frankford Arsenal, to cost about $200,000.

PHILADELPHIA, PA.—Contract has been awarded by the Bell Telephone Company to the F. L. Hoover & Sons Company, 1023 Cherry Street, for extensions and alterations to its building at 26 West Chelton Avenue, Germantown.

PHILADELPHIA, PA.—Steps have been taken by the Pennsylvania Railroad Company, the Baltimore Railroad Company and the city of Philadelphia to establish a new railroad yard and freight terminal in the vicinity of Government Street and Jones Lane, near League Island. It is proposed to erect storage buildings, freight houses and other buildings, equipped with hoisting and conveying machinery for the use of both railroads as well as the Schuylkill River East Side Railroad.

PHILADELPHIA, PA.—The contract for the construction of the submarine battery storage building at the Philadelphia Navy Yard has been awarded by the Bureau of Yards and Docks, Navy Department, to the Turner Concrete Steel Company, 1713 Sansom Street, to cost about $125,000. Contract has also been awarded to the Industrial Engineering Company, 30 Church Street, New York, N. Y., for the erection of a storehouse at the local navy yard, equipped with hoisting and conveying machinery, etc., to cost about $1,263,000.

PITTSBURGH, PA.—A section of the substation of the Duquesne Light Company in the North Side district was recently damaged by fire. The company, it is understood, will rebuild immediately.

THROOP, PA.—Contract has been awarded by the Price-Pancoast Coal Company of Scranton for the construction of its electric power plant at Throop to Salvatore Palumbo, Real Estate Exchange Building, Scranton. The cost of the plant with equipment is estimated at $75,000.

BALTIMORE, MD.—The Bartlett-Hayward Company, Scott and McHenry Streets, Baltimore, is planning to erect three additional buildings and also a boiler plant at its works at Turner's Station, Md.

BALTIMORE, MD.—A. S. Goldsborough of the War Industries Board, 111 East Redwood Street, Baltimore, and the Baltimore Real Estate Board have been authorized by the United States government to look for a site of 150 acres for the establishment of a nitrate plant.

BALTIMORE, MD.—Contracts have been awarded by the Baltimore & Ohio Railroad and the Western Maryland Railroad Companies of Baltimore to the Price Construction Company, Maryland Trust Company, for the construction of new railroad shops and repair work at Connellsville, Pa., to cost with equipment about $250,000 and $100,000 respectively.

HAMPTON ROADS, VA.—Contract has been awarded by the War Department, Washington, D. C., to John Gill & Sons, Cleveland, Ohio, for the construction of an electrical feeder and distribution system at the naval training camp and hospital at Hampton Roads.

NORFOLK, VA.—Plans are under consideration by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of an emergency hospital at Norfolk, to cost about $1,500,000 (Specification 3620).

RICHMOND, VA.—Plans are being prepared by Alfred M. Quick, engineer, 706 Munsey Building, Baltimore, Md., for the construction of flour mill, hydroelectric power plant and dam, to cost about $100,000.

WASHINGTON, D. C.—Plans have been prepared by the War Department for the establishment of six large plants for repair work on the motor transport equipment for the army, to be located as follows: Camp Holabird, Baltimore, Md.; Atlanta, Ga.; Fort Sam Houston and El Paso, Tex.; Chicago, Ill., and San Francisco, Cal.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 27 for furnishing and installing lighting fixtures in the United States post office buildings at Burlington, N. C.; Columbia, S. C.; El Paso, Tex.; the United States post office and court house at Chadron, Neb., and federal building at Glenwood Springs, Col. For details see Searchlight Section

WASHINGTON, D. C.—Bids will be received at the General Engineer Depot, United States Army, 1438 U Street, Washington, D. C., until Nov. 19, under Proposal 1501, for lamp sockets, cut-outs and lighting material; Proposal 1502—knobs, tubes, insulators and lighting material. Bids will also be received until Nov. 22 as follows: Proposal 1503—900 miles of bare copper wire; Proposal 1504—2650 miles of bare copper wire. Further information may be secured on application to the above office.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Eastern and Western yards, Schedule 6795½—crane trucks and storage batteries; Schedule 6805½—167 trainers' foot switches. Boston, Mass.—Schedule 6807½—25-hp. motors; Schedule 6891½—two electric hoists. F.o.b. works, Schedule 6808½—one refrigerating apparatus. Sayville, L. I., Schedule 6816½—25,000 ft. silicon bronze wire. Portsmouth, N. H., Schedule 6333½—ammeters and voltmeters. Mare Island, Cal., Schedule 6839½—72 electric portable drills. Philadelphia, Pa., Schedule 6841½—one generating outfit. Washington, D. C., Schedule 6878½—two motor generating sets. Brooklyn, N. Y., Schedule 6879½—four turbo-generating sets. Boston, Mass., Schedule 6883½—65 tables and under-drivers, 13 one-hp. motors and 85 sewing machines. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 6821½—motor-driven hacksaws. F.o.b. works, Schedule 6900½—electrical material; Schedule 7009½—650,800 lb. chain cable. Boston, Mass., Schedule 6988½—200 transmitters; Schedule 6899½—cable terminals, insulated fiber, 415 vibrating bells and 200 buzzers and annunciators. Philadelphia, Pa., Schedule 7005½—350 storage batetries. Norfolk, Va., Schedule 7007½—brass wire. Bids will also be received until Nov. 22, as follows: F.o.b. works, Schedule 6912½—for ten generators, Norfolk, Va., Schedule 6932½—motor generators. Washington, D. C., Schedule 6935½—25 radio buzzer transmitters; Philadelphia, Pa., Schedule 6968½—telephone cable. Brooklyn, N. Y., Schedule 6974½—1000 ft. of cord and 1000 ft. of wire. Bids will be received until Nov. 18 for the following supplies: Eastern yards, Schedule 6927½—battery-charging outfits Washington, D. C., Schedule 6939½—10,000 dry-cell batteries; Schedule 6918½—motor generator set. Mare Island, Cal., Schedule 6928½—Lamp wire, magnet and wire annunciator cord. Application for proposal blanks should designate the schedule desired by number.

North Central States

CALEDONIA, OHIO—The local electric light plant has been abandoned and an electric transmission line is being erected from the plant of the Columbus, Delaware & Marion Railway Company at Marion.

CLEVELAND, OHIO.—Contract has been awarded by the Willard Storage Battery Company to the Gaylord W. Feaga Company, Citizens' Bank, Building, for the erection of a two-story warehouse, 35 ft. by 205 ft., to cost about $50,000.

GERMANTOWN, OHIO—Negotiations have practically been completed between the city authorities and the Dayton (Ohio) Power & Light Company for taking over the local municipal electric light and power plant. The company has petitioned the Public Utilities Commission for permission to issue $26,000 in capital stock to carry out the project.

LIMA, OHIO.—Plans, it is reported, are under consideration by the Garford Motor Company for extensions to its local plant, to cost about $300,000.

YOUNGSTOWN, OHIO—The Mahoning & Shenango Railway & Light Company has petitioned the Public Utilities Commission for authority to issue $485,000 in bonds, the proceeds to be used to retire a bond issue of $194,000 and the remainder for improvements to its system.

CORBIN, KY.—The plant of the Corbin Ice & Carbonating Company was recently destroyed by fire, causing a loss of about $10,000.

GALENA, ILL.—Arrangements are being made by the Interstate Light & Power Company for two extensions to the government acid plants at Cuba City and New Diggings and for extending the Mineral Point transmission line into the Platteville substation.

GREAT LAKES, ILL.—The Bureau of Yards and Docks, Navy Department, is planning to erect an addition to the outgoing detention group of buildings, to cost about $602,000 (Specification 3621).

EVANSVILLE, WIS.—The Porter Electric Line Company, recently incorporated with a capital stock of $6000, proposes to supply electricity to the farmers in the vicinity of Porter and Evansville. Joseph E. Porter, F. F. Miller and J. K. Porter are interested in the company.

HAYWARD, WIS. — The American Veneer Company, recently incorporated with a capital stock of $100,000, is planning to build a veneer and hardwood products plant, to cost about $75,000. The plant will be equipped for electrical operation.

MILWAUKEE, WIS.—Owing to the increase in demand for electrical service the Milwaukee Electric Railway & Light Company is considering the construction of a new electric power plant.

OSCEOLA, WIS.—The Osceola Milling Company has engaged the Millford Manufacturing Company, 303 South Third Street, Minneapolis, Minn., to design and construct a new power plant and mill addition, 30 ft by 87 ft., four stories high.

MINNEAPOLIS, MINN.—The Northern States Power Company has been authorized by the Capital Issues Committee to sell a large block of its first and refunding mortgage bonds, the proceeds to be used for improvements. The company operates electric light and power, gas, steam heat and other utilities in Minneapolis, St. Paul and 170 communities in Minnesota, Wisconsin, Illinois, North Dakota, South Dakota and Iowa.

WORTHINGTON, MINN.—Plans have been completed by the Charles L. Pillsbury Company, Metropolitan Building, Minneapolis, for an addition to the municipal electric light plant. W. H. Buchan is city clerk.

ALTENBURG, MO—The plant of the Altenburg Light & Power Company was recently destroyed by fire.

KANSAS CITY, MO.—Plans have been prepared by the engineering department for a machine shop at the Quindaro pumping station. W. G. Goodman is chief engineer.

MARSHFIELD, MO.—An election will soon be held to submit to the voters the proposal to issue $15,000 in bonds for the purchase of the local electric light plant.

ST. LOUIS, MO.—Plans are being prepared by the Inland Machine Company, 1500 North Broadway, St. Louis, for the construction of a two-story-and-basement building, 200 ft. by 300 ft., to cost about $150,000. O. G. Stark is president.

SLATER, MO.—At an election held Oct. 29 the proposal to issue $25,000 in bonds for extensions to the municipal electric light plant was carried. The installation of new boilers is included in the proposed improvements.

SCRANTON, N. D.—The Johnson Fuel Company is planning to install an electric light plant in Scranton. C. A. Johnson of Fairfax, S. D., is president of the company.

OMAHA, NEB.—Plans are under consideration by the Union Pacific Railroad Company for the erection of a new machine shop at Eighth and Cass Streets, to cost about $200,000.

WICHITA, KAN.—The Arkansas Valley Interurban Railway Company has acquired a site on Douglas and Waco Avenues on which it proposes to erect shops and depot.

GLEN ELDER, KAN.—The Council is considering connecting the municipal lighting system with the power plant at the Kaull Milling Company to distribute electricity for lighting the town. The municipal plan was recently destroyed by fire.

Southern States

MONROE, N. C.—Plans are under consideration by the managers of the Bearskin Cotton Mills for the installation of an electric lighting system in the mill village.

MONROE, N. C.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 25 for construction of twenty radial brick towers for naval high-power radio station here. (Specification 3600). The cost is estimated at $3,000,000.

ATLANTA, GA.—Machinery for the proposed cotton-duck plant at the United States Penitentiary at Atlanta has been purchased by the Department of Justice, Washington, D. C. The equipment includes 500 looms and 71 twisting frames. The plant will be equipped for electrical operation. The cost is estimated at $1,000,000.

DUBLIN, GA.—The Farmers' Co-operative Association, which operates a co-operative store in Dublin, would like to receive prices on lighting systems, gas engines, farm implements, etc. J. R. Cherry of Dublin is manager.

FORT McPHERSON, GA.—Contract has been awarded by the Construction Division, War Department, Washington, D. C., for the construction of a hospital building, to cost about $500,000. General R. C. Marshall, Jr., Seventh and B Streets, S. W., is in charge of construction division.

STILLMORE, GA.—A. C. Price, it is reported, would like to receive prices on a 20-kw. generator (second-hand). A larger size would be considered.

CRESCENT CITY, FLA.—Bonds to the amount of $10,000 have been authorized for the installation of an electric lighting system in Crescent City. A. E. Lounds is city clerk.

KINGSPORT, TENN.—The chloride distilling building at the government chemical plant in Kingsport was recently destroyed by fire, causing a loss of about $100,000.

BIRMINGHAM, ALA.—Condemnation proceedings have been started by the United States government for the acquisition of a strip of land in Walker County for the construction of a branch railroad, in order to establish a line of communication between the power plant of the Alabama Power Company at Gorgas and the new nitrate plant No. 2 of the government at Muscle Shoals. Approximately 186,000 hp. of electricity, it is understood, will be required to operate the plant. Work has been started on the construction of the first unit of the nitrate plant.

TUSKEGEE, ALA.—Plans are being prepared for rebuilding the shops at the Tuskegee Normal and Industrial Institute. The industrial and trade building was recently destroyed by fire, causing a loss of about $100,000.

EUREKA SPRINGS, ARK.—The property, including both ice and electric plants, of the Eureka Springs Electric Company has been purchased by the Home Electric Company, recently organized by B. H. Blockson, F. A. Butt, C. A. Fuller and others.

ALEXANDRIA, LA.—Plans are under consideration for the construction of a hydroelectric power plant, irrigation and navigation systems. It is proposed to divert the water of Red River to the Gulf. Welman Bradford, engineer, is interested in the project.

ENID, OKLA.—The Oklahoma Garage & Sales Company is considering the purchase of complete equipment for a motor-vehicle repair shop.

Pacific and Mountain States

ABERDEEN, WASH.—Several new buildings, including a tin shop, tree-nailing building and planing mill, are being erected at the Grant Smith-Porter Shipyards at Aberdeen. New equipment, including two electrically operated derricks, band saw, ripsaw, etc., will be installed.

BREMERTON, WASH.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 2 (extension of date) for improvements to power plant at the Puget Sound Navy Yard (Specification 3298).

SEATTLE, WASH—The substation of the Puget Sound Traction, Light & Power Company at Seventh and Jefferson Avenue was recently destroyed by fire, causing a loss of about $100,000. The station was equipped with ten large transformers, necessary switchboards, dynamos and converters, etc.

SPOKANE, WASH.—The Spokane Heat Light & Power Company has been authorized by Federal Judge Rudkin to issue $60,000 in receiver's certificates, the proceeds to be used for extension of its heating service in Spokane.

SPOKANE, WASH.—The United States government, it is reported, is considering the establishment of a nitrate plant near Long Lake, possibly near the site of the Washington Water Power Company. The government has asked the power company to furnish rates on power. The cost of the proposed plant is estimated at about $500,000.

TACOMA, WASH.—The contract for the construction of building 100 houses in Capital Heights has been awarded to the Todd Dry Dock & Construction Company. The necessary extensions of electric lighting and sewer service will be taken care of by the City Council.

PORTLAND, ORE.—An order has recently been placed by the Pacific Coast Steel Company of Portland for transformers having a total capacity of 1500 kw.

PORTLAND, ORE.—Plans have been completed by the Northwestern Electric Company of Portland for the erection of a large oil tank at the foot of Lincoln Street on the harbor line. The building will cost about $18,000.

CHICO, CAL.—Contracts have been awarded by George Welch, secretary and manager of the Phelan interests, for pumps, motors and culverts, amounting to about $30,000, for the proposed irrigation system to be installed on the Phelan ranch. The cost of the entire irrigation system is estimated at about $60,000.

EL CENTRO, CAL.—Plans are under consideration by the Utah Construction Company for the erection of a telephone line from El Centro to the grading camp in the mountains.

OAKDALE, CAL.—An agreement has been reached by which the old Knight's Ferry power plant will again be put into operation in order to supply power to munition and shipbuilding plants around the bay. About $5,000 has been expended to put the plant in running order.

OAKLAND, CAL.—Plans are being prepared by H. A. Broberg, architect, 845 California Street, San Francisco, for the erection of several factory buildings at Melrose for the National Lead Company, Merchants' Exchange Building, Oakland, to cost about $300,000.

SAN FRANCISCO, CAL.—The Sierra & San Francisco Power Company of San Francisco and the Coast Counties Gas & Electric Company of Santa Cruz have petitioned the State Railroad Commission for an extension of time in which they must reconstruct their overhead lines in order to comply with the law of safety in reference to telephone and other electric lines.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company has been authorized by the State Railroad Commission to issue $5,000,000 in bonds, to be sold at 85, or $5,000,000 in capital stock, to be sold at not less than $82.50, the proceeds to be used to reimburse the treasury of the company for capital expenditures made before May 31, 1918, and to finance future construction work.

PROVO, UTAH.—The Beaver River Power & Light Company of Provo has changed its name to the Telluride Power Company and increased its capital stock from $400,000 to $1,000,000.

GREAT FALLS, MONT.—The Great Northern Railway Company is considering improvements to its local yards, including the erection of new shops, to cost about $250,000. A. H. Hogeland of St. Paul, Minn., is chief engineer. Through error this item appeared under Great Falls, Ont., in the issue of Nov. 9.

GREAT FALLS, MONT.—The new substation of the Montana Power Company at Tenth Street and First Avenue is nearly completed. The building and equipment will represent an expenditure of about $200,000 and is designed to provide for power requirements of the city for many years to come

Canada

POWELL RIVER, B. C.—The Powell River Pulp & Paper Company contemplates rebuilding its mills, at a cost of about $40,000.

WINNIPEG, MAN.—The Campbell-Gray-Carey Company is planning to rebuild its factory, recently destroyed by fire. The loss is placed at $350,000.

Record of Electrical Patents

Notes on United States Patents

1,280,576. Electrode Holder for Electric Furnaces; Sergius Steinberg and Igor Gramolin, Motowilichi, Russia. App. filed July 19, 1916. Relates to furnaces of resistance type for melting steel.

1,280,582. Railway and Like Signaling; Reuben W. Tarrant, London, England. App. filed Feb. 12, 1916. Contact of wheels on both rails closes circuit.

1,280,587. Electrical Supply System at Constant-Current Strength and Varying Voltage; Rene Thury, Geneva, Switzerland. App. filed March 30, 1916. For exciting generator or motor for better regulation and greater stability.

1,280,594. Overload Switch or Cut-Out; Pieter G. van Wijk, Geldermanlsen, Netherlands. App. filed May 23, 1916. Relates to automatic overload switches having delayed or retarded action.

1,280,609. Automatic Telephone System; Bernard D. Willis, Chicago, Ill. App. filed May 2, 1914. Traffic trunk provided from which ringing current is disconnected without reversing current on calling line for sufficient interval of time to cause operation of measured service device on that line.

1,280,624. Motor-Control System; Ernst F. W. Alexanderson, Schenectady, N. Y. App. filed April 1, 1916. Relates to the operation of induction motors used for propelling railway vehicles and more especially to parallel operation of plurality of such motors.

1,280,659. Automobile Semaphore; James M. Canfield, Claremont, Cal. App. filed Oct. 30, 1916. For use on automobiles and arranged to indicate to occupants of other vehicles and to pedestrians direction in which it is intended to turn.

1,280,661. Electromagnetic Switch; Eugene R. Carichoff, Schenectady, N. Y. App. filed Nov. 7, 1914. Characterized by improved magnetic circuit rugged and compact construction.

1,280,655. Switch Front Plate; Stephen F. Briggs, Milwaukee, Wis. App. filed Sept. 13, 1915. Means for connecting front plate of switch with switch frame in such a manner that connection will be invisible.

1,280,705. Apparatus for Signaling; Fulton Gardner, Chicago, Ill. App. filed June 22, 1917. Sound-operated protective device for use with bank vaults, safes, etc.

1,280,709. Indicating Means for Electrically Heating Flatirons; Edward L. Glass, Chicago, Ill. App. filed Jan. 12, 1918. Resistance wire disposed in series with heating element will glow as long as current passes through it and get cold as soon as current is turned off.

1,280,713. Rheostat; Maurice M. Goldenstein, Milwaukee, Wis. App. filed April 4, 1914. Movable contact member rests squarely on selected contact or contacts.

1,280,714. Telephone System; Charles L. Goodrum, New York, N. Y. App. filed March 29, 1917. Utlizing magneto telephone receiver in transmission of voice currents, means are provided to amplify minute voice currents.

1,280,733. Electric Switch; Karl Hohn, Zurich, Switzerland. App. filed Jan. 23, 1917. Improved releasing mechanism for automatic overload switches, no-voltage circuit breakers, lock switches or like devices.

1,280,751. Telephone System; Kenneth S. Johnson, Jersey City, N. J. App. filed Sept. 25, 1917. Operator's telephone circuit when connected to telephone line is efficient for both talking and receiving, and when bridged across talking circuit between subscribers for monitoring purposes will not materially decrease transmission efficiency of talking circuit.

1,280,752. Telephone-Exchange System; Lewis H. Johnson, Bloomfield, N. J. App. filed March 21, 1917. To reduce number of contacts in ringing circuit of ringing system commonly known as four-party "selective" or "semi-selective code."

1,280,768. Wireless Signaling System; Irving Langmuir, Schenectady, N. Y. App. filed Dec. 29, 1913. To receive signals produced by waves of determined frequency to exclusion of signals produced by waves of different frequency.

1,280,769. System of Distribution; Irving Langmuir, Schenectady, N. Y. App. filed March 31, 1914. Direct currents having voltage at least as great as those now used in alternating-current transmission may be obtained and economically transmitted to great distances.

1,280,776. Engine Starter; Paul M. Lincoln, Pittsburgh, Pa. App. filed March 24, 1914. Employs electric motor for making initial turns of engine shaft, whereupon motion of engine shaft releases connection.

1,280,782. Automatic Release for Telephone Systems; Fritz Lubberger, Chicago, Ill. App. filed June 16, 1910. When operated by accidental grounding of line, will be automatically released.

1,280,783. Ring-Back Arrangement for Common-Battery Telephone Party Line; Fritz Lubberger, Chicago, Ill. App. filed Sept. 19, 1907. Relates to automatic party-line telephone systems in general, but more particularly to a non-interfering and intercommunicating party-line system.

1,280,806. Induction Apparatus; Walter S. Moddy, Pittsfield, Mass. App. filed March 23, 1918. More poorly ventilated parts of cores are made up of thinner laminations than better ventilated parts.

1,280,826. Canopy Fixture; Henry T. Paiste, Philadelphia, Pa. App. filed July 24, 1913. May be easily applied to ordinary form of electric wall bracket and designed to receive a contact or attachment plug.

1,280,818. Electric Welding Apparatus; John P. Nikonow, Baltimore, Md. App. filed Oct. 5, 1917. Electrodes of portable apparatus can be manipulated with one hand, closing electric current in one spot on two or more metal sheets and exerting suitable pressure in this spot to produce desired welding action.

1,280,831. Vehicle-Signal Device; David T. Pitkethly and Henry L. Baier, Brooklyn, N. Y. App. filed Dec. 27, 1915. Comprises plurality of semaphore arms to be displayed in one direction or another to indicate direction of turn.

1,280,832. Starting Automobile Vehicles; William B. Potter, Schenectady, N. Y. App. filed April 21, 1916. Relates to self-propelled vehicles wherein internal-combustion engine is employed as source of power and electrical apparatus is utilized for propulsion.

1,280,833. Controlling Mechanism for Power-Generating Systems; William B. Potter, Schenectady, N. Y. App. filed May 17, 1916. When regulator for engine is moved to reduce speed to predetermined value the transmission system is automatically rendered inoperative and battery disconnected from motor in self-propelled vehicle.

1,280,857. Electrotherapeutic Apparatus; Vern L. Ruiter, Myrtle Creek, Ore. App. filed Oct. 16, 1915. Applies intense dry heat and strong rays of light to limbs.

1,280,867. Electrical Connection; George L. Scheel, Chicago, Ill. App. filed Nov. 6, 1916. Means of electrically connecting two elements to permit relative rotary movement.

1,280,914. Circuit-Controlling Appliance for Series Incandescent-Lighting Systems; William C. H. Wefel, Denver, Col. App. filed March 21, 1917. Extinguishment of one or more lamps connected in series in an incandescent lighting system will not affect other lamps.

1,280,955. Lighting Fixture; Michael B. Bowen, Decatur, Ill. App. filed Jan. 27, 1916. Portable standard for electric lamp engages edge of table, etc.

1,280,969. Through-Ringing Amplifier; Charles S. Demarest, Brooklyn, N. Y. App. filed Oct. 16, 1917. Does not affect balance of repeaters or interfere with transmission.

1,280,982. Ventilating Storage-Battery Cells; Bruce Ford, Philadelphia, Pa. App. filed Feb. 8, 1918. Combination of horizontal cover, pair of vertical baffle plates depending from cover and passages communicating with exterior of cell.

1,280,990. System of Control; Arthur J. Hall, Wilkinsburg, Pa. App. filed June 5, 1916. Relates especially to regenerative control of electric railway motors and like.

1,281,013. Indicator and Alarm; Ira D. Humphreys, Elkville, Ill. App. filed May 23, 1917. Especially applicable to bins to be filled with fine flowing material, it indicates by audible and visual signals when bin is nearly full.

1,281,036. Electric Lighter for Oxyacetylene Torches; Arthur M. Lofstrom, Cambridge, Minn. App. filed April 17, 1918. Orifice end of torch is separated from one of electrodes connected in circuit while contact is maintained with other, so that jump spark will cause gas to ignite.

1,281,045. Safety Device for Sadirons; Richard J. Marshall, Brooklyn, N. Y. App. filed Aug. 24, 1917. Manipulating handle of iron enables iron to be heated or cooled according to will of operator.

1,281,051. Electric Water Heater; Paul Mispel, New Lenox, Mass. App. filed Feb. 9, 1918. For preventing short-circuiting of current and loss of heat from device.

1,281,084. Demagnetizing Apparatus; Thomas Shaw, Hackensack, N. J., and Clement J. Koukol, Elmhurst, N. Y. App. filed March 4, 1918. For periodically reversing direction of current in circuit and simultaneously reducing strength of said current, whereby magnetized iron cores may be demagnetized.

1,281,085. Process of Making Permanganates; Mark Shoeld, Chicago, Ill. App. filed June 14, 1917. For economical production at minimum expense.

1,281,089. Switch; Walter S. Smith, Columbus, Ohio. App. filed July 6, 1915. Requires small amount of energy in its operation and bridges gap in open circuit effectively.

1,281,095. Portable Moving-Picture Machine; Frederick C. Taylor, Philadelphia, Pa. App. filed Feb. 27, 1917. Relates to circuit breaker for automatically cutting out motor and shutting off illumination of machine for repairing broken film.

1,281,100. Controller; John F. Tritle, Schenectady, N. Y. App. filed June 25, 1918. Series-parallel system of control for plurality of series-wound motors.

1,281,106. Meter System for Telephone Exchanges; Richard I. Utter, Chicago, Ill. App. filed June 22, 1914. Call is registered whenever plug is inserted into jack at operator's position of trunk circuit.

1,281,112. Special-Service Trunk for Automatic Telephone Systems; Bernard D. Willis, Chicago, Ill. App. filed Oct. 27, 1916. Discriminating test system whereby recording toll operator may be immediately apprised of any limitation on long-distance service of calling line.

1,281,137. Automobile Signal; Marvin R. Cole, Stewartsville, N. J. App. filed Aug. 10, 1917. Push-button on steering wheel controls motor-operated signal on rear mud guard.

1,281,139. Air-Supply Heater for Carburetors; Wert D. Colvin and Charles D. Bartholomew, Beardstown, Ill. App. filed March 14, 1918. Assists in vaporizing liquid fuel and consequently increases efficiency of fuel mixture.

1,281,157. Fluid Heater; William S. Hadaway, Jr., New Rochelle, N. Y. App. filed Jan. 28, 1913. Electric heating units may be removed without dismantling heater, and heater of any desired capacity may be quickly assembled out of units of standard size and shape.

1,281,158. Electric Water Heater; William S. Hadaway, Jr., New Rochelle, N. Y. App. filed Feb. 28, 1914. Heating unit is readily removable for repairs or replacement, while ready access to circuit terminals and switch and means for indicating when heating current is flowing and when it is turned off are provided.

1,281,172. Means for Protecting Timer Wires; Arthur S. King, New Hampton, Mo. App. filed Sept. 11, 1916. Especially adapted for protecting timer and wires commonly used on Ford cars from short-circuiting.

1,281,208. Electric Switch; Carl P. Richetelle, New Haven, Conn. App. filed Jan. 13, 1917. Relates particularly to switches of remote-control type and provides safety device to protect switch circuit against fuse blow-outs due to improper use of switch.

1,281,210. Automatic Light Switch; James F. Rippin, Johnstown, Pa. App. filed Dec. 1, 1917. Light of other circuit may be completed or broken by opening door or other swinging member.

1,281,218. Resistance Element; Edward Schwartz, New York, N. Y. App. filed June 18, 1918. Adapted to be used with hair curlers, drying combs, etc.

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Hold Fast to the Good

THE war just ended has brought with it many changes in the electrical industry, some for its betterment and some not. Manufacturers know to what extent standardization of design and curtailment of styles has worked out to their advantage, and not theirs only but that of the jobbers, the contractors and the ultimate users as well. These changes have meant lower costs all around, and it would be a pity to depart from them in peace times.

Public utilities, because of the higher costs of labor and material, have learned how to economize, how to generate electricity more cheaply, and, best of all, have experienced in some degree the benefits of interconnection. If now they will employ the scheme of interconnection for all it is worth, still greater economies may be effected. There are greater possibilities in interconnection than the mere exchange of a few thousand kilowatts. Until use is made of the idle investment in various companies to the benefit of all the highest economies will not be realized. The greatest kilowatt-hour output per dollar of investment should be the goal, and this will not be reached until the generating plants of interconnected systems are pooled so as to permit of unified operation. Such an arrangement is working out well in Pennsylvania, where a superstation has been located at the mines, and has been applied to some extent in California, where the interconnected hydroelectric systems terminating in San Francisco are under the direction of a single system operator. Economies which have been forced on small stations by necessity should not be forgotten with the coming of peace. If the industry is to go forward and fulfill its destiny, every branch must strive for greater and greater economies. The war has brought about many of these, and we should hold fast to all of them.

Labor and capital both need guidance in the days immediately before us. Violence, discord and confusion are bound to arise if reconstruction problems are not settled aright. Social readjustments involve human nature and human motives, and these cannot be ignored.

Concrete Brick

PEOPLE who are building switchboards of the design now common find themselves facing problems that pertain quite as much to architecture as to electrical construction. A brief article by E. B. Meyer in this issue points out the usefulness of concrete brick for much of the construction of the fireproof compartments necessary for switch and other apparatus. These have been built of smooth brick or monolithic concrete. This brick is not just now altogether easy to get, and the present cost of lumber puts the somewhat intricate forms necessary for molding into the class of luxuries. The material found most desirable in Mr. Meyer's practice has been concrete brick of standard brick size, made in a very simple machine out of one part of cement mixed with one and one-half parts of sand and two parts of gravel. Three men can turn, mix and turn out about 2000 bricks a day, which are cured in about twelve hours in a steam bath. It is found by experience that a given structure can be built more quickly and cheaply at present from such concrete brick than from the molded concrete, making a strong and fireproof structure at a cost materially below that of ordinary brickwork. Of course, concrete brick has been largely used for general purposes, but few people seem to have appreciated the ease with which such bricks of standard size can be made and laid into almost any kind of construction.

Fifty-five million tons of coal can be saved annually in Great Britain by thorough and extended use of electricity in that country, not to mention increased production and earnings. We use more coal than England, and a saving of 100,000,000 *tons of coal is not beyond possibility in this country. Electricity can do it.*

A Study of Boiler Settings

IN THESE days, when the efficiency of prime movers and generators has been pushed well toward the topmost limit, it is to the boiler and furnace that one must look for improved economy of power production. Cold air coming in through loose boiler settings and heat wasted from this same setting by radiation are not inconsiderable factors in the final result. Many methods of keeping the setting tight and lessening heat transference from it have been tried out, and E. S. Hight's discussion of this matter is a material addition to the sum total of useful experience. The whole matter came seriously before the engineering staff of the Illinois Traction System, operating twenty-two power plants. After considering various methods of incasing the boiler settings, the one finally settled upon was of exceedingly simple character.

Wire loops were set in the brickwork so as to project about one inch and a quarter. This done, the surface gets a heavy coating of rather thick coal tar mixed with the asbestos wool. When two or three coats of this are dried a layer of asbestos cement something less than an inch thick is laid on, and over it a layer of chicken wire is drawn tight and fastened to the wire loops. Then another layer of asbestos cement goes on, and the whole coating is finished off with a jacket of duck coated with asphalt varnish. The top of the boiler is covered with cement concrete rather than with the coating just described on account of its greater resisting power when often walked over, as is the fate of boiler coatings. This comparatively simple process of protecting a boiler setting against leakage and loss of heat is fairly cheap, easy to accomplish and quite effective in checking losses. Experience indicates that the saving of coal insured by the process is enough very frequently to pay for the expense perhaps even in a few months. The boiler is commonly the weak point of the generating system, and when it can be helped out so easily neglect would seem to be most unwise.

The splendid economies and service electricity is capable of yielding have at last been brought home to most manufacturers. Its great power for production made its use imperative in war industries, and, knowing its possibilities, industry will no longer part with it

Permanent Outdoor Substations

THE outdoor substation has now taken its place as part of the regular machinery of power transmission. It had its origin mainly in the extreme difficulty and expense of getting the high-tension leads into and out of an ordinary substation, resulting in an absurdly large and expensive structure for a relatively small output. The outdoor equipment very naturally took the simplest possible form, being derived directly from the ordinary pole distribution of transformers. It consisted generally of four ordinary standard poles framed together, with the transformers between them carried on a platform, while the accessory apparatus was variously mounted on the structure above. The danger of fire soon became an obvious one, not only fire originating in the apparatus, but flames coming from the outside—for example, from grass fires.

In last week's issue S. B. Hood gave some interesting details of a very convenient form of fireproof outdoor substation built to last. The ordinary wood poles are replaced by steel ones set in concrete. The wooden platform for the transformers is replaced by a concrete blanketing over the space between the poles, and the whole is protected by a wire fence with top guards to prevent intrusion. The whole thing is extremely simple and durable, and its cost, although somewhat above that of a wooden structure, is still very low compared with the output. It has the advantages of permanence which one generally ascribes to an old-fashioned closed-in substation, but it combines the advantage of the outdoor type of substation with a cost which makes it a thoroughly practicable structure, even for relatively small output. The fact that substations of this general character are finding their way into very general use in all the kinds of climates which these United States can furnish is evidence of their permanent usefulness.

Cancellation of Government Contracts

CANCELLATION of government contracts is inevitable. Let it be done wisely. Every one knew that the time would certainly be reached some day when the orders for military and naval supplies would cease, when different orders would be required if plants were to be kept in operation. Only a prophet, however, could have foretold long in advance what exact dates on the calendar would mark the sharp stoppage of the tide. And manufacturers, no matter how successfully they look ahead in days of peace, cannot base their war-time business on elements of prophecy; in that business they did what the military establishments of the nation asked them to do. In the normal course of operations when they face only the regular manufacturing problems, they can feel into the future to determine their policies as to buying stocks of raw materials, expanding plant, increasing or reducing the working forces; but when they are mobilized into the military resources of the country they cease to function as independent units, they become a willing part of the vast effective war machine. This, in brief, is what the branches of the electrical industry which are concerned with the manufacturing and distribution of apparatus and supplies have, to a large extent, experienced from the sweeping changes wrought in the industrial structure by the heavy war requirements.

Acceleration of the government war machine has stopped; the movement becomes slower and slower. Demobilization has started. The "mopping up" is rapid. Every brain, every hand is being turned toward production for the new peace era. We do not need munitions, we do need other products. Stop the war work; start the pursuits of peace. That is the simple way, and if it could be arranged as easily as it is expressed problems would disappear like the dew before the sun. But there is a rigid business problem which is inescapable. How are these contracts, which were made in the vital interest of the nation during the grave world crisis, to be liquidated? Two extreme courses are in general open to the government authorities: They may cancel with the heavy power of authority, letting the axe fall where it will, or they may let the contracts be carried out and the unneeded products be made. The first of these courses has in its favor the argument that the authorities would lessen the burdensome war debt; it has against it the very practical and objectionable feature that it means that the operation of factories may be stopped and labor thrown out of needed employment. The second course would assure a longer period for the manufacturer to continue operations, keep labor employed and plan for the future; but it would do all of this at the cost of further addition to the stupendous expense of the war. There are great questions of public policy in these issues; there are questions of purely political expediency which should be small. We can face the issue as one touching closely the whole of the nation, as a public welfare issue of intense and far-reaching importance, or we can see it handled, perhaps only because of the lack of proper consideration, as if it were a matter of petty politics.

We think that the attitude for the authorities to adopt is clearly not either one of the extreme courses, but a fair, generous middle path. All elements in the nation are in the boat together. We pooled our resources for a righteous victory and we got it. We expected to pay a price, a big one if necessary, and the price will be paid. But in paying it every one concerned will do well to remember that we are still in the boat together and that rocking the craft is always a dangerous pastime and sure to be unpopular. It is in the deepest interest of the nation that the orderly processes of government and industry shall be sturdily maintained at this critical juncture. Having taken the manufacturing establishments and their working forces for war purposes, it would not be just for the authorities to put them cold-bloodedly in a position where they will have large pay-roll expense and will lack materials for normal products, and will also be without markets. They cannot regain in an instant the markets from which they have been separated by priority regulations. Some will need more time than others. This can be given best by a mutual arrangement which shall recognize frankly that we are still meeting expenses due to the war. It is better that the nation shall shoulder expense than that the manufacturer and his labor shall suffer as a result of abrupt cancellation of war contracts. An individual manufacturer can tell the government how much and what of the raw materials he can use for other than war products and how soon he can be in touch with normal markets. Until that is done and a workable plan is developed and put in practice the government should be willing to defer cancellation, if the manufacturer finds that course essential for the protection of his plant and labor against disaster.

The electrical industry faces the brightest period in all its history. War has given it a growth many times normal and advertised it as it was never advertised before. We need not therefore sit around with our hats on like Quakers waiting for inspiration. If we seize the opportunity, a golden future is assured.

Operating Records

THE subject of operating records is one which has been threshed over by central-station men to an almost unlimited extent. In some plants these records are kept with minuteness of detail which probably costs more than it saves; in others with a reckless disregard of detail which renders them almost valueless. Charles C. Raitt's article on this subject in this week's issue gives a somewhat comprehensive account of necessary records and the bearing which they have on operation. If we were to summarize his conclusions, with which we heartilly agree, it would be in a single sentence: Keep your records, simple or elaborate, always rigorously up to date and in such form that they can be immediately inspected and discussed. It is quite an easy thing to overdo system so that the working force becomes the slave to notebooks, but a little forethought will make it possible to get together promptly and keep together effectively all the information that is really needed, extending from the simplest sort of thing to the most thoroughgoing and complete records of performance.

The Use of Synchronous Motors

IN VIEW of the increasing trouble experienced with low power factor as motor load increases the synchronous motor is steadily assuming greater importance. Will Brown in his article in the current issue follows up his consideration of power factor by pointing out some of the characteristics of the synchronous motor in practical use. Its value in dealing with power factor has been appreciated from the very beginnings of modern electrical transmission. In fact, some of the very first three-phase machines installed were of the synchronous type, fitted with auxiliary starting windings in the pole pieces. The great convenience of the induction motors, however, put the synchronous machine into the background for a long time, until the insistence of the power-factor question brought it out of its retirement. It is easy enough to make a synchronous motor which will start light without difficulty; it is not easy to produce one which will start with a fair amount of load and pull into synchronism without demanding excessive current. The synchronous machine comes up to the slip speed which it possesses as an induction motor fairly easily, but this speed, as in other induction motors, falls off with the load, and pulling into synchronism becomes progressively more difficult as load increases. If the starting torque is increased by increasing the resistance of the auxiliary winding, there is more slip and consequently greater speed difference in pulling in. This difficulty may be in part remedied by rheostatic control of the auxiliary windings, which, however, is a device seldom used.

One thing on which Mr. Brown lays emphasis, and which is important to remember in this connection, is that in designing a self-starting synchronous motor the ordinary alternator with narrow pole span is a bad beginning. In other words, a synchronous motor to start well under load requires a compromise design which shall both give it better starting power as an induction motor and incidentally greater opportunity to obtain some advantage from flywheel effect. In point of fact there is no difficulty in accomplishing all this, but, on the other hand, no considerable starting torque is generally necessary, since either by mechanical or magnetic clutch load can be picked up without difficulty. And since the synchronous motors are usually of considerable size, they are most often applied to the driven load through shafting and can consequently be clutched in without any particular inconvenience. At all events, the process is one which does not have to be gone through with frequently, which is perfectly familiar in mechanical drives and which involves no special complication. With a magnetic clutch flywheel effect can easily and advantageously be applied. The fact that a synchronous motor requires an exciter is not really a material disadvantage, especially in machines of large output. Taking the whole situation together, there seems to be no reason why the synchronous motor should not be used much more extensively than it is at present, thereby greatly relieving the now serious power-factor situation. Motor load is becoming steadily a greater and greater factor in electrical supply, and with it steps must be taken to see to it that injudicious application of motors and occasionally motors of bad characteristics are not allowed to interfere with the practical efficiency of the distribution.

INTERCONNECTION HAS CONSERVED THE POWER PRODUCTION OF EACH UNIT IN THE SOUTHERN CALIFORNIA GROUP

Connected Load in War and Peace

Government Analysis of Business of the Southern California Edison Company Shows that the Industries Supplied in War Time Will Continue to Require Power for Production

BY S. M. KENNEDY
Secretary and General Agent Southern California Edison Company

A REPRESENTATIVE of the War Industries Board, Major George F. Sever, has been making investigations regarding power conditions on the Pacific Coast for some months past, with the object of learning if there are any industries necessary to the carrying on of the war which might be suffering from lack of electric power. The inquiries made also embraced the building plans of the different power companies and their financial ability to carry out programs which may be necessary to enable them to supply power in sufficient quantities to meet the expected demands during the war period. In connection with this investigation it is of unusual interest to note how the load of the Southern California Edison Company measured up after a most critical analysis had been made by the government's expert.

The Southern California Edison Company operates in the city of Los Angeles, and from that center the company's lines extend for a distance of approximately 100 miles (160 km.) to the north, east and south and 25 miles (40 km.) to the west, the limitation in the westerly direction being the Pacific Ocean. In addition, there are two subsidiary companies—namely, the Mount Whitney Power & Electric Company and the Santa Barbara Gas & Electric Company—which distribute energy in territories immediately north of the Edison company's sphere of operation. Altogether there are approximately 100 cities and towns furnished with service, and in addition the requirements of an extensive intervening agricultural territory are supplied—these requirements consisting largely of power for pumping water to irrigate citrus and deciduous fruits, walnuts, vegetables, alfalfa, beans and sugar beets. The lines of the Mount Whitney Power & Electric Company and the Santa Barbara Gas & Electric Company are connected with the Edison company's system, and the figures given below concerning the details of load include the loads of the two subsidiary companies.

In connection with a well-developed plan for the conservation of all hydroelectric energy available for use in southern California, interconnections have been made for the supply and interchange of power between all the companies operating in the territory from Fresno, in the north, to San Diego, in the south, an extreme distance of about 350 miles (560 km.). The companies tied in with the Southern California Edison Company are the San Joaquin Light & Power Corporation, the Southern Sierras Power Company, the Los Angeles Gas & Electric Corporation, the Los Angeles Aqueduct & Municipal System, the Ontario Power Company, the

Ojai Power Company and the San Diego Gas & Electric Company.

The Edison company has a total maximum generating capacity of 222,000 kw., of which a little more than one-half is in hydroelectric plants. The peak load for 1918 was 180,000 kw. The total connected power load as of August, 1918, was 353,595 hp.

The analysis of the connected load first required a segregation as to plants of 50 hp. and under and plants of more than 50 hp. The total connected load in plants with a capacity of 50 hp. and under was 117,262 hp., or 33 per cent of the system's total connected power load, and the total in plants over 50 hp. was 236,333 hp., or 67 per cent of the total connected power load.

THE FOUR CLASSIFICATIONS OF LOAD

The next classification pertained to the kind of load, or the use for which the energy was required. There were four segregations, namely, (1) war industries, these being direct contracts with some department of the government; (2) war essentials, or plants engaged in producing materials necessary for the conduct of the war; (3) public necessities, or energy required for purposes essential in the life of the country's communities, and (4) non-war industries.

In the first classification—war industries—the company showed a connected load of 4573 hp., or 1.3 per cent of total connected power load. This was divided among three industries, namely, shipbuilding, shoe manufacturers and sugar plants. The relative distance from the center of population of the United States and the scarcity of certain kinds of raw materials have tended to limit in southern California the number of enterprises having direct contracts for government requirements.

In the second classification—war essentials—the company showed a connected load of 171,393 hp., or 48.6 per cent of total connected power load. This segregation embraced the following industries—bakeries, canneries, chemical works, cottonseed plants, fertilizer plants, foundries and forges, ice and refrigeration plants, irrigation plants, machine shops, meat-packing houses, flour mills, oil wells, fruit-packing houses, paper factories and railway power. An important feature of the load under this classification is that 107,169 hp. is connected for irrigation purposes, almost entirely operating in connection with the production of food and foodstuffs.

The third classification—public necessities—showed 144,476 hp., or 40.8 per cent of total connected power load. Included in this segregation were amusements, battery charging, building supplies, cement plants, creameries, domestic uses, elevators, garages, ice-making and ice-cream plants, laundries, mining, motion-picture producers, newspapers and printing, packing houses, paper mills, public service, power sold for resale, quarries, railway power, schools, churches and libraries, tire factories, woodworking industries and a large number of miscellaneous plants. Some of the uses in this classification are also included in the fourth classification, a portion of the load being considered necessary, and the balance could be temporarily eliminated if conditions should require a reduction in amount of service.

The fourth classification — non-war industries — showed 33,153 hp., or 9.3 per cent of total connected power load. Included in non-war industries were breweries, brickyards, cement plants, elevators, garages, glass factories, laundries, mines, newspapers and printing, quarries and woodworking industries.

The examination demonstrated that 90.7 per cent of the connected power load of the Southern California Edison Company is required for war industries, war essentials and public necessities, and adding to this the normal lighting load, which is properly considered a public necessity, the total connected load amounted to almost exactly 95 per cent for these purposes. It is apparent, therefore, that of the total connected load for all uses on the company's entire system only a fractional percentage could be classed among non-war industries.

In connection with the foregoing analysis there are two features worthy of note: First, the representative of the War Industries Board did not deem it necessary to issue any instructions or make any suggestions to the officials of the Southern California Edison Company regarding the channels into which its electric energy should be distributed, it being evident that all available power was being put to the best use and that no essential industry was in danger of an insufficient supply. Second, the investigation plainly indicated that without regard to the question of when the war should end, all the industries now being supplied with power by the company would continue to require power, as none of them depended upon the war for its origin or upon the duration of the war to insure its continued existence.

THE experience of the past among nations has taught us that the attempt by one nation to punish another by exclusive and discriminatory trade agreements has been a prolific breeder of that kind of antagonism which oftentimes results in war, and that if a permanent peace is to be established among nations every obstacle that has stood in the way of international friendship should be cast aside. It was with that fundamental purpose in mind that I announced this principle in my address of January 8. To pervert this great principle for partisan purposes and to inject the bogie of free trade, which is not involved at all, is to attempt to divert the mind of the nation from the broad and humane principle of a durable peace by introducing an internal question of quite another kind. American business has in the past been unaffected by a policy of the kind suggested, and it has nothing to fear now from a policy of simple international justice. It is indeed lamentable that the momentous issues of this solemn hour should be seized upon in an effort to bend them to partisan service. To the initiated and discerning the motive is transparent and the attempt fails.—*Woodrow Wilson.*

Boiler-Setting Radiation and Air Leakage

Results of Experiments to Determine Best Method of Covering Boiler Settings to Bring About a Reduction in Radiation and Escape of Air—Type of Covering Which Saves $1,000 per 500-Hp. Battery per Year

BY E. S. HIGHT
Chief Operating Engineer Illinois Traction System

FOR the purpose of determining the most economical methods of preventing infiltration of air and preventing radiation from the side walls of boilers, an extended investigation has been conducted by the Illinois Traction System. Three general methods were considered—incasing the boiler setting entirely in sheet iron, covering the top of the boiler setting and of the side walls with a thick coating of tar, pitch, asphalt or other materials in which were stirred quantities of magnesia or raw asbestos, and covering the boiler settings with heavier coatings such as are applied to steam piping and other highly heated metal surfaces. It is the purpose herein to describe briefly the methods which were found to be most satisfactory considering first cost, maintenance expense and benefits attributable to making the installation. Because of the fact that the method of covering these settings has been applied primarily to Stirling boilers, of which the Illinois Traction System has by far a greater number than of any other kind, this discussion has been confined entirely to Stirling equipment.

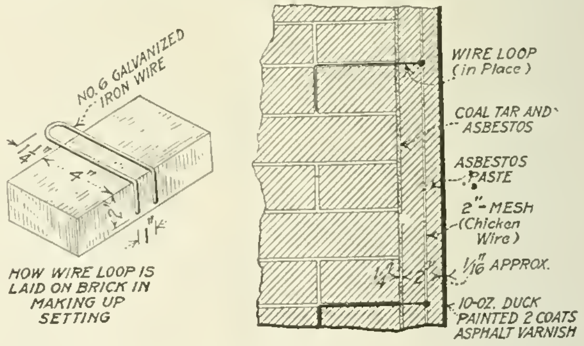
How the Boiler Walls Are Covered

One of the methods of covering the walls is shown somewhat in detail in the accompanying drawing. It will be noted that wire loops made of No. 6 galvanized wire are installed in the brickwork. These loops are made up in such a manner that about 1.25 in. (30 mm.) of the loop projects outside of the finished brick surface of the boiler setting, while the remainder of the loop passes into and down behind the course of red brick which constitutes the outer wall of the setting. These loops are now placed on all new boiler settings which are built in the plants of the Illinois Traction System.

After a boiler setting has been completely finished a coating of coal tar is applied which has been boiled to a consistency somewhat thinner than pitch and into which has been stirred asbestos wool. A heavy brush similar to a whitewash brush is usually employed to apply the mixture. As much of the material is placed on these bricks as it is possible to make stick, and this usually amounts to two or three coats. After this has dried a mixture of asbestos paste or asbestos cement is applied to a thickness of approximately 1.25 in. (30 mm.), which brings the level of the coating to about the end of the loops which are sticking out of the side of the setting. Before this application has dried a layer of chicken wire of 2-in. (5-cm.) mesh or less is stretched tightly over the entire boiler setting and fastened by small wires to the loops that protrude. Over this is placed another layer of asbestos paste or cement so that the final total thickness of the asbestos covering is approximately 2 in. (5 cm.). This is permitted to dry thoroughly and covered with 10-oz. (290-gm.) duck, which is pasted down tightly and fastened at the edges by means of wires or with metal straps along the steel beams and columns of the boiler setting. The duck is then painted thoroughly with two coats of asphalt varnish or a very heavy asphalt paint of good grade.

After a covering of porous brick of the nonpareil type with a covering of red brick has been placed over the drum and tubes, the top of the boiler setting is usually covered with a coating of 2 in. to 2.5 in. (5 cm. to 6¼ cm.) of concrete in which the constituents are present in a ratio of approximately 1:2:4. The side covering is not used on top of the boiler because of the continual necessity of walking over the top of the setting, which would in a short time destroy the adhesiveness of the asbestos paste and make a powdery sort of material on the top that would not impede the transference of heat in the manner that solid asbestos would be sure to do.

This type of covering, of course, is readily applicable to any type of brick boiler setting. While it is difficult for the first time to properly insert the loop in a boiler setting which is already in place, it is possible to drive loops between the bricks so that they will hold such a covering very satisfactorily. They need not be used in any larger number than is indicated on the accompanying drawing, but there should be approximately that number to insure the covering holding tightly to the side of the brickwork.


NO. 6 GALVANIZED IRON WIRE
1¼"
4"
2"
1"
HOW WIRE LOOP IS LAID ON BRICK IN MAKING UP SETTING
WIRE LOOP (in Place)
COAL TAR AND ASBESTOS
ASBESTOS PASTE
2"-MESH (Chicken Wire)
1/16" APPROX.
¼"
2"
10-OZ. DUCK PAINTED 2 COATS ASPHALT VARNISH

METHOD OF ATTACHING INSULATING COVERING TO BOILER SETTING

Although it is expensive to install such a covering on a boiler setting already in place, it has been found by the engineering department of the Illinois Traction System that it is well worth the expenditure. The saving effected by having an airtight setting and one which reduces the radiation very materially is sufficient in the course of even six months, provided that the boilers are run at full load and at a reasonable load factor, more than to repay the first cost of the installation of the covering. Of course, when the boiler setting can be built new from the floor, the loops can be inserted at practically no additional expense, except a slight one for the time of making them, and in this case the only cost of installing the covering is that of the materials and the labor of fastening it on the outside of the setting.

This type of covering was installed on a battery of 370-hp. Stirling boilers of which the setting was already in place, for approximately $150 complete. This same covering at the present time, owing to higher prices, costs approximately $200 to $250 when installed. The total cost for labor and material for applying this covering to the outside of a battery of two 500-hp. boilers which were constructed new during this last spring was $400. It is estimated from the increase in operating economy at the first plant after this type of covering had been applied to the boiler that the saving to the company per battery in a course of a year was ever $500. In the second case, while the operation has not been carried on long enough to determine with any degree of accuracy what the final saving will be, it is conservatively estimated that it will be not less than $1,000 per battery per year. This is based on full-load operation approximately 50 per cent of the time, which is the general condition obtained at the first plant in question.

The general conclusion has been reached from the various tests conducted that of all of the types of coverings considered, from steel casing to ordinary commercial products, the one described herein is the most economical from the standpoint of first cost and the saving which the company may obtain from its installation. This method of covering has the additional advantage that it will produce a relatively equal amount of saving on either hand-fired or stoker-fired boilers and on very small or very large boilers, although its percentage of the coal saved on the smaller boiler settings is liable to be greater than on the larger ones.

ADMITTING AIR THROUGH THE FUEL BED

After this method is adopted to stop all possible leakage of air into the furnace, it is a good policy to consider the admission of the proper amount of air under and through the fuel bed. The economy of combustion and the efficiency of the boiler equipment can be very markedly increased and have been increased by this means in plants of the Illinois Traction System from 3 per cent to as high as 10 per cent.

During the last seven years the operating engineering department of the Illinois Traction System, which is at Peoria, has exercised direct supervision over the operation of the twenty-two power plants of the Illinois Traction System in Illinois, Iowa, Missouri and Kansas, in so far as the economy of operation and the means of converting the energy in the coal into electrical energy have been concerned. The results of applying the method described herein and other methods of increasing the economy have resulted in the saving in five years of over $250,000 in coal expense. It is firmly believed that the application of the type of covering outlined above, together with other careful and close supervision of the covering of high-temperature piping and the careful supervision of the admission of air to the fuel bed will still further increase this saving during the coming year. The first five months of operation this year point conclusively that way.

REINFORCED CONCRETE SAVES STEEL IN POWER PLANT

Example of the Extent to Which Steel Can Be Replaced if Unavailable—Expediency and Not Economy the Important Factor

IF THE steel shortage should become more acute, power plant designers would probably themselves be surprised to find how far they could go in the matter of substitution of other materials for steel. Fortunately, engineers have not yet been put seriously to the test. Here and there are isolated instances where partial attempts have been made to reduce the amount of steel used, but few sweeping examples of substitution are found in this country to-day. For this reason it seems important to publish a general account of a power station design wherein an extraordinary effort was made to use materials other than steel. While the idea of steel saving, essentially as a conservation measure, may not have been the guiding motive of the engineers, the resultant design is none the less interesting and important as a pioneer example.

The station in question is the 15,000-kw. plant of the Universal Portland Cement Company, Buffington, Ind. In the design an attempt was made to utilize reinforced concrete as far as possible. The station is constructed entirely of reinforced concrete with concrete-block curtain walls and hollow concrete roof-tile covering. It is separated into two parts by a concrete-block division wall. The foundations are of the mass concrete type built on a sand-bearing surface, concrete piles being used wherever necessary to take care of the heavy loading coming on them. No unusual features were encountered in their design. The framework of the building is of the self-contained skeleton type, such as is being used in recent warehouse building construction, and carries the concrete-block curtain walls.

The stresses allowed in the design of this building were as follows: Steel in tension, 18,000 lb. per square inch (1250 kg. per sq.cm.); concrete in compression: 700 lb. per square inch (50 kg. per sq.cm.); concrete in direct compression, 550 lb. per square inch (39 kg. per sq.cm.); concrete in shear, 40 lb. per square inch (3 kg. per sq.cm.). The main generating or turbine floor was designed to carry a superimposed load of 500 lb. per square foot (2440 kg. per sq.m.). While this is slightly under the load caused by the heaviest machine part likely to be placed on it, it was deemed sufficient. The floor varies in thickness from 6 in. to 11½ in. (15 cm. to 30 cm.) and is reinforced with ½-in. (1.2-cm.) diameter rods.

The design of the columns presented no unusual features. They are square and rectangular in shape. Those in the center of the transforming section, supporting the second floor, measure 24 in. by 24 in. (61 cm. by 61 cm.), and those supporting the third floor measure 21 in. by 21 in. (56 cm. by 56 cm.). Those supporting the roof girders measure 18 in. by 18 in. (45 cm. by 45 cm.). The remainder of the columns in the building are rectangular in shape and measure 27 in. by 33 in. (68 cm. by 84 cm.). All columns are reinforced with round rods of different sizes and numbers according to the strength required to take care of the loads they carry. The columns that carry the crane runway girders are reduced in section above the girders to 15 in. by 33 in. (38 cm. by 84 cm.), and these in turn carry the roof girders. Especial care was taken to see that any tendency to bending in these narrow columns due to wind racking was properly provided for.

The crane runway girders were designed to carry a 30-ton traveling crane and are 18 ft. (5.4 m.) span, 41 in. (104 cm.) deep and 18 in. (45 cm.) wide, reinforced with four $1\frac{5}{8}$-in. (4-cm.) diameter rods in the top and bottom and the necessary rods in the web to take care of the shear. The roof joists were designed to carry a total roof load of 60 lb. per square foot (293 kg. per sq.cm.) on an 18-ft. (5.4-m.) span. They are 18 in. (45 cm.) deep by 7 in. (18 cm.) wide and are reinforced with one $1\frac{1}{2}$-in. (3.8-cm.) diameter rod in the bottom and two $\frac{7}{8}$-in. (2.2-cm.) diameter rods in the top. These roof joists were premolded on the ground and hoisted into place when the forms for the roof girders were constructed, the reinforcing rods being arranged in such a manner as to secure a firm joint with the main girders when they were cast. This method of roof construction has been followed for some years by this company with good results as it eliminates the necessity of building forms and supports up in the air for these joists.

The design of the main roof girders which support the roof joists involved some unusual features on account of the length of the span, which is 63 ft. (19 m.). The girder is 18 in. (45.7 cm.) wide and 71 in. (180 cm.) deep at the center. The top surface slopes with the roof $\frac{1}{2}$ in. in 12 in. (approximately 4 cm. in 100 cm.), the bottom surface being horizontal for a distance of 41 ft. (12 m.). From this point it tapers down to a depth of 66 in. (168 cm.) at the connection of the girder to the columns. The girder is reinforced with eight $1\frac{5}{8}$-in. (4-cm.) diameter rods in the bottom and eight $1\frac{1}{2}$-in. (3.9-cm.) diameter rods in the top. The shear rods in the web are $\frac{3}{8}$-in. (0.94-cm.) diameter rods in the form of vertical stirrups. The majority of the girders in this building were designed with compression reinforcement with the idea of keeping the depth and width of the girders down to the minimum and to keep the appearance consistent with the entire design.

The roof is composed of hollow reinforced-concrete slabs, shipped to the job and laid on the roof joints. On top of the slabs was laid a composition tar and asbestos cement roof covering to make the job water proof.

All the concrete in the building above the foundations was mixed in the proportions of one cement, two sand and four pebbles passing a 1-in. (2.5-cm.) ring, with the exception of the concrete in the columns carrying the crane and large roof girders, which was mixed one cement, one and one-half sand and three pebbles. This difference was made to take advantage of the extra strength of the richer mixture.

The floors in the transformer section of the building were designed for a floor load of 150 lb. per sq.ft. (732 kg. per sq.cm.), are of the usual girder and slab construction and present no unusual features. All the switch cells, busbar structures and supports were made entirely of concrete either cast or plastered on expanded metal; which gives an entirely fireproof structure throughout.

PRORATING LINE LOSS

How a Company May Be Equitably Charged for Line Loss When It Is Connected to a Line Already Serving Another

A problem sometimes arises in which it is necessary to prorate line losses between two companies. For instance assume that company A is purchasing power over a transmission line with a loss of 5 per cent. It is desired to purchase over the same line an additional block of power to be delivered by company A to company B, the line loss being increased to 10 per cent. It will be obviously incorrect to bill company B at the purchase price increased by 10 per cent for line loss and an allowance for profit, since the additional load delivered to B has also increased the loss on the load delivered to A, which increase is also a proper charge against B. Thus, if the line delivers to A 1000 kw. with 5 per cent loss (in terms of energy received), or 50 kw., and an additional 1000 kw. is purchased for B's account, the loss will be increased to 10 per cent of 2000 kw., or 200 kw. The loss properly chargeable to B is therefore 200 kw. less the original 50 kw. loss sustained by reason of A's load, which equals 150 kw., or 15 per cent of B's load.

The proper loss in per cent chargeable against an additional block of power may in any case be found by multiplying the per cent loss in the original block by a quantity equal to 2 plus the ratio of the added block to the original block.

This may be proved as follows:

Let L = loss in kilowatts;

W = delivered power in kilowatts.

Required to find X, the per cent of line loss chargeable against an additional block of power expressed as a percentage of that block.

We have:

Per cent loss $= 100\ L/W$.

The loss chargeable against the primary block $= L_a$.

The loss chargeable against the second block $= L_{a+b} - L_a$,

And the required per cent is:

$X = 100\ (L_{a+b} - L_a)/\ W_b$;

$X = 100\ L_a\ [(L_{a+b} - L_a)/L_a] \div W_b$.

But in any circuits the I^2R loss is proportional to the square of the power delivered; therefore $L_{a+b}/L_a = W^2_{a+b}/W^2_a$.

Substituting:

$X = 100\ L_a\ [(W^2_{a+b} - W^2_a)/W^2_a] \div W_b$

$X = 100\ L_a\ (W_{a+b} + W_a)\ (W_{a+b} - W_a) \div W^2_a W_b$

$X = 100\ L_a\ (2W_a + W_b)\ W_b \div W^2_a W_b$

$X = 100\ L_a\ (2 + W_b/W_a)/W_a$

which is the per cent loss of the original block multiplied by 2 plus the ratio of the second block to the first.

It will be noted that as W_b approaches zero the multiplier approaches 2; therefore the per cent line loss in the increment is never less than twice the per cent line loss in the original block. When the two blocks are equal, the per cent loss chargeable against the additional block is three times the per cent loss in the original block.

Concrete Brick for High-Tension Cells

Compartments Made with This Material Have the Advantage that They May Be Put in Service Immediately—They Are Also Quicker and Less Expensive to Construct than Those Built of Other Materials

BY E. B. MEYER
Assistant to Chief Engineer, Public Service Electric Company of New Jersey.

MANY expedients have been developed and many lessons in economy have been learned during the trying times now passing that may be put to use with equal benefit in the period ahead. It would be a serious mistake indeed to forget them, and a valuable service to the industry will be overlooked if every engineer does not make it his duty to give others the benefit of his experiences. It is to relate one such economy and expedient that this article has been written.

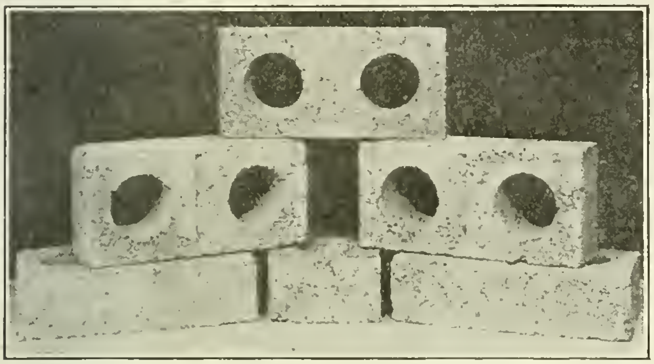


FIG. 1—CONCRETE BRICKS USED FOR HIGH-TENSION CELLS

To supply the needs of industries working on war contracts it has been necessary in many cases to furnish the industries with high-tension service and provide and install the switching equipment at the customer's substation. Usually the demands for service were so urgent that the company had to use all the resources at its command in order to meet the customer's requirements. Where the central station had to finance the work the cost had to be kept low, first, because of the high money rates, and, second, because many of the installations were more or less temporary in character and might have to be written off in a few years. Where it was necessary to provide high-tension equipment on the customer's premises, switch cells and bus compartments had to be erected. Proper attention to the matter of proper design and construction of these compartments resulted in a considerable money saving, particularly in large installations.

One large electric company which has had to furnish high-tension service to many customers during the last two years has, after considerable experimental work, adopted concrete brick for the building of switch cells and bus compartments both in stations and substations. Usually these structures have been built with smooth or faced brick, while in other cases monolithic construction has been employed. The serious objection to the use of brick under war conditions as well as at the present time is that it cannot always be obtained within a reasonable time, and where the work consists of an extension to an existing structure it frequently happens that the new brick does not match the old.

While monolithic concrete construction is a very reliable substitute, the fact that expensive wooden forms have to be employed makes this type of construction undesirable. From an operating point of view, monolithic construction has a further disadvantage in that the concrete has to be poured wet and the dripping of water from the new compartment into other compartments is both inconvenient and dangerous. In many installations, particularly in those where service must be supplied in the shortest possible time, it is necessary to put each compartment into service as soon as it is completed. With the use of monolithic construction this is not practicable because of the fact that moisture is apt to leak from cells in process of construction, causing short circuits and consequent service interruptions.

One of the special methods of meeting this problem, not only as it applies to customers' substations, but also in large power stations and substations, has been the use of the special concrete brick illustrated in Fig. 1. These bricks are made in the proportion of one part cement to one and one-half parts of sand and two parts grit or pebbles, which have been passed through a ¼-in. (6-mm.) screen. The materials are mixed dry because experience has shown that even a slight excess of water causes a ragged surface due to the drag when the bricks are being removed from the machine. The machine employed is of the lever compression type originally designed for making large concrete blocks but modified to make standard bricks.

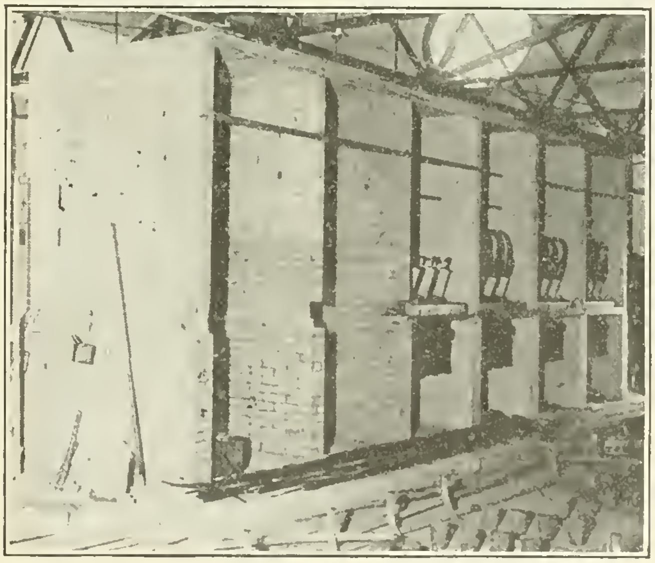


FIG. 2—PARTLY COMPLETED CELLS WITH OIL SWITCHES IN FAR ONES ALREADY OPERATING

More than 1,000,000 bricks have been made by the company mentioned, and it has been found that with one man mixing and two men operating the machine the average output for a nine-hour day is about 2000 bricks. After forming in the machine the bricks are racked on trucks holding about 800 bricks and are removed to a steam room to be cured in a moist atmosphere at a temperature of about 120 deg. Fahr. (49 deg. C.). The process requires twelve hours usually, after which the bricks are ready for use.

The bricks are of standard size, 8 in. by 4 in. by 2¼ in. (20 cm. by 10 cm. by 5.6 cm.), with two 2-in. (5-cm.) holes along the center line. These holes afford space for control conduits or for reinforcing, if such reinforcement is thought necessary or desirable. A V-notch is molded into the bricks to facilitate breaking them with a chisel or trowel, which is required in breaking the joints on alternate courses.

The Cell and Bus Structures

In Fig. 2 is illustrated a cell structure, part of which has been completed and the equipment put into service. The oil switches which have been placed in service may be seen at the far end. A bus structure with bus insulators and bus mounted complete is shown in Fig. 3. In this installation concrete slabs with cast-in inserts are used for supporting the bus insulators. The slabs are cast in wooden forms and after proper seasoning are built into the brick structure as the work progresses. A reactance-coil compartment built of concrete brick with wire-mesh doors on the front for protection is shown in Fig. 4.

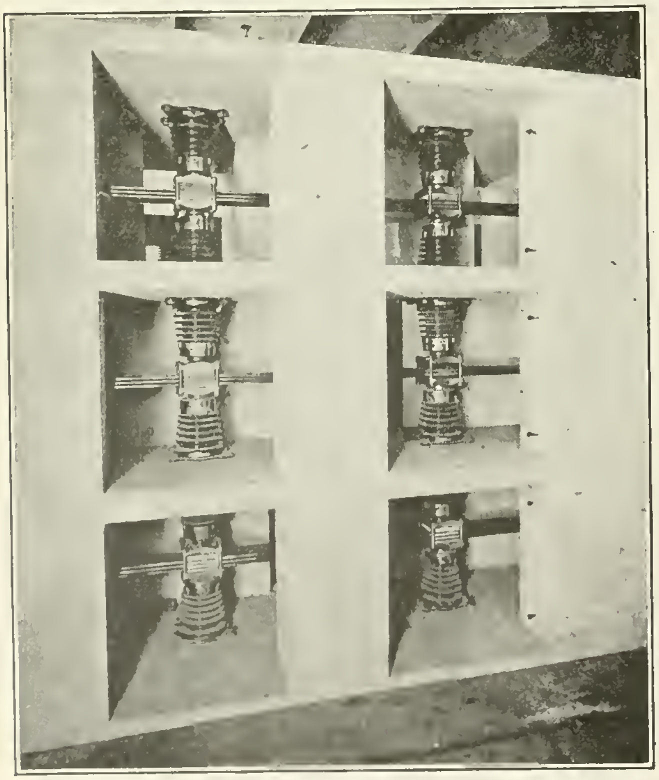


FIG. 3—BUS STRUCTURE MADE OF CONCRETE BRICK WITH CONCRETE-SLAB PARTITIONS

Compared with poured concrete, the concrete brick has the advantage of being readily adapted to varying sizes and shapes of compartments and permits of quick construction of a job with but one class of labor and material. The average number of bricks that may be easily laid per day is about 200. If a poured finish is desired the completed cells are treated with cement wash worked with a trowel to a hard finish. If a brick effect is desired, the points are raked when the bricks are laid up and are later filled or pointed. The resulting structure is stronger than pressed brick and is considerably cheaper as has been ascertained by actual cost records.

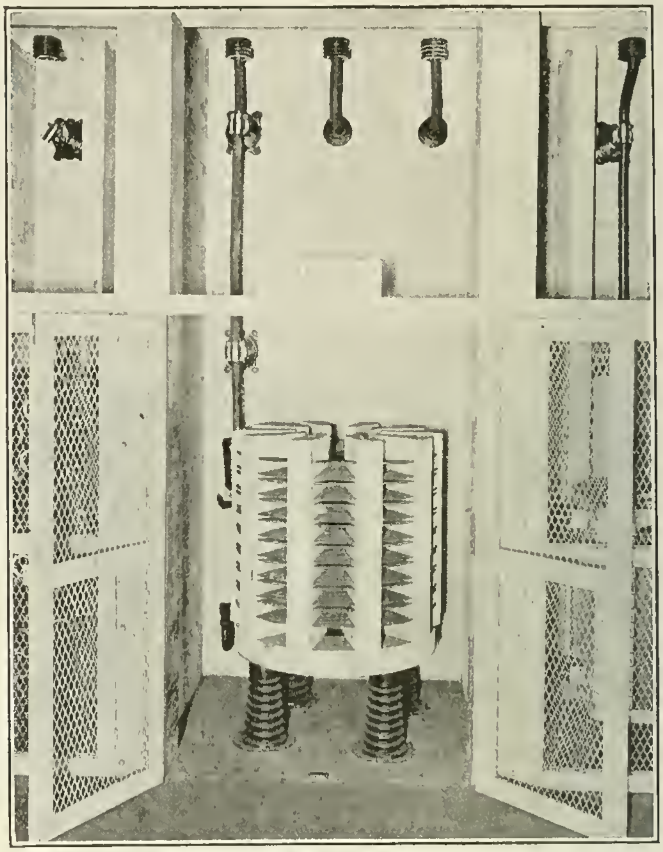


FIG. 4—REACTOR COMPARTMENT MADE OF CONCRETE BRICKS

IT IS time to look ahead to the future of American business and industry. Our tax measures should be so devised as to encourage and stimulate rather than to burden and repress them. I, therefore, recommend the immediate amendment of the pending bill so as to provide that, with the collection of the taxes levied upon war and excess profits for the calendar year 1918 and payable in the year 1919, the war and excess-profits taxes shall come to an end, except in so far as may be necessary to subject to these taxes profits which, though arising from the contracts entered into during the war period, would, under existing regulations, technically be profits of 1919 and not profits of 1918. I can think of nothing which would do more to encourage industry and enterprise than this measure, carrying with it as it would the assurance that with the cessation of war there will come cessation of taxes on so-called war profits and war excess profits.—*Secretary of the Treasury McAdoo.*

Keeping Operating Records

Basic Requirements of Records—What Records Are Essential—How Accuracy May Be Maintained—Station Records, Line Records, Construction Records and Their Proper Checking

BY CHARLES C. RAITT

THE economies and increased efficiencies demanded of all central stations during the war period can not be forgotten now that peace is at hand. In fact, these measures will be even more necessary during the reconstruction period which is just opening. To improve the operation of central stations we must first know how efficiently we are operating. For this reason some of the ideas and convictions of the author concerning the proper operating records for a central-station company to keep and the way in which to keep them will be given in this article. The decision of just what records are necessary rests to some extent upon local conditions, yet there must be some well-defined general principles that will apply to all central stations, and it is these general principles that the author wishes to bring out.

Reliability Is Imperative

First the records must be "reliable." That is not an easy requirement. How often we find when we check up our line maps that a certain extension has not been recorded, or certain transformers have been changed and no record made of the change. How many companies know positively just which of the poles they are using are their own property, which are jointly owned, etc.? If no records have been kept, there is nothing to depend on but the memory of the men who set the poles.

The next demand is that the records must be kept up to date. If important changes are made in the routing of certain feeders, it is not sufficient that this information will be recorded eventually. An emergency may arise the very next day that will make it imperative for all concerned to know about the changes involved.

Records must also be adequate. Scarcely a day passes when some one does not want some information on past performance that has never been recorded or that has been lost. To record any information that may be needed concerning present and past conditions in the operating departments may be an ideal that is impossible to reach, but it is one toward which companies should constantly strive.

Some of the larger central-station companies of the country have organized large record departments in which dozens of clerks are employed. The daily operation is tabulated in detail in these departments, and frequent reports are prepared and distributed, covering every branch of work. One company, for instance, employs eight clerks to do nothing but keep track of the street-railway load which is carried by that company. There are other companies of size comparable with the one just mentioned which keep very few operating records, and these are handled as a side issue by two or three clerks who were employed primarily for some other purpose. Between these two extremes there may be found all degrees of development.

One of the most frequent and expensive faults among central stations is the spasmodic effort at keeping records. For instance, in one company complete records were made of all poles used by the company and the line material attached, only to have these records dropped after they had been carried a while. Then a few years passed and again some one decided that the company should have these records. By this time the old system was so out of date that it was necessary to start all over again. The result is that the company had all the expense of getting the records without any of the benefits of them. True, it may not always be necessary to have such detailed information as that mentioned above; but the time to settle that question is before the expense is incurred.

There is a strong tendency to follow a cycle like that just illustrated unless there is a good stabilizing influence always at hand. When earnings are good and the company is expanding fast, it is very likely to start a more elaborate system of records than it really needs. The system may flourish for a while, but when the boom has spent its force and earnings drop back to normal or below there immediately comes a demand for curtailment of all unnecessary expenses. When the trimming process is over there is not likely to be much left of the record department. Of course, the wiser plan would have been to start the record system on a conservative basis where it might have been maintained even in slack times.

Station Records

In keeping records of the station operation there are a few essential items that should be found on the log sheets of every generating station, whether large or small. In the boiler room the principal items are coal burned and steam generated. If an accurate record of these two items is to be obtained, some way of measuring them over a definite period of time must be adopted. There are many large stations that have no such way of measuring and must depend entirely on estimates which are always more or less inaccurate. There are very good reasons in some cases why measuring facilities have not been provided. For instance, it is necessary, in order to get an accurate record of the coal burned over a twenty-four-hour period, to have some sort of weighing hopper or a system whereby all coal burned can pass over a platform scale. This type of apparatus is expensive to begin with, and in many cases of older plants which were built without any provision for these facilities it would be difficult to put them in.

In the absence of any equipment to weigh the coal burned each day, the next best thing is to measure it by some device which may be placed in the chutes leading to the stoker or a counter mechanism on the stoker plungers. The accuracy of these methods depends largely on the uniformity of the coal used. Wherever any such method of measuring (not weighing) the coal is used it is well to check the figures by means of a monthly inventory of coal on hand. This may be done by laying off the coal pile roughly in 10-ft. (3-m.) squares and taking the elevation of the coal at each intersection.

By adding the coal received during the month to the inventory at the beginning of the month and subtracting the inventory taken at the end of the month the coal consumed is obtained. The author has used this inventory in connection with the counting of plunger strokes and has been able to check the two figures within less than 5 per cent under the worst conditions. There is no intention of giving the impression that these methods give as good results as weighing the coal, for they do not. They are only makeshifts at best, but they are better than nothing at all.

Next comes the measuring of the steam evaporated. There are several fairly accurate flow meters on the market that will measure the flow of steam over a given period, and it is well to have one on each boiler if possible. Where this is not practicable it may be possible to provide one such meter to measure the total steam evaporated. If even this is too expensive for the size of the plant, a fair estimate of the steam generated may be obtained from the feed-water meter. The losses between this meter and the steam header should be pretty constant and by no means hard to determine.

There are dozens of other boiler-room records which are kept in many plants, covering boiler pressures, feed-water temperatures, flue-gas temperatures, etc. These all have their place in determining the best methods of handling the boilers, but they do not get outside of the station and have no place in the permanent records of the company.

Of the turbine-room or engine-room records, those giving the generated output of each unit and the hourly or half-hourly demand readings on these units are most important. The input to all of the important feeders and the demand readings on them should also be recorded.

If there is a sub-utility operated by the company, such as a steam or hot-water heating system or a city waterworks plant, some data on these should be kept.

Checking Station Records

The accuracy of the records which the record department makes must necessarily depend on the care with which this information is obtained. It is only by the utmost coöperation between the record department and the various operating departments that it is possible to secure data that are reliable. From this point on the success of the record department depends largely on the support and encouragement which it receives from the management of the company. The clerical work involved in keeping the records requires a little more than average ability, and for that reason it must be expected that the department will cost something, but there is no doubt that it will pay its own way if properly handled.

The first step after the station records reach the record department is to check each log sheet and report that is received. The operators and engineers are likely to be busy at other things when the time comes to take readings, in which case the meters will be read hastily and there is abundance of opportunity for error. These errors can nearly always be detected by the record clerk if he is on the look-out for them. Constant vigilance is the price of accuracy here as elsewhere. For instance, an average of the demand readings on a given generating unit multiplied by the hours operated should give the output for that unit roughly. If there is any material difference between this figure and the difference of first and last readings on the watt-hour meter, it is certain that there is an incorrect reading somewhere. As soon as this is determined the error can be hunted down.

In case of converting equipment a very good check may be obtained by providing an input meter and an output meter and watching the efficiency of the machines day by day. Any radical variation in efficiency that cannot be readily explained by operating conditions is an indication of bad readings. Mistakes in subtracting meter readings are also common errors and must be carefully guarded against.

There are two load factors which are valuable as a check on the accuracy of the station records as well as being indicative of the character of the load carried. One is the twenty-four-hour-curve load factor, obtained by dividing the average load by the maximum demand. The other load factor is the plant factor, or the ratio of the average load to the rating of the station.

Another thing that helps to catch errors in the records and at the same time forms one of the most valuable reports that the record department can put out is the daily load curve. If the hourly or half-hourly demand readings for the total load and the important subdivisions are plotted on cross-section paper each day and the characteristics of this curve are watched day after day through the seasons of the year, much information can be gained that would otherwise escape notice. The curves may be drawn on tag stock, cut out with a sharp knife and filed by date. Since the contour of all the curves can be seen at once, it is possible to follow the seasonal characteristics of the load and also the effect of any serious temporary conditions. Such a method was described and illustrated by William Le Roy Robertson in the *Proceedings* of the A. I. E. E. not long ago.

All data concerning kilowatt-hour output, steam-generated and coal-burned, should be posted daily in some sort of summary, so that it can be readily totaled by weeks or months as required. Along with these records should be those of the sub-utilities, if any.

Frequency of Reports

It would be useless to specify just what reports should be made on these data or how often they should be made, since these are matters which depend on how rapidly the load characteristics change and on what the reports are to be used for. Once a month would not be too often to make a regular report of the more important features, such as total generated output, maximum load, load factor, evaporation rate (pounds steam per pounds coal), station water rate (pounds steam per kilowatt-hour) and coal per kilowatt-hour.

In the larger companies these data should be reported once a week or even daily. Where the methods of keeping records of coal burned and steam evaporated are not the best, it would be useless to try to make daily reports, as the chances for error are too great. By making the reports over longer periods the opportunities for checking the data are better, and thus the reports will be more reliable.

Whether regular reports are made daily or monthly, the important thing is to keep an accurate record of the operation all the time so that it will be available when it is needed. It is impossible to plan the future expansion of the system properly, and the additional equipment that such expansion involves, unless records are available which cover every season of the year.

Line Records

There is the widest diversity of opinion as to how much detail should be shown in the records of transmission and distribution lines.

If an attempt is made to record just how much line material is in service at all times, an unwieldy mass of clerical work will be involved in making adjustments for maintenance and new extensions. On the other hand, if no effort is made to keep this record at all, the record department is apt to be frequently embarrassed when asked for data by the state commissions, etc. Where the company is a large one and the extra clerical force required will not be a burden, it might be advisable to keep a running inventory of all line material in service. For smaller concerns it should be sufficient to keep track of the larger items, such as poles and wire.

Most central stations keep some sort of line maps, but they do not always serve the full purpose of which they are capable if properly kept. A line map is intended to show just as accurately as possible the position of the company's lines. If it does not show this accurately, it is worse than useless. If it is accurate and strictly up to date, it will never be necessary to send out an inspector before promising to give service to a prospective consumer.

There are a number of good schemes for making line maps, and the method used does not make so much difference. The principal thing to keep in mind is: "Do the maps show conditions as they are now—today?" If the answer to this question is yes, and if the records are not too complicated to be kept up by some one of average intelligence, they will serve the purpose for which they were intended.

There are two general types of line maps. One is the system based on a color scheme, where the single-phase and three-phase primary and secondary are shown in different colored inks. This method is good where it is only necessary to have one set of maps. But where several copies of the same set of maps are required it is better to use a system that can be made up on tracings and blue-printed.

The more detail shown on the line maps, the more work will be required in keeping them up. Furthermore, every extra symbol used tends to confuse the record so that a closer study of the maps is necessary to obtain any desired information.

Transformer records are probably more important than the records of any other line of equipment because they do not remain permanently in one position until worn out, but are constantly being changed about as the load grows. Therefore it is necessary to have some more or less elaborate method of tracing them from one position to another. An excellent system is that which attaches to each transformer a number which indicates the capacity and whether it is single-phase or three-phase. The first two or three digits of the number will serve to indicate the size, and the rest of the serial may be used to give any further information that may be desired. Thus transformer number 7503 would be a 7½-kva. transformer, while 75003 would be a 75-kva. transformer.

There should be a card file with a card or filing envelope for each transformer, filed by number and bearing all the name-plate data and any other information that may be found needed. Besides this there should be a cross index with a card for each transformer bearing both the "company number" and the manufacturer's serial number and filed by manufacturer's serial number. This file has proved to be very useful in finding lost transformers. While transformer location may be kept on cards the same as the other two files, and arranged alphabetically by street names, it is better to use the line maps for this purpose. This helps to condense the records, which is very desirable.

Meter records may be handled in much the same way as that mentioned above.

There are innumerable details that may be added to a system of line records as the need for them arises, but if the proper foundation system has been provided, these details will fall naturally into place.

Construction Records

A simple and efficient work-order system is of great value in keeping accurate records. It would be impossible to get changes on the line maps if all work done were not reported in detail. A good work-order system will provide for this.

It is rather common practice to separate the simple meter and service installations from the general construction work by providing a separate form to serve as an order for this work. The procedure in installing services is about the same in each case, and therefore estimates are seldom necessary except in the case of underground services. For this reason simple service drops and meter sets may pass directly from the new-business department to the department doing the work.

Where an extension is required to give service to a new customer the matter is not so simple. The extension may be one span or it may be ten spans. It may be possible to take care of the new customer by extending the secondaries, or it may be necessary to extend the primary lines, change a transformer and rearrange the secondaries. Furthermore, the request for an order to make line extensions or other line changes may not originate in the new-business department, but may be made necessary by the gradual growth of the load and overloading of certain sections of the distribution system.

Along with the latter type of work is the installing of underground cable, mains for the steam heating or water systems, customers' substations and any other construction work that the company may be called upon to do. All of this work requires a little more elaborate system of records to keep track of it.

If several people were allowed to issue orders for work to be done, it would be very difficult to keep a record of these orders, and so it is better to have all orders issued by a work-order clerk. The orders should be numbered consecutively and should be issued only on written request and after the necessary approval. Oral orders lead to all sorts of mistakes and misunderstandings, and there is no way to fix responsibility for work done under such orders.

Work orders should be made out in multiple form so that a copy can be forwarded to each man who must handle the work, and one copy can be kept by the work-order clerk for a tracer. When the work is completed the man doing the work should mark the date completed and any other necessary data on the copy of the order which he holds and return it to the work-order clerk to be filed. These files are then available for any purpose for which they may be needed. For instance, if all time spent on the work were recorded on the order and all material requisitions attached, the file would then contain complete information for finding costs on all jobs handled. This is a handy way of finding the cost of work for which the consumer is to be billed.

In the foregoing discussion no effort has been made to describe a complete record system or to show sample forms for keeping records. When it is determined what records are to be obtained and how to go about getting them, it is not difficult to devise forms for keeping the data.

There is no intention of giving the impression that the methods of getting data given in this article are original with the author. They are only an accumulation of what seemed to be the best methods in this line of work that have come under his observation.

For and Against Synchronous Motors

Four Objections That Have Frequently Been Made to Using Synchronous Motors, with a Discussion Showing How Conditions Have Changed—Synchronous Motors and Unity Power Factor

BY WILL BROWN

THE synchronous motor has always been supposed to have certain drawbacks which limited its application for industrial drive. First among them was low starting torque. Second, since a synchronous motor runs at a fixed speed (the direct-current field of the rotor is locked to the alternating-current field of the stator) no slip is allowed; therefore the flywheel effect was supposed to be limited. Complication due to the separate exciter has also been cited. A fourth objection is sometimes made, viz., that synchronous motors require more careful attention and more skilled operators than other kinds. In order to determine the advisability of installing synchronous motors these four objections must be considered in turn and the question decided in view of the facts. This is the purpose of this article.

The Starting Torque

It is necessary to make a distinction between a synchronous motor's operation during the starting period up to the point of pull-in and its operation after synchronism has been attained. The critical point in starting a synchronous motor is the pull-in. Like a squirrel-cage motor, it starts and increases speed up to a certain point, known as its rated slip speed. This slip-speed rating varies according to the load. At this point of maximum speed as an induction motor a synchronizing torque must be exerted to pull the rotor field up into step with the rotating field of the stator. This operation may be compared to paralleling an alternator on the line. All operators have observed the large synchronizing power which is exerted as the incoming alternator approaches the frequency of the line. It is the same thing with the synchronous motor. The line current might be considered as gripping the field of the rotor and yanking it up into step.

It can be readily understood that the more slip there is in the rotor speed at the pull-in point the greater must be the torque exerted to pull the rotor up to full speed. It is possible to increase the initial starting torque by increasing the resistance in the damper bar windings, but this results in a larger slip or lower speed at the pull-in point. Therefore the limit of load which can be "pulled in" at a specified kva. input determines the starting torque. The future will doubtless see a considerable improvement in this pull-in characteristic of synchronous motors. By proper design it may be possible to change the pull-in peak current so that the same work can be done by lower current input over a longer space of time. Synchronous motors can now be designed to start and pull into step a load amounting to from 30 to 50 per cent of full load with a kva. input not to exceed 250 per cent of normal rating. It is probable that the time will come when the synchronous motor can be made to start and pull in its full rated load with a kva. input which will not exceed safe operating limits.

Use of Clutches

When the starting duty is so severe that a synchronous motor cannot handle it—on heavy line shafts, for instance—the solution may be found by the proper use of clutches. There are two types of clutches used, viz., mechanical and magnetic. The cost of a magnetic clutch is higher, but it has a number of points of superiority for certain types of duty, such as automatic safety control, etc. The variation of the grip on the clutch faces allowed by magnetic control can often be used to good advantage.

Among certain industrial plant operators of the old school there has been a widespread prejudice against the use of clutches. Their favorite remark was: "Oh, I wouldn't bother with a clutch. . get a slip-ring motor big enough to start the load and that's all I care about."

It is true that they could do this very thing in the past, but it is equaly true that they are not going to be able to continue doing so. Central stations supplying power to these kinds of motors on this kind of drive have learned a lesson. They are going to demand high power factor, and the use of large synchronous motors for driving line shafts is one solution. Proper clutch installations will take care of severe starting duty.

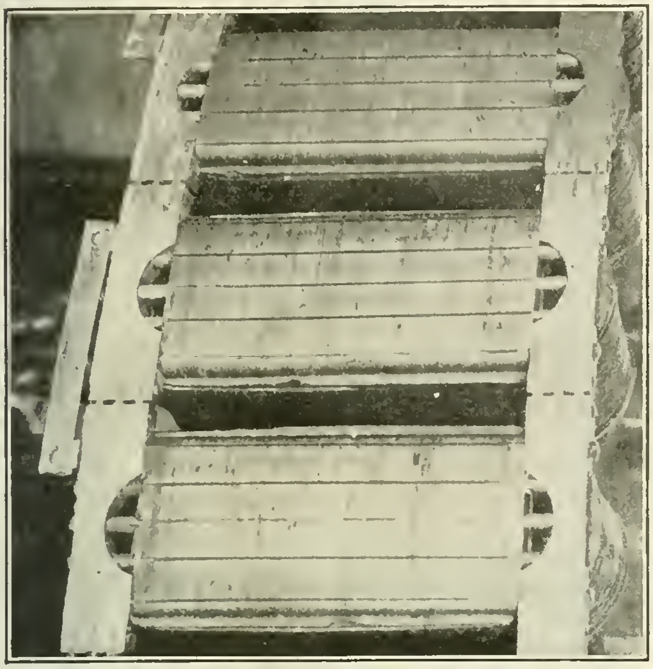


FIG. 1—SQUIRREL CAGE ON SYNCHRONOUS-MOTOR ROTOR TO GIVE HIGH STARTING TORQUE

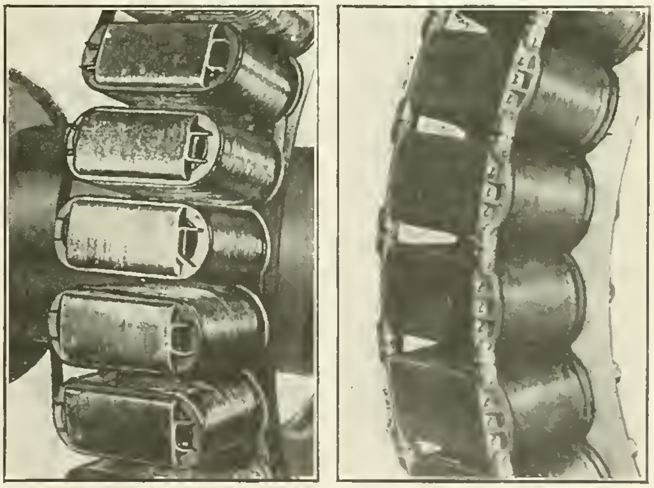
The Northern States Power Company, at Minneapolis, has a number of flour-mill loads, many of them driven by slip-ring motors. There have also been quite a few installations of synchronous motors belted or directly coupled to the line shafts. According to their experience, the synchronous motors are superior to the induction motor for this service. They have proved more satisfactory to the power user in point of efficiency and to the power company in point of power factor. The above company has recently ruled that it will allow nothing but synchronous motors on loads of this kind above 100 hp.

The clutch problem, after all, is not the bugbear that many operators think it is. Trouble in the past has often been due to the fact that too small a clutch was installed. It was not always the buyer's fault either. Many clutches were overrated by the manufacturers. The buyer would select a clutch too small and then his troubles would begin—clutch linings would burn out and necessitate shut-downs. The result was that the plant owner would condemn all clutches. With the selection of a clutch of proper size to allow sufficient margin for all conditions of starting and running there should be no trouble. Most assuredly it will pay engineers to investigate this subject of clutches from an impartial standpoint. At the present time clutch manufacturers are very willing to make the necessary engineering investigations and recommend the proper size amply to take care of the load.

Those who have studied the present performance of synchronous motors must admit that while low starting torque has been one of the chief objections in the past, motors as now designed are able to carry a wide variety of loads without trouble. A still greater improvement in starting characteristics is likely to further widen the application of such motors for industrial drive.

The subject of flywheel effect required for synchronous motor drive is too technical to discuss in an article of this kind. Synchronous motors as now designed with normal excitation can stand instantaneous overloads of several hundred per cent. In fact, the pull-out point of a synchronous motor can be made so high that it is far beyond the heating limits of the machine. It is true that the synchronous motor does not allow the flywheel to act over a definite slip period as does the induction motor. There is, however, a certain amount of "give" between the direct-current field and the alternating-current field on the synchronous motor as the load increases instantaneously. That is, the rotor can slide back a portion of a pole face, and during this brief interval the flywheel is allowed to act. This helps considerably in taking care of the sudden jolts of the load such as those at the end of the stroke on compressors and other reciprocating machines.

On certain heavy, fluctuating loads it is possible to use a magnetic clutch with the magnetic pull on the clutch lining set to allow slippage at a certain maximum load. When the load exceeds this there will be a slip between the two halves of clutch, and the flywheel can carry part of the load. An interesting example of such an installation may be seen at the Trap Rock plant, Dresser Junction, Wis. A single line shaft is driven by a 600-hp., 200-r.p.m. synchronous motor. From this line shaft several crushers and other machinery are driven by ropes or belts. There is one large jaw crusher capable of receiving a full carload of rock in the hopper. Two large flywheels, approximately 16 ft. (4.8 m.) in diameter, weighing from 15 tons to 20 tons each, are set on each side of the crusher. When the heavy peak comes on the crusher the magnetic clutch slips, allowing the flywheels to help carry the load.



FIGS. 2 AND 3—ROTORS OF SYNCHRONOUS ALTERNATOR AND MOTOR

Note that there is comparatively more space between pole tips on the alternator than on the synchronous motor which is designed for unity-power-factor operation. The extra space is necessary to minimize field leakage at low power factor.

The third objection, previously mentioned, namely, the complications due to a separate exciter, is not a very serious one and is much more than offset by the advantage that synchronous motors can supply the necessary magnetizing kva. for induction motors to counteract the lagging power factor they produce. Very little trouble or inconvenience arises from the separate excitation since it involves no more complication than there is in the exciter circuit of any direct-current motor.

Synchronous Motors for Unity-Power-Factor Operation

Motors which are to drive mechanical loads at the highest efficiency should be operated as nearly as possible at unity power factor. Motors operated in this manner constitute a non-inductive load, and while they do not operate at leading power factor, except at infrequent intervals, they do help the power factor of a line to a limited extent.

The design and construction of synchronous motors for unity-power-factor operation differs from synchronous condensers in the following respects:

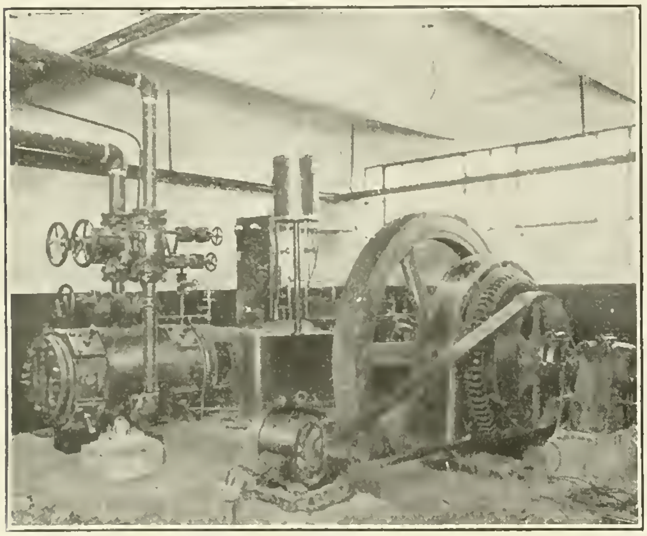


FIG. 4—SYNCHRONOUS MOTOR WITH FLYWHEEL DIRECT-CONNECTED TO AMMONIA COMPRESSOR

First—The field winding need not carry so large a current for unity-power-factor operation, therefore field copper is somewhat reduced. Also the rating of the exciter is reduced to about half the size of exciter used for a condenser. Since the field current is thus limited, it is impossible for the motor to operate at a low leading power factor anywhere near its kva. rating at unity power factor. At very low leading power factor such a motor could carry less than one half its normal kva.

When a motor is operating at leading power factor the field is overmagnetized from an exterior source of magnetization, in this case the direct-current exciter. When the motor is running at lagging power factor the field is magnetized from the alternating-current side. Since this magnetizing current is in quadrature with the voltage, it has zero power factor and produces no heating effect in the field. This explains why the field heating in a synchronous motor is high at leading power factor and low at lagging power factor.

Second—Among the differences between a synchronous motor designed for unity-power-factor operation and one designed for power-factor correction is that no rheostat is necessary for controlling the field of the synchronous motor of the first type. This eliminates rheostat losses and helps efficiency to a slight extent.

Third—It has often been said that a synchronous motor is merely an alternator supplied with damper windings on the pole faces. This is not quite correct. In any alternator the shape of the pole tip as well as the extent of the pole span is limited by the field leakage which the poles must withstand when operating at low lagging power factor. Since it is not necessary to provide for such a condition with a synchronous motor operating at unity or slightly leading power factor, it is possible to design the pole faces and pole tips so as to get much better distribution of the slots for the squirrel-cage winding, and thus succeed in reducing the actual electrical air gap. (This is different from the mechanical air gap.) This makes it possible to reduce the amount of excitation necessary to produce a certain specified pull-out torque. It can be seen that such a design of pole construction will reduce the field losses and increase the efficiency of the unit as compared with the alternator (shorter pole span) type of design. Manufacturers who use the same design for their synchronous motor poles that they use for the alternator poles cannot take full advantage of the above-mentioned opportunities.

A synchronous motor designed to operate at full-load unity power factor will be from 10 to 25 per cent lower in price than a synchronous motor designed to operate at low leading power factors. This comparison is based on prices including exciter in both cases.

Attention Required

The fourth objection, that synchronous motors require more careful attention and more skilled operators than induction motors, is less important to-day than it was a few years ago. Most operators who are capable of handling induction motors of larger sizes can easily learn to start and operate synchronous machines. In the past the manual operation of starting a synchronous motor was often done in rather a crude and unscientific manner. Starting has now been simplified to such an extent that any careful operator can start a synchronous motor without mistake. It seems quite likely that automatic starting devices will ultimately be installed for synchronous motors which will guarantee at all times the most efficient starting, regardless of the skill of the operator.

After the motor is running at synchronous speed there is very little likelihood of "hunting" any more. Whenever such action arises it is generally due to faulty engineering in the installation. Commutator trouble in the exciter is not nearly so likely to arise on a synchronous motor operating at unity power factor as would be the case on an alternator where the power factor of the line is varying. Besides, exciters, as now designed, give comparatively very little trouble.

After facing all the practical objections which can be made to synchronous motors we must admit that the advantages more than offset the handicaps—on heavy loads of constant speed. With ordinary intelligent handling they operate satisfactorily with very low maintenance cost.

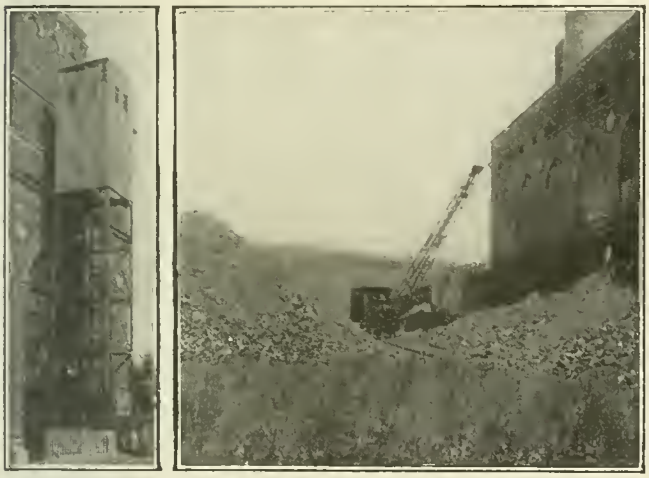
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

ECONOMICAL METHOD OF HANDLING COAL AND ASHES

System Used in New York Plant Has Advantage of Affording Ground Storage for Coal Until Handled by Crusher

In these times, when coal is difficult to obtain, the adaptability of the coal-handling apparatus to existing conditions should not be overlooked. The plant of the Elmira (N. Y.) Water, Light & Railroad Company was very well designed and proved very effective under ordinary conditions, but now that coal must be stored in the summer to prepare for the months when only a small amount of it can be obtained some method had to be devised whereby the coal could be stored until the crusher could take care of it. The accompanying illustration shows the method used in handling the incoming coal, which is ordinarily dropped from the coal cars through the tracks and directly to the intake of the crusher. When this intake bin fills up coal is dropped further along the track and is there picked up by means of a locomotive crane running on a track parallel to the main railroad track. This crane stores the coal in large piles. From time to time as the crusher comes into operation the coal from storage is handled to the bin by means of the crane.



ASH HOIST AND COAL-HANDLING CRANE TRANSFERRING COAL FROM STORAGE TO CRUSHER

After being crushed, the coal is run into a Meade-Robinson skip hoist which is manually controlled and delivers it to the top of the power plant. The coal drops into a bucket and travels above the overhead storage bins, and when released by the man stationed at the top of the bunker it travels by gravity along the bin until it is tripped and emptied. The reaction on the car when it hits the trip sends it back to its original place.

Tracks built underneath the ash receivers of the boilers run to a central point at the door of the power plant. These cars can be pushed out by two men. At present the ashes are taken out and dumped on the river bank, which is low. In the future, however, when it is desired to haul the ashes away, the hoist, as shown, can be used for raising the ash car, and it then can be dumped into a railroad car brought to the bottom of the hoist.

The operators of this plant think that the skip hoist is ideal for a small plant. Its cost and maintenance are very small, and the entire coal passing from car to overhead storage requires only one man for the crusher, one for the skip hoist and one on top of the plant, making a total of three men to operate the coal-handling system. The operation of this hoist is easy, and repairs can be made without difficulty. It is large enough to handle all coal as fast as the crusher can deliver it. The cost of the entire handling from car to the storage bin has been estimated as 15 cents per ton.

What Lessons in Economy Have You Learned?

A REQUEST has been received from the United States Fuel Administration asking our coöperation in a concerted effort to effect still greater fuel conservation. While the ELECTRICAL WORLD has been championing this cause right along, we want to answer the administration's request with stronger and more original articles than ever. You can help by contributing something on your observations and experiences in coal conservation.

Attention should be directed to immediate and practicable means of conservation. To be of greatest service in this campaign information should be applicable to central-station engineers, consulting engineers, industrial-plant electrical engineers and those with similar interests. Subjects relating to economies from the coal pile to the motor driving industrial-plant equipment are interesting.

Specific information is preferred. In other words, refer to definite cases that have come to your attention; outline the conditions involved, relate how the problem was solved, what results were obtained, and what conclusions were reached from your investigations.

While the war is over, we still have to economize as much as, if not more than, ever, because there may be tendencies to stop saving since the patriotic incentive that existed during the war is, unfortunately, not so dominant now. Failure to observe the lessons in economy learned during the war and relaxation in efforts to extend economies would be a serious mistake.

ASPHALT PAVEMENT INCREASES TEMPERATURE OF CABLES

Prevents Moisture from Penetrating the Soil and Thus Helping to Conduct Away the Heat Generated in the Ducts

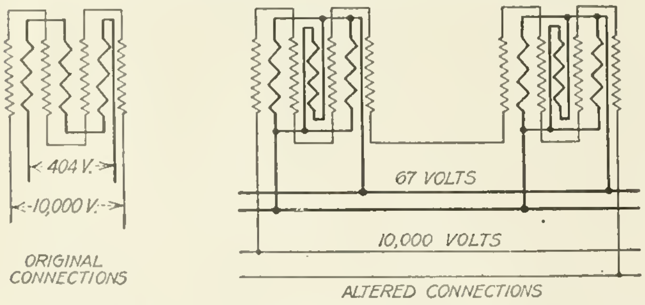
A peculiar case arose recently where a customer lost several cables through burn-outs within a short time, without any apparent reason. Further investigation brought out the fact that the street had been but recently covered with asphalt pavement. On taking up the pavement it was found that the sand soil around the duct structure was absolutely dry from the excessive heat, the layer of asphalt having prevented the water from entering and cooling the soil around the ducts. This case emphasizes the old engineering truth that in a complex phenomenon or structure it is not safe to introduce a new factor, no matter how remote or insignificant its effect upon the desired performance may seem.

EMERGENCY SERVICE FOR ALLOY-STEEL COMPANY

Rotary-Converter Transformer Reconnected to Give Desired Voltage as Special Transformers Were Not Available

Having a request for service from a ferro-alloy steel products company and being unable to secure transformers of the desired voltage in less than eight to nine months, the Portland (Ore.) Railway, Light & Power Company employed the connections shown in the accompanying illustration.

Two single-phase air-blast 10,000/404-volt transformers were employed, each of which originally had three secondary coils and four primary coils in series. The primary coils were left as they were originally connected, and those of each transformer were joined in series across a 10,000-volt supply. The secondary coils, however, were reconnected as shown, and the transformers were joined in multiple on the secondary side. With these connections the desired secondary voltage (67 volts) was obtained. As far as the transformers were concerned the operation was satisfactory, but the method of operation had to be abandoned later on account of trouble with the furnace electrodes.



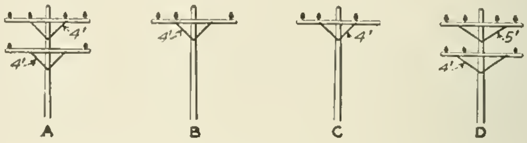
TRANSFORMER CONNECTIONS FOR SERVING FURNACE LOAD

This was a temporary connection inasmuch as the transformers were borrowed from a rotary-converter station to which they have been returned since this emergency service was furnished. C. P. Osborne is superintendent of light and power for the Portland Electric Service Company.

USING BRACES ONCE CONDEMNED

Scheme Which Relieves Trouble and Permits Company to Get Full Value from Stock on Hand

A Middle Western central-station company which has standardized on the type of construction illustrated in sketches A and B had trouble when the proximity of a tree or other obstruction caused linemen to set the third wire over as in sketch C. The clearance between the steel pin and the 4-ft. (1.2-m.) steel brace was only about 0.25 in. (6 mm.), and this led to trouble from current flowing from phase to phase. In some cases the line was burned down.



BRACES NEAR PINS CAUSE BURNING

It was obviously possible to cure the trouble by using a longer brace. But the company had on hand a large number of 4-ft. braces which had cost about $1.15 each and naturally did not want to scrap them. Consequently it was decided that on all top arms a 5-ft. (1.5-m.) brace should be used, as in sketch D, and on bottom arms the old 4-ft. braces should be employed (D). Some exceptions to this rule were made where there was no possibility of pin No. 3 on the top arm ever coming into use. In such places the old 4-ft. braces were used.

CEMENT FIREPROOFING FOR CABLES

Cost Is About the Same as for Asbestos, but Construction Stands External Heat Better

From the actual experience of cables fireproofed with cement and asbestos the Cleveland (Ohio) Illuminating Company has found that the cement covering is unaffected by a burn-out in a manhole, whereas the asbestos covering sometimes proves ineffectual. Cables have failed in manholes in which these two types of protection were present, and on investigation the cable covered with asbestos has been found severely burned whereas the cement-covered cable was practically undamaged. The burn-outs have been caused by a short-circuit of 500,000 kw. on 6-in. (15-cm.) cable.

The company has found that this method of fireproofing is as cheap as the asbestos method, if not more economical. It will average about 15 cents or 20 cents per linear foot when used for covering 4-in. (10-cm.) cables. The covering consists of ½-in. (13-mm.) cement, mixed in a ratio of one to three with sand formed by wrapping a 3-in. (76-mm.) wide cheesecloth in a spiral covering. It also is said that the fireproofing ability is two to one in favor of cement on account of the larger radiating surface.

When it is required to remove the covering from the cable it is easily chipped off by means of a light blow with a hammer. The labor cost is somewhat greater for the cement than when installing asbestos coverings, but this is compensated for by the increased cost of the asbestos. The Cleveland company is adopting this method of covering whenever an open run of cable is required.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

APPLIANCE LINE BROADENED IN CITY OF NEW ORLEANS

Coffee Roasters, Meat Choppers, Fuses, Etc., to Be Featured in Order to Keep Selling Force Together and Build up Profits

Interesting steps are being taken by W. E. Clement, commercial manager of the New Orleans (La.) Railway & Light Company, to increase the scope of the merchandise sold to the company in order to increase both the market opportunity and the profit. He believes that it is far better to broaden the line and build up profits in order to keep pace with the higher costs of doing business rather than to cut down the selling force too far and lose "steerage way." Therefore, in addition to the regular merchandise which has been on display and sale, arrangements have been made to sell electrically driven coffee roasters, meat choppers, domestic ventilating fans, ceiling fans, bell transformers and a number of other appliances for which it is believed a good demand can be created.

All these devices are adaptable to the company's selling methods, and, being kindred lines, it is felt that they can be handled well by electrical salesmen. As a matter of convenience for the public, a full line of fuses of both plug and cartridge type are being featured in the store and will be sold at a good profit. As a result the New Orleans sales department expects to find ample opportunity to justify a very active selling campaign this year, with sufficient profit assured to make it possible to do good creative work in market development.

EFFECT OF THE WAR ON REVENUE FROM LIGHTING

Maine Central Station Seeks Rate for Period of Emergency Revision Upward to Offset the Heavy Increases in Cost

The York County Power Company, affiliated with the Cumberland County Power & Light Company, Portland, Me., recently prepared a revised schedule of commercial and seasonal lighting rates in which the effect of the war upon costs was strongly reflected. The company proposes to advance the price of energy (maximum retail) from 9¼ cents to 11 cents per kilowatt-hour. The existing seasonal rate E of the company provides in part that "a customer may use in one or more of the months of November, December, January and February at 5 cents per kilowatt-hour an aggregate amount of energy up to, but not in excess of, the aggregate amount used by him at 15 cents per kilowatt-hour in any or all the months of June, July, August and September."

The proposed schedule contemplates advancing the rate charged for all energy except that used during the summer months, quoted at 15 cents per kilowatt-hour, and the compensating amount at 5 cents per kilowatt-hour during the four winter months. The company will fulfill its contract with customers served under lighting rate E during the past summer. For the excess energy used in the winter months over that used in the summer months the charge will be at the rate of 11 cents instead of the 10 cents called for by the old rate.

The lighting revenues for the year ended Sept. 30, 1918, were less by $4,554 than for the preceding year. This is attributed to the daylight-saving plan and to a reduction made in the seasonal lighting rate by order of the Maine Public Utilities Commission.

A comparative statement of the results of the operations of the light and power department for the twelve months ended Sept. 30, 1918, is as follows:

	1917–1918	1916–1917	Increase
Gross revenue	$261,979 79	$253,637 92	$8,341.87
Operating expenses	138,800.98	132,562 45	6,238 53
Net operating revenue	$123,178.91	$121,075 47	$2,103 34

No fixed charges are included in the above figures.

The lighting revenue for this period is as follows:

	1917–1918	1916–1917	Decrease
Lighting revenue	$145,099 99	$149,654 68	$4,554 69

In accordance with the clause previously mentioned under lighting rate E, the company during the months of November, December, January and February will have to refund to its year-around customers about $2,423. This amount is included in the above lighting revenue, so that the actual decrease is $2,423 more than the $4,554.69, or $6,977.69. The $2,423 represents the "aggregate amount of energy used" by the year-around customers during the months of June, July, August and September and is the amount of energy these customers are entitled to during the months of November, December, January and February at 5 cents per kilowatt-hour.

Upon May 1, 1918, the rates of wages in the lighting department were advanced about 12.5 per cent. On Oct. 1, 1918, another advance in rates of pay equivalent to about $4,400 per year was made.

The taxes for the year ended Sept. 30, 1918, are $10,456.64, an increase of $4,756.64 over the corresponding period of 1917. The 1919 taxes will doubtless exceed the 1918 taxes by about the same amount.

It is estimated that the proposed increased lighting rate will add $12,600 per year to the revenues of the company, $11,100 of which will come from the regular commercial lighting rate. This the company believes to be a most reasonable added charge to insure adequate and continued good service. "To avoid a loss in the electric department good service demands that remedies be applied in time to prevent deficits from occurring with their accompanying impairment of service. The company's entire interest—even its selfish interest—is to give good service. Protection of the credit of the company assures permanent good service," the company stated at a hearing Oct. 31 at Bridgeford.

The company asks that these rate schedules be considered as temporary, that they become effective forthwith, and that they apply for the period of the emergency. In the view of the company this proceeding today is not the usual proceeding of a rate based on valuation, but is an application for immediate relief because of the extraordinary conditions now existing. No prospect for the improvement of these conditions is yet apparent.

The company believes that the lighting department will have to meet further increased operating costs in addition to those already mentioned. Just what these costs will be cannot be stated, but experience shows that an adequate margin is required to meet unforeseen expenses and contingencies. In order to have funds available for such purposes and to prevent financial loss, the company asks that the proposed lighting rates be allowed to become effective forthwith as an emergency measure. At the above hearing before the Maine Public Utilities Commission there was no opposition to the proposed increase.

RETURN TO NORMAL DAYLIGHT INCREASES STATION LOAD

At Boston the Demand, Part of Which Was Due to Street-Lighting Service, Increased by About 15,000 Kw.

A comparison of the peak loads on the system of the Edison Electric Illuminating Company of Boston before the daylight-saving program was abandoned and afterward showed that the recent change in time was accompanied by an increase of about 15,000 kw. in the demand upon the generating plant. Part of this increase was due to the street-lighting service.

TURNING AN EXPENSE INTO A SOURCE OF PROFIT

By Selling Lamp Boxes and Fuses, Salvaging Repair Parts and Inducing Customers to Buy Lamps in Carton Quantities Savings Are Made

The Little Rock (Ark.) Railway & Electric Company is not a large property, and its savings through measures of economy consequently do not bulk very high. However, it has learned to turn what was formerly an expense into a profit, making thereby a double gain.

Incandescent lamp boxes are now an asset instead of being a liability. Lamps are unpacked once a week. Formerly a wagon hauled the empty boxes to a dump at a cost of 50 cents per trip. This cost the company $26 a year. Now these boxes, instead of being destroyed, are sold at 15 cents each, giving an annual income of $78—total saving $104.

Fuse plugs to the number of 520 annually were formerly given away. These cost 2 cents each, making an expense of $10.40. Now they are sold at a profit of $25, making a total saving of $35.40.

Lamp sales show a saving which is hard to estimate. Now ninety out of every hundred customers readily agree to take a carton of five lamps instead of purchasing lamps one or two at a time. The customers, according to R. I. Brown, commercial manager, seem to continue thereafter to purchase carton quantities.

Scrap metal formerly hauled away with other trash, at a negligible cost, now returns to the company about $25 annually from the salvage of repair parts.

GRAPHICAL METHOD OF MAKING FINANCIAL STATEMENTS

Manager of a Middle Western Utility Uses This Plan as a Spur to Keep the Gross Income Above the Operating Expenses

In order to present the factors contained in his monthly report in a graphical form, the manager of the electric utility in Rice Lake, Wis., a town of about 5000 population, plots the results on cross-section paper. This permits him to compare easily the results for successive years and to see at a glance the trend of the various factors. A study of the curves shows that during the fiscal year 1916-1917 the maximum total revenue for any month was obtained in March and the maximum gross revenue was obtained in January, while for the year 1917-1918 the maximum total revenue and gross income were both obtained in December with a rapid decrease in both factors for the months following that date.

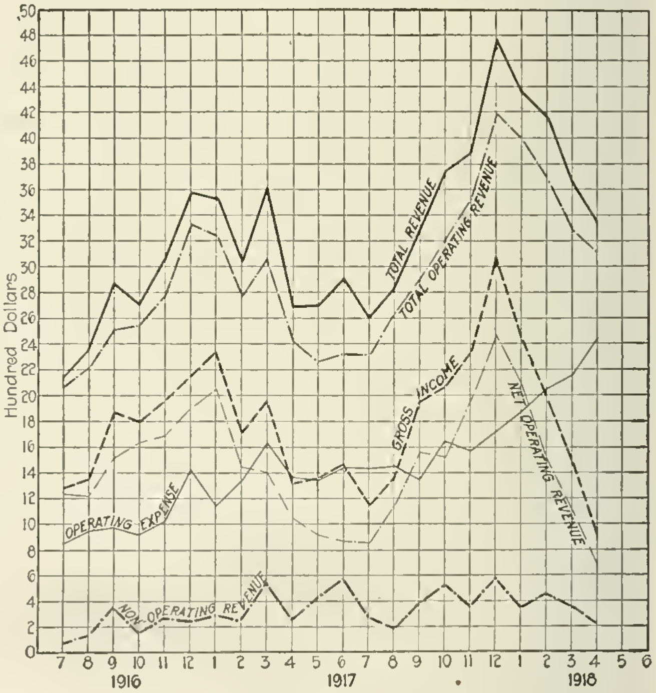


CHART OF REVENUE AND EXPENSE

There has been a steady increase in the operating expense curve since November. If the factors follow the present tendency, it is evident that an increase in rates will have to be obtained.

The manager not only uses this set of curves as an indication of conditions but as a spur for himself, as he endeavors to keep the gross income well above the operating expense.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Short Circuits in High-Tension Machines.—Discussion upon the conditions of heating of the relay coils of circuit breakers in case of short circuit in the circuits which they protect.—*Revue Générale de l'Electricité*, Sept. 7, 1918. (Abstracted from *Elektrot. Zeit.*, May 16, 1918.)

Accidents to Turbo-Alternators.—P. BOUCHEROT.—A sub-committee of the Union des Syndicats de l'Electricité was appointed to consider how to reduce, if not to abolish, these accidents and divided its investigation into three parts: (1) Improvements in construction of turbo-alternators; (2) eventual modifications in the conditions of their installation; (3) proper measures to limit the damage when accidents occur. The report dwells on the necessity of paying more importance to overheating than has hitherto been done and makes suggestions to this end both as regards the construction of the turbo-alternators and as regards their setting up and connection. American practice is quoted approvingly.—*Revue Générale de l'Electricité*, Sept. 28, 1918.

Current Distribution in Three-Phase Commutator Armatures.—M. ERNST.—The heat generated in a three-phase armature with six-brush studs is zero with the brushes in the no-load position. If half of the brushes are shifted, the copper losses increase. Diagrams are drawn showing how the currents in the different armature conductors vary as the brushes are shifted, and it is shown that if the current supply is constant, the copper losses increase proportionally to the displacement of the brushes until this becomes 120 deg.; from here onward the copper losses remain constant until the short-circuit position is reached. The first investigation refers to diametrical windings and the second to chord windings. Practical conclusions are drawn as to the best position for the brushes for normal running. They are usually set at an angle of 120 deg. This is just the point at which the copper losses begin to decrease with decrease of the brush angle, and it might be considered desirable to work with smaller brush angles in consequence. It must, however, be remembered that as the angle is decreased the power factor is diminished. On the other hand, the angle might be increased without augmenting the copper losses, but an increase of the angle above 120 deg. has the effect of diminishing the overload capacity of a motor at a given speed.—*Science Abstracts, Section B*, Aug. 31, 1918. (Abstracted from *Elekt. Zeits.*, 39, May 9, 1918.)

Lamps and Lighting

Street Lighting.—G. L. THOMPSON.—The author discusses the street-lighting problem from the viewpoint of the manufacturer, the central station and the municipality. He shows that the rate of increase of improvement in lighting is not likely to be so great in the future as in the past. Therefore the changes necessary to secure the latest type and highest efficiency will be less frequent. He states the difficulties confronting the lighting committees, reviews the advantages of large individual lighting units and summarizes some of the most important points to be considered in the lighting of business centers, intermediate sections and outlying districts of municipalities.—*General Electric Review*, October, 1918.

Apparatus for the Determination of the Luminous Intensity of Lamps in All Directions.—J. SAHULKA.—This installation is composed of a vertical ring supporting a number of small plaster disks at an angle of 45 deg. with the axis of the ring and so placed as to mark in rotation horizontal zones of equal height upon the sphere made by the ring. The lamp under test, placed in the center of the circle, can be turned around its vertical axis. The ring is normally placed on a photometric bench. A screen prevents the light from the lamp striking the photometer directly, which receives only the light reflected by the plaster disks. In order to measure the hemispherical luminous intensity half the disks are hidden. A single measurement thus suffices to give the mean intensity in any plane. By turning the lamp it is obtained in all the other planes. The mean of the measurements gives the true mean spherical intensity. The reading must, of course, be multiplied by a coefficient pertaining to the apparatus, since only a fraction of the light of the lamp is reflected toward the photometer. In the apparatus described this coefficient is about 20.—*Revue Générale de l'Electricité*, Sept. 7, 1918. (Abstracted from *Elektrot. Zeits.*, June 27, 1918.)

Office Lighting.—WARD HARRISON and J. R. COLVILLE.—The authors stated that the problem of office lighting was fundamentally one of providing the best illumination for the sustained vision of flat surfaces in horizontal or slightly oblique planes as contrasted with lighting for the perception of objects in their three dimensions, so important in the industries and the arts. Illumination intensities of 4 to 8 ft.-candles were mentioned for offices and of 8 to 12 ft.-candles for drafting rooms. The use of daylight lamps was suggested in offices where daylight must be supplemented by artificial light during a considerable portion of the time. Emphasis was placed upon the desirability of low ratios of brightness between visible light sources and their surroundings. Direct, semi-inclosing, semi-indirect and indirect units were classified as to their relative desirability from the standpoints of glare, specular reflection and shadow. The proper field for each type of unit was taken up. Coefficients of utilization for the various equipments and proper spacing ratios were included. The use of individual lamps in lighting offices was discussed.—*Transactions I. E. S.*, Oct. 10, 1918.

Generation, Transmission and Distribution

Waterwheel Types and Settings.—David R. Shearer.—Various forms of waterwheels and turbines are described with regard to the direction of flow of the water, the position of the shaft and the casing of the wheel. These types of wheels are all illustrated.—*Power*, Nov. 5, 1918.

Care of Heating and Ventilating Equipment.—Harold L. Alt.—In this paper, third installment of the series, the author treats of the proper firing of heating-plant boilers. Smokeless combustion is shown to be the most efficient combusion, and devices for preventing smoke are described.—*Power*, Nov. 5, 1918.

Conservation of Heat Losses from Pipes and Boilers.—Glen D. Bagley.—The purpose of this paper as stated by the author is to present a more complete and detailed method of solving problems involved in the calculation of the heat losses from bare and covered pipes and the economic problems encountered in the practical application of coverings. Curves showing the heat losses from bare and covered pipes as functions of the temperature of the pipes are presented. He also shows by means of a curve that the absolute conductivity of magnesia covering depends on the temperature difference. The effect of cooling air currents on pipe coverings is also discussed. Curves are presented to show the initial cost of pipe coverings for various sizes of pipes and varying thickness of covering. The economical thickness of heat insulations for various sizes of pipes is also shown in the form of curves. The writer gives some very useful data showing the saving in the monthly coal bill by the use of 85 per cent magnesia pipe covering of standard thickness for various sizes of pipes per 100 ft. (30 m.) of pipe. There is also some discussion of the permanency of insulating coverings and the selection of coverings to give the lowest operating expense.—*Journal A. S. M. E.*, November, 1918.

Utilization of the Hydraulic Power of the Thur Region in Switzerland.—This proposed development concerns a territory of 1150 sq.km. where there are available water powers capable of supplying in winter time 20,000 kw. to a projected central station at Thur and 35,000 kw. to 40,000 kw. to another projected central station near Lake Constance. The author holds that the installations would pay for themselves in twenty years in coal saved.—*Revue Générale de l'Electricité*, Sept. 7, 1918. (Abstracted from *Schweizerische Bauzeitung*, June 22, 1918.)

Power: Its Significance and Needs.—C. G. Gilbert and J. E. Pogue.—It is recommended that the power situation in this country might be improved by the establishment of a comprehensive system of electric transmission lines to be administered much as are the railway systems. Such a system would encourage the coördinated growth of central power stations in coal fields and water-power sites, and would diminish the transportation of fuel and also make available electrical energy where this is now not commercially accessible.—*Bulletin Smithsonian Institution* (abstracted in *Science*, Oct. 4, 1918).

Electrolytic Corrosion in a Westinghouse-Leblanc Air Pump.— L. Conge.—Investigating an instance of this kind in which chemical and galvanic corrosion has taken place, the author maintains that in mechanical construction where a pump or other organ must function in water however soft the employment of metals forming voltaic couples must be avoided; otherwise the rapid corrosion of the more electropositive metal is inevitable. —*Revue Générale de l'Electricité*, Oct. 12, 1918.

Maximum Bituminous Coal Prices.—A pamphlet has just been published by the United States Fuel Administration giving prices of bituminous coal for each state in the Union where coal is mined. Prices are f.o.b. cars at the mines and are given for each seam in every district. The coal prices include run of mine, prepared sizes and slack or screenings. These prices were effective Oct. 7, 1918.

Fuels of Canada.—B. F. Haanel.—Canada's fuel problems are intimately related to those of our own country, for our northern neighbor imports 55 per cent of her coal and 98.5 per cent of her oil from the United States. Canada's coal resources are second only to our own as far as undeveloped reserves are concerned. The lignite field, which contains a large proportion of the coal reserves of the United States, extends into Canada, where it forms a much greater proportion of the Canadian coal reserves. The high-grade coal fields are much more limited in extent and occur only in the extreme eastern and western provinces. The further development of Canadian fuel resources will be a relief to both countries.—*General Electric Review*, October, 1918.

Efficiency in the Use of Oil Fuel.—J. M. Wadsworth.—The pamphlet is intended as a handbook of information for the man intimately associated with the use of fuel oil. In 1917 there were 160,000,000 barrels of fuel oil burned in the United States. At a conservative estimate 40,000,000 barrels, or one-fourth of the total, might have been saved by more intelligent operation of plants and by proper firing. Therefore the users of oils are urged to take steps immediately to reduce their fuel consumption. The article gives extensive information on the subject, acknowledgment being given to Ernest H. Peabody, Babcock & Wilcox, Lionel S. Marks, William Kent and Henry Kreisinger, and William T. Ray of the Bureau of Mines. The subject is treated under the following divisions: Heat transmission, boiler and furnace design, steam and its properties, oil fuel and its properties, heating the oil, combustion of fuel, flue-gas analysis, boiler efficiency, capacity and rating, auxiliary apparatus, publications on oil fuel, rates and specifications for the purchase of fuel oils. The article is well illustrated and contains many tables of a handbook character.—*Bureau of Mines*, August, 1918.

Installations, Systems and Appliances

High-Current Transformers for Electric Ovens.—R. Jacquot.—An explanation of the radical variations in the price, output and voltage drop of transformers designed for electrometallurgy as affected by the conditions of operation imposed and the number of secondary voltages required. The author seeks to arrive at certain economic conditions capable of realization.—*Revue Générale de l'Electricité*, Oct. 12, 1918.

Time-Limit Induction Overload Relay.—F. E. Jaquay.—The relay described in this article is built on the principle of the well-known induction-type meters. The contacts are closed by rotating elements supported by jewel bearing and pivot. The relay is provided with a temperature-compensating device which causes it to function correctly with large variations of temperature, and provision is made for a wide range of adjustments for time delay and current values at which the overload relay will trip.—*General Electric Review*, October, 1918.

An Ideal Twenty-four-Hour Load.—S. G. GASSAWAY and W. G. TAYLOR.—The fuel-oil shortage now developing, which is analyzed by the authors in an interesting manner, brings to the front the fact that in the oil fields themselves an exceptionally large saving in oil can be obtained by electrification. Not only is the opportunity for the extension of electric power there a large one, but the load itself closely approaches the ideal sought by central stations, as the illustrations attest. The article will for this reason be of particular interest to central-station men.—*General Electric Review*, October, 1918.

Electrophysics and Magnetism

Specific Heat of Tungsten at Incandescent Temperatures.—PAUL FREDERICK GAEHR.—A scheme used and described by Worthing has been slightly altered by using a cyclic method. The chief advantage is a saving of time in making the measurements. Details have been worked out for making the method accurate. A second plan has been worked out, differing from Corbino's bridge method in two important details: (1) It is adapted to lamps with potential leads, and (2) the procedure is so modified as to simplify the measurements and calculations. The second method appears to render somewhat more consistent results, although, like the first method, differences in the specific heat appear when computed with increasing and decreasing temperatures, these differences being greater at the lower currents.—*Physical Review*, November, 1918.

Miscellaneous

Opportunity of Electrical Refrigeration.—H. N. SESSIONS.—(On account of two typographical errors which occurred in a digest of this article in the issue of Sept. 14, the paragraph is printed again as corrected.) The author suggests the possibilities of electrical refrigeration as one of the most extensive summer loads at the present time, with enormous opportunities for the future. The Southern California Edison Company is supplying electricity to one ice company alone using approximately 2000 hp. in motors to manufacture raw-water ice in connection with cold storage. Several of the large electrically operated ice plants show an average consumption for the year of less than 50 kw.-hr. per ton. The usual motor installation of an ice plant, including all auxiliaries, is approximately 3 hp. per ton of ice to be made each twenty-four hours. The average ice-plant load is one with an annual load factor above 80 per cent, a monthly load factor of 90 per cent, and by using synchronous motors the power factor may be kept close to unity. Advantages in the use of electricity in ice plants are that less labor is required for operating and that the fire hazard is also reduced. Owing to the fact that higher speed, and thus cheaper compressing machinery, may be used with electric drive, electricity is fast supplanting steam in this service.—*Journal of Electricity*, Aug. 1, 1918.

Utilizing Waste Heat and the Fuel Shortage.—A large untapped source of heat of which little use has been made hitherto, and which costs nothing, is to be found in the waste heat of internal-combustion engines, in which some 70 per cent of the total heat of combustion is carried off by the exhaust gases and water jackets. Although there are many hundred thousand gas and oil engines in the United Kingdom, the use of their waste heat has been confined to a very limited number of installations. Some details of a system which has been devised by F. A. Wilkinson of Hatfield, Hertfordshire, England, for heating his house in connection with his electric lighting plant will be of interest. In effect, the system comprises the connection of the exhaust piping, which is fitted with a patent silencing device, to lengths of pipes in the rooms in such a manner that the temperature can be regulated, while, in addition, a branch pipe is taken to the kitchen, heating a jacketed cooking range which is also fitted with electric heating elements. The piping from the water jacket of the engine is run to hot-water radiators and terminates in the bathroom. Electric radiators will absorb any surplus electrical energy that will be generated on very cold days.—London *Electrical Review*, Oct. 11, 1918.

Portable Automatic Trimming Conveyor.—It is said that up to the present time very little has been done for the mechanical filling and trimming of bunkers in loading coal on ships. The portable automatic trimming conveyor illustrated in this article has been designed for the purpose of handling coal with the minimum of labor, trimming it into all the bunkering spaces provided in mail and cargo steamers, reducing the cost and displacing the hand labor required in the present bunkering system.—*Electrical Times*, Sept. 19, 1918.

Scientific and Industrial Research.—In presenting the report for 1918 of its advisory council, the Committee of the Privy Council for Scientific and Industrial Research says, among other things, the following: The proposals for the erection of a national fuel research station submitted by the Fuel Research Board has been approved. The station is in course of erection at East Greenwich and will, it is hoped, begin work by the close of the year. From April 1, 1918, the council assumed responsibility for the maintenance and development of the National Physical Laboratory. There has also been established a research board under the chairmanship of Sir Lionel Phillips, to continue and develop the researches into the production of tin and tungsten. Among other important investigations sanctioned is that of a series of tests of home-grown timber which will. it is hoped, afford useful guidance in the reforestation of the country after the war. Satisfactory progress has been made in the past year with the negotiations between the department and the industries of the country for the establishment of industrial research associations. During the year fifteen recommendations in respect of individual researches, inquiries and schemes of research to be directly controlled by the department have been sanctioned. These include the scheme of fuel research, food investigation, tin and tungsten research, as well as five other researches which were begun last year and have been continued under the control of the departmnt.—London *Engineer*, Sept. 6. 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

WAR INDUSTRIAL LIGHTING AND THE RECONSTRUCTION

Important Lessons Learned from the Enforced Speeding of Production Should Assist in Paying the Cost of the War

Speaking before a joint meeting of the Chicago Section of the American Institute of Electrical Engineers, the Western Society of Engineers and other organizations on Nov. 12, Prof. C. E. Clewell of the University of Pennsylvania declared that the lessons which had been learned by purchasers and salesmen of industrial lighting during the war should now become of value in the reconstruction period.

As the basis of his address Professor Clewell used data which he had collected for the War Industries Board. The data were originally collected to be used in the instruction of employment managers for war industries. They dealt with the effect of proper natural and artificial lighting upon industrial production. The data covered not only the field of interior industrial lighting to facilitate production, but also took up the field of protective lighting, which has been of such importance during the war period. Since the data will later be published in complete form, no attempt was made to recite the figures in individual instances, the speaker preferring rather to outline the general character of the information available and to point out the principles and the trends involved. His address was illustrated with slides showing examples of both natural and artificial lighting.

The speaker emphasized the importance of industrial lighting even if no night shifts are employed, since artificial light is used to such a great extent to supplement the natural light during many days and many seasons of the year. Natural light, he said, deserves more attention than it receives. There is room for study, particularly on the problem of how to furnish adequate daylight illumination. The proper control of artificial lighting systems which are used in conjunction with natural light is also a nice problem. It was formerly quite general practice to arrange the lighting circuits so that those lamps near the windows could be turned on at a later hour than those which illuminated the areas in the central parts of the building. Recent experience seems to show, however, that the lamps nearer the windows need to be turned on earlier than those which illuminate the central parts of the building. No entirely satisfactory explanation of this rather queer condition has been evolved, but it seems probable that the conflict of shadows nearer the windows makes the artificial lighting necessary at this point before it is desirable at a greater distance from the walls.

Curves were given to show the amount of light reflected from the walls of buildings adjacent where a distance equal to the ordinary width of an alley intervenes. A double-photometer method was also discussed for determining how much artificial light must be added to give adequate illumination on the interior of a building where natural light is to be relied on to some extent.

W. A. Durgin of the Commonwealth Edison Company spoke briefly on the high-intensity tests which the company is conducting. About 170 plants have been investigated with amazing results. The data show that by increasing the light from three times to twenty-five times its original intensities increases in production ranging from 15 per cent to 100 per cent can be obtained at a cost of about 5 per cent of the payroll. Mr. Durgin now feels that it is conservative to state that a 15 per cent increase in production can be secured through adequate lighting at an expense not to exceed 5 per cent of the pay roll. He expressed the belief that the American engineer should now begin to think as the English are thinking, namely, that it is time to speed up, not to win the war, but to pay for the war.

Great River Span on Towers 171 Ft. High Takes Energy to Coal Mines

At Van Buren, Ark., is a 1975-ft. (600-m.) river span in the Fort Smith-Alma transmission line. The line, which takes energy to industrial and coal-mining load centers, is the property of the Fort Smith Light & Traction Company. The steel towers on each side of the river stand 171 ft. (52 m.) high. They support two three-phase power circuits and one ground wire, all of which are of plow steel strand $\frac{5}{16}$ in. (7.9 mm.) in diameter. The maximum working tension is 6000 lb. per square inch (422 kg. per sq.cm.), and the greatest possible sag is 92.6 ft. (28 m.).

Optimism in Reconstruction Problems

Brig.-Gen. Guy E. Tripp, Chairman of the Westinghouse Electric & Manufacturing Company, Sees Careful Handling of Affairs at Washington and, After Short Transition Period, Great Business Opportunities

GEN. GUY E. TRIPP

BRIG.-GEN. GUY E. TRIPP has returned to New York to resume his duties as chairman of the board of directors of the Westinghouse Electric & Manufacturing Company. With the signing of the armistice General Tripp was able to be relieved of his responsibility in charge of the administration work of the eleven district ordnance offices having charge of the production of ordnance material. The President having accepted his resignation, General Tripp returned to civil life. He takes his office again in the Westinghouse company with great confidence as to the encouraging future for business conditions.

"I AM AN OPTIMIST"

General Tripp in an interview with a representative of the ELECTRICAL WORLD used the words "I am an optimist" and expressed the opinion that the transition of the nation's industries will be largely completed within six months. He feels that the necessary transition from war to a peace basis will be accomplished easily and smoothly.

Two factors were mentioned by General Tripp as illustrating the admirable handling of the situation in Washington:

"First, the determination of the government to see that manufacturers are treated fairly. They are being given cash for their government work to permit them to take care of their obligations.

"Second, the government will not permit large numbers of workingmen to be thrown out of employment.

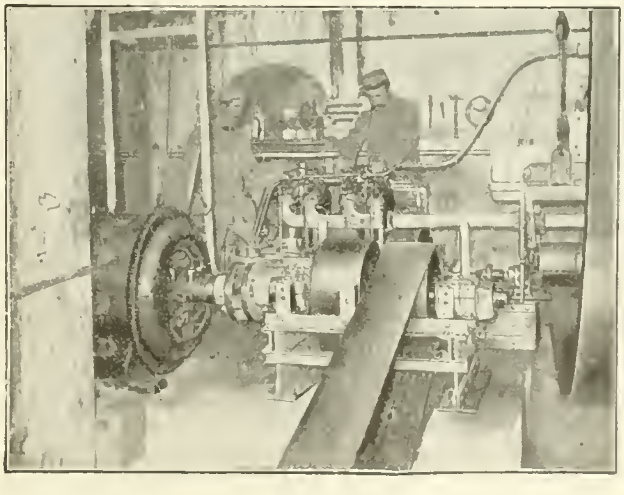
"Those two factors tend to make for a safe readjustment. They make for financial stability without any grave disturbance of conditions."

General Tripp is of the opinion that, assuming that the industries of the country are again in normal channels in six months, there will be great business opportunities before us. He said:

"In considering the probable volume of business after the transition period of six months, which I believe will be sufficient, we should reflect that normal development has been practically at a standstill for the last four years. Bridges, houses, office and other buildings, highway construction, new roads, all things that are necessary to a nation of 100,000,000 population, rapidly increasing, have been to a large degree at a standstill. The deficiency in construction in all of these directions will have to be made up to put the country where it ought to be to meet the requirements of the active population.

"We must also participate in the reconstruction of France and Belgium, doing what we can to restore the devastated sections to their former condition or better. Furthermore, we shall be called on to give help to other countries where development has also been practically at a standstill during the period of the war.

"Nothing short of a grave financial situation—and I do not look for that because the situation is being handled carefully in Washington—will prevent us, in my opinion, from taking a great part in the reconstruction work of the entire world. I believe that the United States is destined to be the leading country of the world, provided, of course, it faces and meets the problems in the ideal American spirit which has brought us the respect of the people of all lands."



READJUSTMENT PLANS IN POWER APPARATUS

Bulletin of the Electrical and Power Equipment Section of War Industries Board Covers Many Important Points

The electrical and power equipment section (of which Walter Robbins is chief) of the War Industries Board has issued Bulletin No. 1 on "Readjustment Plans." It is dated Nov. 14 and follows in full:

"We recognize that every officer of every corporation will be exceedingly anxious to receive as promptly as possible advice as to plans, and are therefore proposing to issue a bulletin to you weekly, or even daily, as we are able to convey anything of a definite nature.

"*General.*—Mr. Baruch has been busy night and day in conference with the heads of other emergency war agencies and with regular Cabinet members in working out definite plans and relations for functions to be performed by each division with reference to its own affairs, so that there may be a consistent policy for all agencies and with reference to matters overlapping or concerning two or more of the agencies. In his session with us yesterday he advised that whereas industry has uniformly, with sacrifice to itself quite irrespective of the degree of hardship, fully supported the war and the controls and restrictions that have been instituted by the War Industries Board, it now becomes the duty of the War Industries Board to assist wherever it properly can industry in its problems.

"*Authority.*—The authority of the War Industries Board will be automatically canceled upon declaration of peace as distinguished from the signing of the armistice. It will continue its functions in assisting the government agencies in all tapering-off programs in the same manner as it assisted the agencies in building up production and in the conversion of industry as long as it may be useful or until the signing of the treaty of peace. In the production program the authority for making contracts lay entirely with the government departments. The War Industries Board advised as to the distribution of those contracts, but could not undertake the responsibility of deciding whether or not contracts should be placed at all. The War Industries Board similarly will not now possess responsibility for tapering down wherever it is found necessary, but probably will be called upon to advise in similar manner as to distribution of any cancellation. Mr. Baruch has expressed the principle that responsibility must be accompanied with final power to act. Likewise, final authority as to action must be accompanied by responsibility. The process of tapering down now seems to be accompanied by a greater degree of responsibility than was incurred when contracts were being placed. For this reason he asks us all to be patient and to urge our industries to be patient, recognizing that it is the desire to withhold all action, if possible, until a clear policy for all industry can be worked out.

"*Standardization.*—Many divisions have under way valuable standardization and conservation programs. So long as the war lasted we felt we had not only justification but authority to bring these programs to consummation. Although we are still technically at war, we feel that since we are only technically at war we have lost our authority, and will attempt to bring to final completion and publication standardization and conservation schedules only upon request of the industry through its war service committees. Those of you who have been serving as members of group committees in consulation here should therefore, by mail or in actual meeting, conclude for yourselves whether you desire to have programs you had tentatively prepared promulgated. If so, the War Industries Board will be glad to do so even at this late date as a recommendation to industry. We feel we cannot go further at this time than merely to make the recommendation. The army has advised that it proposes to go right ahead with army standardization and your group committees should continue to work with it. The distinction we now wish to make, therefore, is the one whether we should recommend that such standardization as has already been effected with the army shall be promulgated as a recommendation of general standardization.

"*Controlled Industries.*—Release of control is to be arranged in the same channel as the control was applied. A recommendation is to be submitted, and if approved by the board members, notification of release will go out in the same manner as notification of control. Each war service committee of an industry now under control will please therefore immediately advise whether it desires to have us recommend that control be released. This should be without regard to the automatic priority now enjoyed which we cover below.

"*Priorities and Restrictions.*—No release of priority has as yet been granted. Much energy, however, is being devoted to the subject with a view to easing from war to peace basis with a minimum of difficulty. There will, of course, be tapering down of many classes of production, such, for instance, as gas masks, as it may possibly be presumed that a league of nations if formed will see to it that Hague conventions are enforced in future so that there will be no need of such equipment. The idea is expressed at this time that some protection may be offered to even such projects as distinguished from a policy of ruthless cancellation, though no definite conclusion has yet been reached.

"Under priority classification and in connection with the Priorities Division we have had voluntary agreements with you as to the non-acceptance of business not in any way related to the war. You are hereby partially released from that phase of your pledge according to the following qualifications:

"(a) In accepting orders of the class heretofore forbidden under this voluntary agreement, such acceptances should be subject to prior delivery of what is essential to that part of our war program which will be carried out, and should also be accepted for secondary consideration as compared with demands incident to reconstruction, which will probably shortly commence to appear. It is due to this last possibility from the point of view of the Allies that the War Industries Board is still holding some measure of restriction on the curtailed industries, and, still further, we may hold some restraint until not only the demands for reconstruction from the Allies can be obtained, but until we can also coördinate the relations between dovetailed industries, if it should be found necessary.

"(b) Restrictions in output were placed upon certain branches and commodities. If the curtailment was 20 per cent, it is now released to 10 per cent; if it was 40 per cent, it is now released to 20 per cent. You are authorized, therefore, to accept orders even on the curtailed industries, though they may be of an entirely non-essential character, up to that basis.

"(c) Delivery, however, for the present will be restricted to such orders: (1) as are covered by specific or automatic priorities; (2) as are authorized by circulars or permits such as have heretofore been issued by the Priorities Division; (3) as may be authorized by circulars or permits issued hereafter by the Priorities Division, such as Circular No. 57 inclosed herewith; (4) or for purposes or firms embraced within Preference List No. 2.

"We suggest that it is perfectly proper for you to solicit business of any and all classes subject only to the reservation that you are not as yet advised as to when production may be undertaken. It is expected that further suggestions or releases will be offered quickly. If so, we will undertake prompt advices, which is one of the purposes of this series of bulletins.

"*Monthly Reports.*—It is our idea at the moment that these will probably be released after those of Dec. 1 shall have been made. We ask you not to release your own machinery for preparation of these reports at this time, relying upon us to release you just as soon as we are sure their usefulness is past and that there would be no need of returning to any substitute system. This applies to the industries administered by this section which have been under the monthly report form system.

"*Individual Problems.*—Let us remind you that under this section we have been handling stokers, boilers, piping and fittings, engines, compressors, motors, dynamos, supplies, etc., and that we are writing these bulletins from the point of view of all or any. Probably much of what we shall have to say will not apply to all. You will also understand that the idea is simply an attempt to convey to you as rapidly as possible conclusions as they are reached here and, so far as possible, to anticipate your questions.

"*Exports.*—No release at this moment has been granted, and possibly none will be, until it can be determined just what ships can be diverted from transatlantic service to their normal service and just how much space will be available for European shipment for other than necessary supplies to our army and policing force abroad, and for other necessities of life for the countries which are in such great distress. We will advise you just as soon as there is anything definite with reference to release on exports."

PRODUCTION WORK FOR SIGNAL CORPS PURPOSES

Overtime, Sunday and Holiday Work to Cease—Operations Under Contracts or Orders Not Actually in Production Suspended

The ELECTRICAL WORLD has received a copy of the following letter from the office of the chief signal officer of the War Department, sent to those interested in pending contracts for Signal Corps needs:

1. Telegram to you from this office of even date is confirmed as follows: "Request that overtime Sunday and holiday work on Signal Corps production cease and that operations under contracts or orders not actually in production be suspended until further instructions."

2. The above telegram does not constitute a cancellation of your order or contract. It is merely a request, and not a direction, and is sent to you in view of the changed war conditions and without prejudice to any of your rights or the rights of the government.

3. It is the desire of the government to avoid so far as possible any undue disturbance of labor conditions and the creation of any situation as the result of which laborers engaged on war orders will be affected.

4. The attitude of the Signal Corps toward you and other manufacturers to whom it has issued orders will continue to be one of coöperation as heretofore, and it is confidently expected that the Signal Corps can in turn rely upon your coöperation in adjusting any problems created by changed conditions in such a manner as to conserve the interests both of the government and of the contractor.

By direction of the chief signal officer,

E. B. POTTS, Captain, Signal Corps.

EMPLOYMENT SERVICE ON LABOR CONDITIONS

Department of Labor Arrangements to Care for Labor in the Shifting of Men from War to Peace Industries

The Department of Labor announces the following:

To enable the United States Employment Service to find other employment for munitions and other civilian war workers as they are released, the service will be consulted by the War Department and War Industries Board before any action is taken on war contracts.

By arrangement now effective the War Department, through the external relations branch of the division of purchase, storage and traffic of the General Staff, for suspension, curtailment or extension of contracts, will hereafter submit its proposals to a representative of the United States Employment Service and a representative of the facilities division of the War Industries Board. The chiefs of the commodities sections of the War Industries Board will be taken into consultation in the draft of proposals covering commodities, through the respective sections concerned.

The facilities of the United States Employment Service for replacing large bodies of men released from war work have been indicated during the past six days, when thousands of men from curtailed war operations had new jobs found for them and were taken to them. The service is now engaged in rapidly expanding its system of clearance in order to meet the readjustment task laid upon it.

In Ohio 11,000 men released from nitrate plants at Toledo and Cincinnati and 1700 released from an airplane plant at Dayton not only had new employment found for them but were distributed by the Employment Service from the gates of their former plants. Six thousand workers from Camp Jackson, at Columbia, S. C., were immediately upon release sent to new work, and a large number of cantonment workers from Camp Polk, Raleigh, S. C., similarly were replaced.

An appeal to sub-contractors on war work and peace work employers to notify immediately the United States Employment Service of coming labor releases or needs was issued by Nathan A. Smyth, Associate Director General of the Employment Service. The appeal reads:

The arrangement with the War Department and the War Industries Board enables the United States Employment Service to know in advance of and to prepare for releases of men by war industries holding direct contracts.

Sub-contractors are urged to notify the Employment Service of coming releases as far in advance as possible, in order that their employees may be placed elsewhere.

It is particularly necessary that the United States Employment Service be advised of all openings for workers, and non-war manufacturers who in their present and future operations need labor are requested to get into touch with the service.

Only through having advance information of the easing off of war industrial operations can the Employment Service adequately devote its facilities toward relocation of war workers.

Extensive transfers made during the past few days, which might well be considered the most dangerous period, give promise that the service can handle the situation, provided that all employers, whether large or small, keep it informed, and it is their patriotic duty to do so.

INDUSTRIAL ASPECTS OF THE DEMOBILIZATION

Assistant Secretary of War Crowell Says that Contract Adjustments Must Be Made Equitably for Industry and Labor

The following statement is issued by the Assistant Secretary of War, Benedict Crowell, as Director of Munitions. Mr. Crowell is specially charged with the industrial aspects of demobilization:

With the signing of the armistice the War Department is faced with an intricate problem and great responsibilities. The industries of the country, which have responded wholeheartedly to the call of the government for increased production and which were going at a rate never before attained, must be diverted from war-time production to their normal occupations in times of peace.

The first and primary consideration in getting back to this normal basis is to make this readjustment with as little inconvenience as possible and with a continuous employment of labor. It is also essential that the production of material for war, which means now a waste of material which could be used for civilian population both here and for the purposes of reconstruction in Europe, should be stopped as speedily as is consistent with the primary consideration of labor and the industries.

Instructions have therefore been issued to all bureaus of the War Department governing the methods of slowing down of production, so that as far as possible there should be a tapering off of war work, giving time for industrial readjustment and for the industry to take up civilian work.

So that manufacturers might as rapidly as possible get into work on civilian needs, at our request the War Industries Board has withdrawn all priority ratings on army work.

No order is being suspended or canceled by the War Department without consideration of the nature of the work or the locality in which the work is being performed, labor and the reëmployment of labor at such places in other industries, and without conference and consultation with the War Industries Board, which has been constantly in touch with the industries of this country, and with the Department of Labor, which is in intimate touch with the conditions of employment in all parts of the United States.

Overtime, holiday and Sunday work has been stopped, and as rapidly as possible and as rapidly as the labor can be used in normal day shifts night shifts will be discontinued. It is often the case that in a certain locality where labor is working on a war project this work may be stopped and the same labor utilized on other work in the same locality.

During the war production has been largely diverted from articles called for in times of peace to war necessities, and civilian needs have been curtailed and non-essentials largely eliminated. With the assistance of the War Industries Board, the articles for war necessities are being rapidly curtailed and the industries proportionately freed to work on civilian needs. Industries which have been largely concentrated in certain areas with resultant congestion of transportation, with a great influx of labor in this area, with inadequate facilities for housing, etc., are being taken into consideration in this readjustment.

The two standards which the War Department has set up for itself are that these contract readjustments must be made equitably, in regard to the industry and labor, and promptly, to safeguard the financial elements of the problem.

NEW FUNCTION OF THE WAR INDUSTRIES BOARD

Under the Arrangement Arrived At, It Will Be the Bridge Whereby Industrial Resources of the Nation Will Be Returned to Peace

B. M. Baruch, chairman of the War Industries Board, authorizes the following:

By agreement with the war-making agencies of the government the War Industries Board is to be promptly advised of revisions and adjustments of all war contracts of the government in excess of $100,000.

Under this arrangement the War Industries Board is to be the bridge whereby the industrial resources of the United States, which have been tied up in the war program of the nation, are to be carried back to a peace basis and rapidly diverted to the normal needs of industry and trade.

While it has never been the function of the War Industries Board to make contracts and while therefore the War Industries Board cannot assume responsibility for any of the financial adjustments with contractors incidental to cancellations, the board will undertake by advice and recommendation so to control the situation as to stabilize the flow of materials, labor and plant facilities back to peace channels.

To this end the facilities section of the War Industries Board will act as the clearing house of all information relating to contract adjustment. It will receive information concerning contracts to be canceled from the various departments of the government and, through the various commodity sections of the board, keep in constant contact with the various industries. At all times will there be contact maintained with the Labor Department also, so that as labor is released from the war industries by contract cancellations immediate demand for its services can be located elsewhere. Bearing in mind the fact that for some time to come there must be continued those parts of the war program necessary to maintain the existing military establishment here and abroad, it will likewise be a function of the facilities section to divert, where possible, the material, labor and facilities released by one department to the requirements of another department.

Conservation of Power Used by Coal Mines

The approach of peace has materially altered the plans of the Production Bureau of the United States Fuel Administration for conserving electric power used at coal mines. It had been planned to establish a field organization throughout the coal-producing fields of the country in connection with obtaining increased efficiency in the use of electric power in the production of coal.

The return to peace conditions will make this organization, which was outlined in a statement recently issued by the Fuel Administration, unnecessary, and the work will be undertaken on a scale more restricted than had been the intent.

RECONSTRUCTION PLANS CLEARER IN WASHINGTON

Progress of Demobilization in the War Department and Return of Men and Officers to Civil Life

The reconstruction situation of the country, so far as Washington is concerned, is clarifying itself from day to day. It appears now that there will not be any reconstruction legislation for the immediate present, and there is every likelihood that there cannot be, because the plans of the leaders of Congress are to adjourn two or three days after they meet Dec. 2 until early next year. This plan is bound up with the desires of the administration, it is understood, owing to the fact that the President intends to sail on Dec. 3 for the peace conference to be held in France. The President intends to address Congress, when it convenes on Dec. 2, the day before the proposed departure, upon the reconstruction needs of the country and to urge that there shall be no hasty legislation.

It is understood in Washington that the President adheres to his previous ideas, recounted in these columns, that the War Industries Board, perhaps in association with members of the War Trade Board, etc., shall carry out whatever reconstruction details are needed to be carried out now. In fact, the War Industries Board is now doing much of this work, although it is a matter of general knowledge in Washington that many members of this board are leaving for their homes; likewise resignations from army officers all over the country who were commissioned for the "emergency," which emergency is said to have now ceased to exist, are being received in large numbers by the War Department, especially from engineers who have been engaged in munition production.

Moreover, army officers who went into what were at first called the various army reserve corps, especially those who are engineers, are receiving opportunity to express preference whether they wish to go to France and Belgium to take part in physical reconstruction work, whether they wish to go into an army reserve or whether they wish to be discharged from the service as soon as possible.

This demobilization and reconstruction is seen in various other agencies of the government. The Food and Fuel Administrations have begun laying off war workers of all ranks. The administration is understood to believe that much of the demobilization of personnel will come about naturally, without legislation immediately, and the United States Employment Service in Washington has announced, after sending out a questionnaire to 500 peace industries, that the 1,700,000 men now in the army camps who did not find their way abroad before the armistice can be taken care of in peace industries at once.

Committees of Congress dealing with questions of taxation and coming appropriations are sending for various heads of government bureaus, insisting that the estimates which were prepared to be sent to Congress Dec. 1 shall be cut very materially, and these cuts are being made, resulting in a wholesale cancellation of orders of a war character not only by the War Department but by navy ordnance bureaus.

The army Ordnance Division has undertaken a wholesale readjustment of its personnel through a board of officers which will consider the subject of arsenal facilities required hereafter for work of manufacture and repair.

WAR EMERGENCY POWER ACTS TO BE ABANDONED

Senator Bankhead, Who Is in Charge of the Two-Hundred-Million-Dollar and Fifty-Million-Dollar Bills, Says the Emergency Has Passed

The so-called war emergency power act, under which Congress was to have appropriated $200,000,000 for assisting in the supply of power by privately owned companies for munitions, transportation of munition makers, etc., will in all likelihood be abandoned. This is also true of the intended so-called temporary substitute for the same measure, which was to have appropriated $50,000,000.

These statements were made to the Washington representative of the ELECTRICAL WORLD by Senator Bankhead, who is in charge of the measures and who had them placed upon the Senate calendar. In the opinion of Senator Bankhead no further emergency for the passage of these bills exists, and he says other Senators share his views.

ABANDONS PRIORITIES FOR ALL WAR MATERIALS

War Industries Board Rescinds Preference List—Preference Will Be Granted to Public Utilities and Other Necessary Enterprises

Edwin B. Parker, priorities commissioner of the War Industries Board, announces that the board has rescinded the entire "preference list."

This means that the classification of industries as essential or less essential to the winning of the war has been abandoned, and that the government will no longer direct the distribution of materials and facilities to industries engaged particularly in war work.

Meanwhile, to aid reconstruction, preference in the allocation of materials and facilities will be granted to railroads, shipbuilding plants, waterways and other public utilities and to enterprises of greatest civilian importance.

JOBBERS ARE RELIEVED FROM THEIR WAR PLEDGES

They Are Free to Proceed in the Conduct of Their Business as Before the War, Says the War Industries Board

By a notice from F. B. Eaves, of the electrical and power equipment section of the War Industries Board, dated Nov. 18, all certificated jobbers and all dealers, contractors and other customers of jobbers are relieved from the obligation to give and require pledges relating to raw materials, semi-finished and finished products They are free to proceed in the conduct of their business as they were before the war as all restrictions have been removed from jobbers. Jobbers are therefore relieved of the necessity for filing with manufacturers and their suppliers the section certificates.

FUEL ADMINISTRATION SUPERVISION CONTINUES

Dr. Garfield Gives Notice that the Work Will Be Carried On Until the Promulgation of the Treaty of Peace Takes Place

In order that no confusion or misunderstanding resulting from the signing of the armistice might ensue, United States Fuel Administrator Harry A. Garfield gives notice that the rules and regulations and the supervision of the Fuel Administration now in force will continue until the promulgation of the treaty of peace. The statement follows:

In order that there may be no confusion or misunderstanding, the United States Fuel Administrator wishes it understood that the signing of an armistice in no way alters the rules and regulations or the supervision now in force. By act of Congress the Fuel Administration continues until the promulgation of the treaty of peace, and its powers extend to the production, distribution and conservation of fuel, including fuel oil and natural gas.

Due notice will be given of any cancellations or changes in orders and regulations by the duly authorized officials of the Fuel Administration in Washington.

PROGRAM OF MEETING ON ENGINEERING EDUCATION

Joint Meeting of British Educational Mission and Society for Promotion of Engineering Education at M. I. T., Dec. 6 and 7

A joint meeting of the British Educational Mission to the United States and the Society for the Promotion of Engineering Education will be held at the Massachusetts Institute of Technology, Cambridge, Mass., Dec. 6-7, 1918.

The topics to be discussed are:

"The Organization of Engineering Education in Great Britain and the United States." Discussion led by a member of the mission representing Great Britain and Charles S. Howe, president Case School of Applied Science, representing the United States.

"The Effect of the War on Engineering Education in Great Britain and the United States." Discussion led by a member of the mission representing Great Britain and Dr. C. R. Mann, Massachusetts Institute of Technology, representing the United States.

"The Liberal Element in Engineering Education." Discussion led by a member of the mission representing Great Britain and Professor George F. Swain, Harvard University, representing the United States.

WAR-TIME IMPROVEMENTS IN RADIO-TELEGRAPHY

Roy A. Weagant, Chief Engineer of the Marconi Wireless Company of America, Discovers Solution of Static Problem

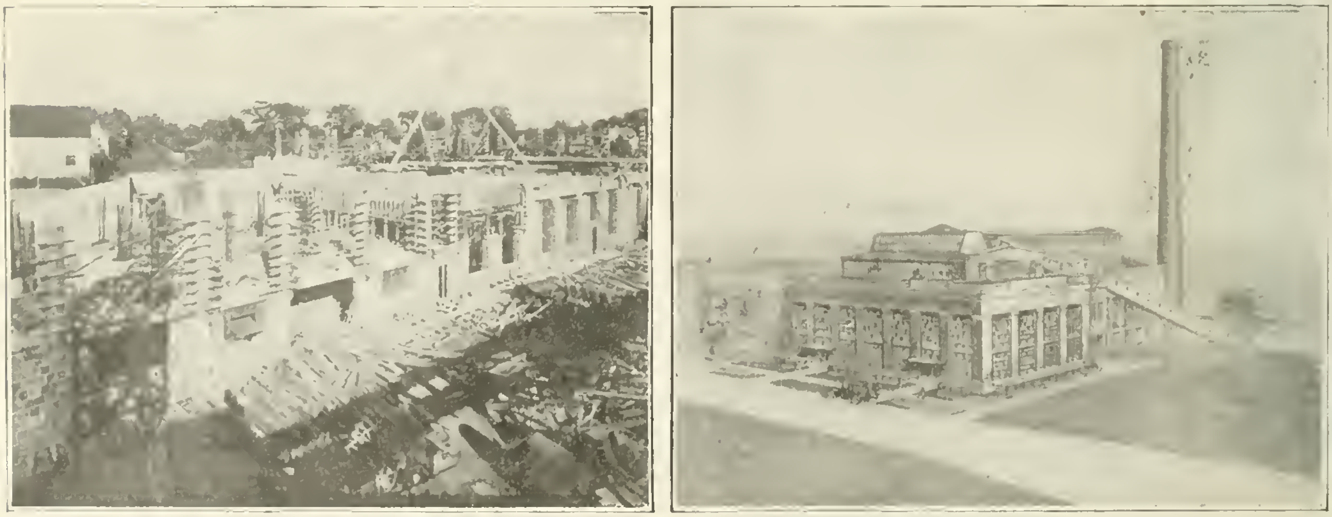
Edward J. Nally, vice-president and general manager Marconi Wireless Telegraph Company of America, has made a statement regarding the invention of Roy A. Weagant, chief engineer of the company, to overcome the effect of static conditions. Mr. Nally's statement says in part:

Mr. Weagant virtually had devoted his life to a study of this perplexing phenomenon and the result of fifteen years of experimental work was about to be published to the world when the United States entered the war. Although patent applications had been made and the claims allowed by the United States Patent Office, the Weagant system was immediately placed at the disposal of the American government, and every precaution was taken to keep the invention secret until the discovery could be safely announced.

Among the revolutionary changes that the new system effects in wireless installations will be the immediate disappearance of the huge steel towers heretofore built at great height to catch the incoming wireless waves. Equipped with the Weagant invention, the wireless receiving antennas are stretched merely a few feet above the ground. The Weagant system, based on a unique selective principle, eliminates interference and permits absolutely clear communication, regardless of the operation of other stations even in the immediate vicinity.

The notable contribution to wireless telegraphy opened by Mr. Weagant's discovery makes continuous wireless communication over the oceans and between continents an absolutely assured fact for twenty-four hours of the day and at every season of the year, regardless of atmospheric conditions.

New Station of the Lorain County Electric Company



The view showing progress in construction and the architect's drawing illustrate the new station of the Lorain County Electric Company at Lorain, Ohio, a Doherty property.

POWER SITUATION AT BUFFALO AND NIAGARA

Armistice Has Not Brought Relief and No Serious Curtailment Is Expected—Coal Supply Is Ample

The signing of the armistice has not relieved the power situation in the Niagara and Buffalo districts. Some contracts have been canceled, but the power released has been quickly taken up. Officials of the Buffalo General Electric Company are said to be in Washington negotiating with the power section of the War Industries Board for the restoration of power commandeered by the government for electrochemical purposes at Niagara Falls.

The River steam station of the Buffalo Company has been carrying all the load possible up to the limit of its capacity of 60,000 kw., and a new 35,000-kw. unit will be placed in operation this fall. No serious curtailment of electricity is anticipated in the Buffalo district in the coming winter. The company has made ample provisions for coal supply and has stored quite a quantity at its steam power station. If the transmitted energy from Niagara is restored to it, the situation will be relieved somewhat. No help is expected for the next six months from the enlargements now being made on the American side, and by the end of next year it is expected that the Hydroelectric Power Commission of Ontario will come to the rescue by the partial completion of its new Queenston station. Even then the demand will exceed the supply.

At present Rochester and Syracuse are sending energy back over the lines of the Niagara, Lockport & Ontario system to help out Niagara Falls.

OUTLOOK IS UNPROMISING FOR WATER-POWER BILLS

Regret Expressed that Proposed Legislation Was Not Enacted as a War Measure While the Emergency Still Existed

There is very little likelihood that anything will be done by Congress concerning the passage of the water-power bills for a long time to come. This opinion was expresed to the Washington representative of the ELECTRICAL WORLD at the office of Senator Shields, chairman of the Senate conference committee, in whose charge the water-power bills have been since the measure was passed by the House of Representatives.

It is hardly likely, according to the best information obtainable in Washington, that Congress will be in session more than two or three days after the new short term begins Dec. 2. The present plan of the leaders, which is known to have the support of the president, is to adjourn because of the President's proposed absence in France. Under the plan of adjournment Congress would not reassemble until after Jan. 1.

Senator Shields has not yet returned to Washington from his home in Tennessee, but there is no disposition among other senators who have knowledge of the situation to regard the proposed water-power legislation as merely war legislation. Many senators feel that the proposed legislation is actually peace legislation, although there is a disposition to regret that it was not passed in time to be of use to the country during the war.

PLANS OF SOCIETY FOR ELECTRICAL DEVELOPMENT

Directors, After Meeting in New York, Decide that Peace Means Opportunities for Constructive Work and New Possibilities

At the meeting of directors of the Society for Electrical Development in New York on Nov. 12 the possible future activities of the society had consideration.

In the general manager's report it was suggested that the society's activities to educate the public to an appreciation of the advantages of electric service should be continued, and that the society could do a valuable work along the lines of helping the reconstruction of the electrical industry upon a peace basis. This would include a number of very important items and carefully prepared propaganda. To do the work thoroughly well would cost money, and the society would have to have the fullest support of the electrical industry.

Directors expressed their approval of the work which has been accomplished. They recognized the fact that ever since the society has been actively at work war conditions have existed. With peace opportunities for constructive work are presented, and the possible value of development work is increased tenfold. The opinion was expressed by the directors that the society is a necessity to the industry, but that heretofore it has been very difficult to secure recognition of this fact, and it was decided that steps should be taken to bring to the attention of every one interested in the success of the industry the value of the society.

President Doherty remarked that the long list of special articles supplied to popular magazines and trade papers during the past six months, the good work done through the daily newspapers, the support given to the society by the trade papers and the interest evinced in the "save-by-wire" campaign throughout the country were all very interesting; but that the time had come for the directors of the society and of every other organization in the country to play the part of prophets, not historians. He said that they should try to visualize the problems with which they will be confronted and plan to meet and solve them. There will be large spaces in many factories vacant ana workpeople idle unless something is done, and done quickly, to secure the business necessary to keep such factories and such workpeople employed. He said that the Society for Electrical Development was one of the best prepared organizations to take up this work; that the manufacturers should recognize the possibilities and give the society the whole-hearted support to which it is entitled.

It was voted to bring the matter to the attention of the manufacturers in session at Hot Springs, Va., and a committee was appointed to meet with the jobbers at the Cleveland convention in December. Another committee was appointed to take up the matter with the contractor-dealers at the next meeting of the executive committee. The society committees will request the manufacturers, jobbers and contractor-dealers to appoint committees to meet with a special committee from the society, consisting of Henry L. Doherty, representing central stations; Gerard Swope, representing jobbers; L. P. Sawyer, representing manufacturers; James R. Strong, representing contractor-dealers, and J. Robert Crouse, representative-at-large.

PEACE CONSERVATION OF WIRING DEVICES

War Service Committee Holds that a Return to Old Wasteful Conditions Would Be a Most Unfortunate Proceeding

A meeting of the wiring devices group committee of the General War Service Committee of the Electrical Manufacturing Industry was held at the headquarters of the Associated Manufacturers of Electrical Supplies, New York, on Tuesday of this week. After discussion of the conditions in the industry resulting from the armistice, the committee sent the following letter to the manufacturers of wiring devices:

> The War Industries Board has accepted our final conservation report of the 16th inst., stating, however:
>
> "We all feel that, even though we cannot be used any longer as either an excuse or reason for conservation, it would be almost criminal for the various groups of manufacturers to waste all the work and effort which have been expended on these programs and not derive any benefit whatever therefrom."
>
> It is the unanimous opinion of the committee, expressed at a meeting to-day, that a return to conditions that existed before the war would be most unfortunate. The studies which have been made by manufacturers as the result of proposed conservation have in practically every instance disclosed wasteful conditions that are most disastrous to profits.
>
> At this writing the committee has no recommendations to make, but will attend the convention of the Chamber of Commerce of the United States at Atlantic City on Dec. 4, 5 and 6 and shortly following those dates will have further information to submit to you. In the meantime you are strongly urged to conform to the conservation program as proposed and accepted by the War Industries Board, with the expectation that this program, modified to meet reconstruction conditions, may be eventually made permanent.

The wiring devices group committee consists of J. C. Dallam (chairman), H. W. Bliven, J. W. Perry, J. H. Trumbull, Shiras Morris and F. V. Burton.

PROGRESS IN STUDY OF INTERNATIONAL TRADE

At Meeting of Committee of the Associated Manufacturers of Electrical Supplies Important Matters Are Discussed

An enthusiastic meeting of the international trade committee of the Associated Manufacturers of Electrical Supplies was held at the offices, New York, on Tuesday of this week. Much work was outlined, which will be completed for the next meeting, to be held on Dec. 12. It is expected now that after the December meeting the committee will be ready to make a report with recommendations to the board of governors. Every section of the association is interested in the work and is taking part in the work through the appointment of special committees.

The main business before the meeting was the review of the answers received from members to the questionnaire issued on Sept. 9. The questions dealt with the articles manufactured by the companies, the materials entering into their manufacture and the component material of chief value in the articles. William Burgess, adviser to the committee, said that he was convinced more and more of the advisability of a separate schedule for electrical materials in the tariff. He feels that this can be arranged in a satisfactory and equitable manner.

One of the subjects discussed was dumping. This was referred, after considerable discussion, to a special committee for a report.

A report from Mr. Burgess on the subject of free ports was received and discussed. The committee appreciates the importance of the question and will give further and careful consideration to it before taking action. Mr. Burgess said that the export business must have the best thought of the industry. The new merchant marine, said Mr. Burgess, will open rapidly greater possibilities for export trade. In recent times there have not been adequate facilities for the exchange of goods with South American countries. There must also be, and these are now being established, adequate banking facilities in those countries to coöperate with manufacturers and exporters of the United States.

A resolution was passed in accordance with which a statement will be prepared by Mr. Burgess to be issued to all members of the association. It will be accompanied by a questionnaire and will cover several points. It will explain briefly the application of the existing tariff law to manufacturers of electrical supplies and materials. It will point out the deficiency due to the fact that lines of product are classified solely on the basis of the component of chief value without taking the labor content into account. It will show the necessity for careful cost analysis of each line of product. It will also emphasize the necessity for immediate action and a canvass of all manufacturers in the branches of the industry served by the different sections.

MANUFACTURERS' CLUB ELECTS NEW OFFICERS

At Annual Meeting at Hot Springs, Va., H. B. Crouse Is Elected President and Le Roy Clark Vice-President

At a meeting of the Electrical Manufacturers' Club at Hot Springs, Va., last week the following officers were elected: President, H. B. Crouse, Crouse-Hinds Company; vice-president, Le Roy Clark, Safety Insulated Wire & Cable Company; secretary, Shiras Morris, Hart & Hegeman Manufacturing Company; treasurer, F. L. Bishop, Hartford Faience Company; commissary, F. W. Sanford, General Electric Company.

MORE WIRE FACILITIES UNDER CONTROL OF THE POST OFFICE

Postmaster-General Burleson Takes Possession of the Marine Cable Systems—Close Control During Readjustment

Under authority of the proclamation of the President, dated Nov. 2, Postmaster-General Burleson has assumed "possession, control and supervision of the marine cable systems of the United States." He states that "there never was a time in the history of this war, for which this joint resolution was passed giving the President the right to control the wire and cable systems, which called for such a close control of the cable system as to-day, and this will continue during the period of readjustment."

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Order Provides for Reparation.—A temporary order issued by the Illinois Public Utilities Commission in the case of the Canton Gas & Electric Company requires reparation if rates authorized are in excess of rates fixed by a temporary order. The commission has accepted the schedule filed by the company, which in general increases the rate 1 cent per kilowatt-hour for all classes of consumers. In entering the order the commission said: "The commission during the progress of the war has had repeatedly called to its attention by the national government and authorities responsible for the prosecution of the war the need of maintaining public utility service at a standard such that the utilities shall be in a position to render a maximum service in order that the production of war materials and the general industrial activity of the nation may not suffer. The commission has realized the need for prompt action in the cases of the applications of this nature, in order that along with other business enterprises public utilities should not suffer through unnecessary impairment of their credit, which would tend to result in impairment of service. We judge it is not the idea of the national government that the public should be asked to pay rates which are unreasonable, but that along with the protection of the utilities should go the protection of the public against unreasonable and excessive charges for utilities' service."

Public Utilities Should Protect Payment of Bills for Lighting.—The Public Service Commission of Pennsylvania has handed down a decision in a case brought by a consumer of the Harrisburg Gas Company protesting against the discontinuance of service, and orders the company to arrange for an immediate resumption of such service, even though an existing bill had not been paid. The consumer failed to pay a bill of $57.30 for domestic consumption and obtained service at his local business establishment upon a promise to pay the arrears. The commission says: "Depriving the complainant of a supply at his place of business because of a prior delinquency at his residence was a violation of the rights of the complainant, even though he had specifically promised to pay the old bill as one of the conditions imposed by the company before such service was granted him. Such conditions should not have been imposed. The company by so doing was merely trying to recoup the loss sustained by it at the complainant's home, which loss was due to its own neglect. The public service company law permits the requirement that charges be paid in advance or that a deposit be made to secure future payments of such charges, or the supply can be shut off at the first delinquency. The respondent in this case failed to take these precautions. It lost the protection afforded by the act and then, instead of pursuing the ordinary legal processes for the recovery of its debt, it attempted this short-cut method of collection. The act of the company was arbitrary and oppressive and should not be sustained."

Orders Energy Purchased and the Rates Increased.—When R. C. Wolf & Company, operating a central station at Potomac, Ill., with a single-phase transmission line to Henning, applied for increased rates, the records showed that the plant was earning about $4,500 per year and was spending about the same amount, without taking into account a margin for depreciation or interest. On looking into the situation the engineers of the commission discovered that the chief generating station at Potomac was not on a railroad siding and was of a relatively interesting character. The plant had originally cost not less than $20,000, and a preliminary survey indicated it had a depreciated original cost of $12,000. It had recently changed hands for $16,000. In its findings on the case, requiring the construction of a transmission line between Potomac and the electric system at Rossville, the Illinois Public Utility Commission said: "It appears from the report of the engineering staff that the electric utility in Potomac and Henning is in a very precarious condition as regards the possibility of its continuous operation, due to the poor state of repair of the power plant and other portions of the system. . . . It appears that the transmission system, operating at 6600 volts, is within 5 miles of a transmission system owned by the Rossville Electric Light Company, which in turn connects with the power plant of the Hoopeston Gas & Electric Company and which from the evidence herein would afford a satisfactory, adequate and reliable source of supply for Potomac and Henning. It further appears that the power station in Potomac is inefficient in so far as the consumption of coal is concerned and that the citizens of this community are not at present receiving twenty-four-hour service. . . . The evidence clearly indicates the practicability of measures involving a connection with the system at Rossville which would relieve the power station in Potomac, save fuel and give twenty-four-hour electric service. . . . The commission, having considered the rates, finds that the just and reasonable operating expenses of the petitioner under the existing conditions are not less than $4,200 per year, and that a reasonable allowance for accruing depreciation is $800. The commission further finds that the rates hereinafter authorized will yield to the petitioner 5 per cent upon $18,000."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Louisiana Engineering Society.—"Fuel Conservation in Louisiana" was the title of a paper presented before the Louisiana Engineering Society Nov. 18 by Leo. S. Weil.

N. E. L. A., Philadelphia Section.—At the meeting of the Philadelphia Section, N. E. L. A., Nov. 12, 1918, Walter H. Johnson, vice-president of the Philadelphia Electric Company, addressed the members on the subject "The Company."

A. S. M. E., Philadelphia Section.—On Nov. 26 J. F. Johnson of the Westinghouse Electric & Manufacturing Company will address the Philadelphia Section, American Society of Mechanical Engineers, on the subject "Large Steam-Turbine Design."

I. E. S., Philadelphia Section.—"Accessories for Industrial and Protective Lighting" was the title of a paper presented by Ward Harrison, illuminating engineer National Lamp Works, at the meeting of the Philadelphia Section, Illuminating Engineering Society, held Nov. 15.

A. S. M. E., Connecticut Section.—W. H. Blood addressed the Connecticut Section of the American Society of Mechanical Engineers last Wednesday at New Haven on the "Building of the Hog Island Shipyard." The afternoon was devoted to an excursion trip through power houses in the vicinity.

A. I. and S. E. E., Philadelphia Section.—"Electric Furnaces" was the title of a paper read before the Philadelphia Section, Association of Iron and Steel Electrical Engineers, on Nov. 9 by G. H. Schaffer and L. B. Lindemuth. The subject was discussed from both the electrical and the metallurgical standpoint.

New York Electrical Society.—At the three hundred and sixty-eighth meeting of the New York Electrical Society, held Nov. 19, G. Douglas Wardrop, editor of *Aerial Age*, who has just returned from the front, lectured on the subject "War Aviation in Retrospect; Commercial Aviation in Prospect."

A. I. E. E., Pittsburgh Section.—N. W. Storer, general engineer Westinghouse Electric & Manufacturing Company, spoke recently before the Pittsburgh Section, American Institute of Electrical Engineers, on the subject "New Locomotive and Substation Equipment for the Chicago, Milwaukee & St. Paul Railway." This program was originally planned for the postponed meeting that was to have been held on Oct. 8.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

No Regulation of Opening and Closing Hours.—There will be no national order issued regulating the opening and closing hours of offices, stores and other mercantile establishments and places of amusement, because present conditions do not justify such an order. This is the decision reached by the United States Fuel Administration and communicated to all state directors of conservation. Should an acute shortage of coal occur in any locality, however, the state administrator in whose jurisdiction the shortage occurs will draw up an order which in his opinion will best meet the emergency and have the order approved by Washington before putting it into effect. Reasonable voluntary conservation measures are urged upon all classes of business.

Increase in Brockton Rates.—The Edison Electric Illuminating Company, Brockton, Mass., in announcing an increase in rates says: "This is the first time in the history of this company when rates have been increased. In this instance we have made every possible effort during the past year or more to keep rates down to their present low figure. We found, however, that this could not be done. We are no more immune to constantly rising prices brought on by the war than is the individual, and every one knows how the price of every commodity has soared in the past twelve months. Were the old charges to continue the company would be seriously handicapped in its operations. Rather than sacrifice service when the government is calling for 'more speed and yet more speed' in industry, it was decided that an increase in rates was the wisest course to be pursued."

Ocean Cable Systems.—Preliminary figures of the forthcoming quinquennial report on the ocean cable systems of the United States have been given out by Director Sam. L. Rogers of the Bureau of the Census, Department of Commerce. They were prepared under the supervision of Eugene F. Hartley, chief statistician for manufactures. The companies making up the Ocean Telegraph totals for 1917 are, as in 1912: Central & South American Telegraph Company, Commercial Cable Company of Cuba, Commercial Cable Company of New York, Commercial Pacific Cable Company, Mexican Telegraph Company and United States & Hayti Telegraph & Cable Company. The figures show that for the five years 1907 to 1912, as well as for the ten years 1907 to 1917, there were substantial gains. During the five years the miles of cables increased 4759, or 7 per cent; during the ten years the increase was 26,134, or 56.4 per cent. The gain in number of cable messages was 609,948, or 10.4 per cent, for the five years, and 581,911, or 9.9 per cent, for the ten years. During the five years the gain in gross income from ocean cable telegraph traffic was $7,597,272, or 94.2 per cent, and in net income $3,554,022, or 120.4 per cent. The ten-year gain in these respects was $8,324,790, or 113.4 per cent, and $2,477,795, or 61.5 per cent, respectively. The amount of capital stock outstanding in 1917 was $60,900,000, or 9.8 per cent greater than in 1912. The gain in this respect during the ten years was $8,100,000, or 15.3 per cent. The number of employees, salaried and others, increased 310, or 18.7 per cent, during the five years, and their total salaries and wages $597,337, or 51.2 per cent. For the ten years the increase in number was 759, or 62.9 per cent, and in salaries and wages $849,268, or 92.8 per cent.

Compensation for Land Telegraph Properties.—Newcomb Carlton, president Western Union Telegraph Company, says to stockholders: "On Oct. 9, 1918, the Postmaster General, on behalf of the United States, entered into a contract with the company respecting compensation for the use of the land-line properties during the period of federal control, the salient features of which are: (1) The contract leaves to the company its non-operating income and the income from its eight transatlantic cables. (2) The government to maintain all land-line reserves for depreciation and amortization upon the same bases as heretofore, to continue the maintenance and operation of the property in as efficient condition as when taken over and to return the property on the termination of federal control in as good condition as when received, to pay all other land-line operating charges, including taxes, bond interest and guaranteed rentals and dividends, and to continue the company's plan for pensions, disability and death benefits. (3) As compensation, the government will pay the company the sum of $8,000,000 per annum. Out of such compensation the company will loan to the government each year the sum of $1,000,000, without interest, toward financing approved additions and extensions, funds required for these purposes beyond such amount to be furnished by the government. If new securities are issued by the company for land-line additions or otherwise required, the government will pay the interest or other costs of such securities. The company to limit its dividends during federal control to 7 per cent. (4) On the basis of returns for the first eight months of this year, it is estimated that the company's net income for the calendar year 1918 will be approximately $11,500,000. (5) Viewed in every aspect, the contract is a fair one to the company and the government, and the arrangement was reached through the pursuit of a broad policy by both parties to the negotiation."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Joint Use of Poles.—Where a public telephone line contracted to maintain private wire along its poles, its removal thereof to a different series of pegs on the poles, if without substantial interference with the efficiency of the wire when properly connected, was entirely within its rights, according to the Supreme Court of Iowa (169 N. W. 35).

Right of Appeal.—Where a gas company, under P. L. 1912, Chap. 792, applied to the Public Service Commission to fix rates, the city and town affected thereby, having intervened under Rule 3 of the Public Utilities Commission, as authorized by Section 17 of such act, had the right to appeal, notwithstanding that Section 34 limits the appeal to "complainant," according to the Supreme Court of Rhode Island (104 A. 609).

Insulation of Line.—The law providing that one controlling the transmission of electricity must insulate the wire at all points where the public are liable to come in contact with it does not require insulation on a wire, properly attached to poles, at a point 30 ft. from a pole, the Supreme Court of Oregon held in Turnidge versus Thompson (175 P. 281). The employers' liability act, providing that persons transmitting electricity shall insulate wires at points where the public may come in contact with them, does not give a member of the public a right of action unless he is an employee or is engaged in a hazardous employment, the word "public" relating only to criminal liability under the act.

Municipal Light Company Must Pay for Use of Poles.—The city of Burlington, Vt., at the time it built its municipal plant contracted with the Burlington Light & Power Company for a joint use of poles for ten years in order to save the expense of an independent pole line, estimated to cost $10,000. For five years the city paid the rental charge, but later in order to help show a profit on the municipal venture it was not paid. The basis for thus repudiating the contract was an ordinance adopted years before the municipal plant was projected and relating to fire-alarm wires only. The ordinance decreed that the top of all poles in the city should be reserved for city purposes. The Supreme Court of Vermont on Nov. 7 decided that the city was in error, and it was ordered to pay the light company $2,600.89, the amount called for in the contract, plus interest.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

W. E. Wood has been appointed manager of the Galveston (Tex.) Electric company.

J. B. Partlow has been transferred from the position of superintendent of the Hortonia Power Company in Brandon, Vt., to take the field end of the company's business.

E. N. Lake, Chicago, has been commissioned a major in the Quartermaster's Corps, United States Army. Prior to his entrance into the army he was manager of the Krehbiel Company.

George H. Porter, district manager of apparatus sales for the Western Electric Company, Chicago, president of the Illinois Athletic Club and an active member of the Electric Club-Jovian League, has become a captain on the staff of General Gorgas.

Elliot Reid, for the past six years advertising manager of the Westinghouse Lamp Company, has been appointed assistant to the general manager, Thomas G. Whaling. Mr. Reid was born in New York in 1889 and was connected with the Equitable Trust Company for three years.

Lewis Lillie, vice-president of the United Gas Improvement Company, has recently been elected general manager in addition. Mr. Lillie has been with the company since 1887, when he took the position of auditor. He advanced in 1894 to comptroller and in 1900 to secretary and treasurer. He became vice-president in 1905.

F. B. Steele, who recently accepted the position of vice-president of the Charles M. Kelso Company, Dayton, Ohio, and who was before that time power engineer for the Dayton Power & Light Company, has been appointed associate general manager of the Utica Gas & Electric Company, Utica, N. Y., of which Frank M. Tait is president and general manager.

J. P. Lottridge has been appointed manager of the Eastern Oregon Light & Power Company, Baker, Ore., succeeding the late Frank A. Harmon. He has also been appointed secretary and assistant treasurer of the company. Mr. Lottridge has been the auditor of the company for the last three years and acted as assistant manager during the illness of Mr. Harmon and since his death.

James M. Barry, engineer of distribution for the Great Western Power Company of San Francisco, has resigned to become superintendent of the eastern division of the Alabama Power Company with headquarters at Birmingham. Mr. Barry was identified with the installation of the electrical equipment for the Noble Electric Steel Company in northern California about ten years ago and was for several years designing electrical engineer for the Northwestern Electric Company at Portland, Ore. With the latter company he had responsible charge of hydroelectric plant and transmission-line work. He left Portland in June, 1914, to become chief of the department of electricity at San Francisco, which position he held until he joined the Great Western staff early last year.

Morse DellPlain, whose election to the vice-presidency and general managership of the Northern Indiana Gas & Electric Company of Hammond, Ind., was announced in a recent issue of the ELECTRICAL WORLD, has been connected with the electrical industry in one way or another since he was ten years old. Mr. DellPlain was born in New Orleans, La., September, 1880, and spent most of his early life in Mexico. From 1890 to 1896 he was employed by the Central & South American Telegraph Company as telegraph operator on the Isthmus of Tehuantepec. From 1896 to 1903 he was in school and college, attending Syracuse University to take the electrical engineering course. The next two years were spent as apprentice in the shops at the Westinghouse Electric & Manufacturing Company at East Pittsburgh, after which he was salesman-engineer in the Westinghouse Syracuse (N. Y.) office. In February, 1909, he resigned to become power engineer for the Syracuse Lighting Company, and on Jan. 1, 1918, was promoted to be sales manager. In August of this year he was transferred to Hammond, Ind., as vice-president and general manager of the Northern Indiana Gas & Electric Company by the United Gas Improvement Company, operator of both the Hammond and the Syracuse plant. Mr. DellPlain is a member of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers and is at present a member of the executive committee of the Commercial Section of the National Electric Light Association.

M. DELLPLAIN

H. M. Turner, for several years a member of the electrical engineering staff at the University of Minnesota, has become assistant professor in the United States Radio School for Officer Candidates, Yale University.

George A. Iler has been apppointed to the position of superintendent of operation of the Georgia Railway & Power Company, Atlanta, Ga., succeeding E. P. Peck, resigned. Mr. Iler joined the Georgia company some years ago as chief operator at Tallulah Falls. Afterward he was made head of the repair department under Mr. Peck. Before joining the company he had had experience as electrician in the navy and as a mining electrician.

I. L. Oppenheimer has retired from the active management of the Ohio Electric Railway & Power Company. He will still be connected with the company, however. Mr. Oppenheimer's health has not been good for the past six months. He will continue to carry on his duties as president of the Ohio Electric Light Association. Mr. Oppenheimer promoted and organized the Ohio River property in 1899 and has managed this property ever since that time.

Walter Belding has resigned as superintendent of the municipal electric light plant in Burlington, Vt., to become connected with the Keene (N. H.) Gas & Electric Company. Mr. Belding was graduated from the University of Vermont in 1911 and the next year entered the employ of the Rutland (Vt.) Railway, Light & Power Company. He was electrical superintendent of this company when he resigned toward the end of 1916 to go to Burlington.

H. L. Treeman has been promoted by the J. G. White Management Corporation, New York, from the post of industrial engineer of that organization to that of manager of the electric department of the Eastern Pennsylvania Railways Company and the Pennsylvania Light, Heat & Power Company of Pottsville, Pa. Mr. Treeman was graduated from the Oklahoma Agricultural and Mechanical College in 1909, with the degree of bachelor of science, having specialized in mechanical and electrical engineering. He was associated with the Edison Electric Illuminating Company of Brooklyn as power engineer for a number of years. In 1915 he left the service of that company to accept the position of industrial engineer with the J. G. White Management Corporation.

Obituary

Louis A. Heitmeier, manager of the Detroit office for the F. Bissell Company, Toledo, Ohio, died after a short illness from pneumonia on Nov. 9, 1918. Prior to his joining the F. Bissell Company Mr. Heitmeier was connected with the Wesco Supply Company, St. Louis, and the McGraw Company of Omaha.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

PRODUCTION OF COPPER IS TO BE MAINTAINED

Recent Decisions of War Industries Board on Raw Materials Designed to Make Transition to Peace Basis Easier

By insuring production and continuing wage scales in the raw-materials industries the War Industries Board is attempting to make the transition stage from a war to peace basis less difficult for the manufacturing concerns of the country.

Following the policy adopted with respect to the steel industry, the War Industries Board met the copper producers late last week in Washington, when the following principles were agreed upon:

1. The present rate of production, which is that of the war period, will be maintained in the mines, smelters and refineries, continuous employment being thus assured during the first stage of the transition from a war to a peace basis.
2. The present scale of prices and the existing wage scale will be continued.
3. The War Industries Board or other governmental agencies that may be designated will continue to regulate the price and to allocate the material to consumers on a basis of priority of needs.

It was also announced last week that the War Industries Board had determined on a general policy of continuing all regulated prices in effect until Jan. 1 next, when further developments will be considered. There will be no more price fixing at the present time.

It developed at the copper meeting that the domestic demand for the metal is virtually double that of two weeks ago. In addtiion, Europe is expected to come into the market for very large supplies. In fact, it was brought out as indicative of how Europe would buy that one of the allied governments has made a request to the War Industries Board for the delivery of 200,000 tons of copper.

Both of these decisions should be of considerable importance to the electrical manufacturing industry as they make it possible to enter into negotiations for a thirty days' supply or more without fear of the price dropping. Moreover, by keeping up production and wages a full and satisfactory supply is insured for the consumers. They, consequently, can lay plans for the future with greater freedom and less fear.

ESTABLISHING CREDIT OF CONCERNS WITH TRADE NAMES

Electrical Credit Men Taking Steps to Decrease Losses from Concerns Not Incorporated but Operating as Though They Were

Electrical credit men are making a stand against concerns purporting to be corporations when as a matter of fact the business is unincorporated. These concerns with trade names which do not show the proprietorship are held to be poor credit risks. An attempt is now being made by electrical credit men to establish the credit of these concerns only when the names of the proprietors are known. This not only helps electrical concerns to withhold credit from former poor-pay customers who try to do business under another name, but also in case of necessity gives an attorney the correct legal name.

JOBBERS NOT ORDERING SO FAR IN THE FUTURE

New York Houses Now Have Two to Four Months' Stocks and Are Ordering on a 60-Day Instead of a 120-Day Basis

According to the latest information, jobbers' stocks of electrical goods in New York City run anywhere from sixty days to four months. This condition is better than has generally been reported. However, indications this week were to the effect that these stocks would not be increased but, if anything, allowed to diminsh somewhat.

Ever since the fall of 1915 it has been a more or less general practice on the part of electrical jobbers in New York to order six months ahead. This was necessary owing to delivery conditions. Now, however, the tendency is not to order so far in advance. The prevailing time seems to be sixty days. In other words, the jobbers are not going to replenish their stocks until they have a better idea of how conditions are going to shape up.

There has been a little price cutting, and this for the most part has been in wire and conduit.

While the demand might fall off for a little while, it is expected that there will not be more goods available than the market will absorb. Indications are that the control of raw materials will continue, and the belief exists that the European reconstruction program will require immense quantities of both raw materials and finished products.

JOBBERS ARE BEGINNING TO STIMULATE OLD TRADE

Owing to Condition of Stock and Deliveries, However, Policy of Price Cutting Is Seen to Have Elements of Danger

In accordance with Section 4 of the modified restrictions announced on Nov. 12 by the War Industries Board and reported in last week's ELECTRICAL WORLD, a number of jobbers have already formally notified their trade that they are seeking business and that restrictions are virtually all removed. This action has thrown a kind of scare into the electrical jobbing trade. It is by no means universal, and those houses which have been awaiting developments longer feel that precipitate action might do a whole lot of harm.

Stocks in jobber warehouses, on the whole, are not large. They are decidedly spotty and generally low. Delivery conditions from the manufacturer have not improved, and consequently jobbers' stocks will not be much better this winter unless conditions with the producer change materially.

Therefore a policy of inviting a heavy demand on these stocks might in the long run prove unsatisfactory. Competitive conditions are already starting up, and a few houses are beginning as a result of this policy to shade prices. The damage that can be wrought, especially where stocks are spotty, is not small.

Apparently there is a big building program about to be launched. This alone should provide an outlet sufficient to prevent any price cutting and give the jobbers an opportunity to await developments.

If jobbers will be careful, both in purchasing and in selling so as to shorten the time of turnover to the shortest period consistent with ability to serve customers properly, there is no reason why a large loss should result when prices fall. Prices appear to be at their upper limit, and with the maintenance of price on raw materials it is doubtful if there will be any decided decline in the electrical market before the first of the year.

To force the demand at this time, however, by cutting prices is merely paring down profits, which even now are not high. There will be enough time later on to take lower profits or a loss when prices are declining without precipitating the condition by competition.

COST OF DOING JOBBING BUSINESS VERY HIGH

Instance Cited of Wages of Particular Class of Labor Advancing in Year from $77 to $99 a Month, or Almost 30 per Cent

The extent to which the cost of doing business has advanced in the electrical supply jobbing end of the industry is considerable. No figures will be available before the middle of next month. Rents, transportation, supplies, labor, etc., however, are known to have made some very surprising jumps, and doubts are expressed that these will come down to any appreciable extent during the coming year.

As an instance of how wages have advanced a prominent jobbing house looked up the wages of a certain type of labor. A year ago this class of labor was paid at the rate of $77 a month. To-day the workmen are paid at the rate of $99 a month. This is an advance of almost 30 per cent. Jobbers have found it very hard to get help. One of the hardest jobs to fill has been that of quotation clerk. The natural result of course has been the demand for more wages.

METAL MARKET CONDITIONS

Price of Copper Remains Fixed Until Jan. 1—Ban on Platinum Off—Spelter Unchanged

Government regulation of copper prices and allocation of materials will continue until Jan. 1 next. The present rate of production and existing levels of prices and wages is to be continued. Export demand continues to be enormous, and France is now in the market for 400,000,000 lb. of copper. It is expected that inquiries for 1919 export delivery will continue to pour in to the big producers.

Last week the War Industries Board and the Ordnance Department announced that the government supply of platinum on hand was sufficient to meet the present needs of the War Department and that it would discontinue receipt of platinum metals.

The market in spelter is quiet and virtually unchanged, with a slightly firmer tone.

NEW YORK METAL MARKET PRICES

	Nov. 12	Nov. 19
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26 00
Casting	Govt. price 26 00	Govt. price 26.00
Wire base	28 75	28.75
Lead, trust price	8 05	7 75
Antimony	9 25	7 75
Nickel, ingot	40 00	40 00
Sheet zinc, f.o.b. smelter	15.00	15.00
Spelter, spot	8 75	8 50
Tin, Chinese *	No quotations	No quotations
Aluminum, 98 to 99 per cent	Govt. price 33.10	Govt. price 33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	22.50 to 23 00	22.00 to 22 50
Brass, heavy	12 00 to 12 50	12.00 to 12 50
Brass, light	10 50 to 11.00	10 00 to 10 50
Lead, heavy	7 25 to 7 50	6.75 to 7 00
Zinc, old scrap	6 00 to 6.25	5.75 to 6 00

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*No Straits offering.

THE WEEK IN TRADE

Cancellations of orders are becoming more numerous. This is both on government account and by industrial plants with government work. Except for socket devices and perhaps lamps, there is a visible slackening of demand for electrical goods. This has been expected, and the impression prevails that it will probably continue at least until the new year. Readjustment takes time and cannot be done quickly.

Supplies of raw materials at prevailing prices are insured by the action in the past ten days of the War Industries Board. Prices generally show no change, although a few jobbers are beginning to cut them in order to stimulate trade.

Stocks are still in a spotty condition, and the manufacturers are holding out no hope to the jobbers.

Building interests are preparing for a very large new-construction program, but it seems very doubtful if anything of much consequence can be done for three or four months. It will probably be some time after that before the electrical trade feels the benefits.

NEW YORK

Business the past week has shown a decided falling off, and dealers, so to speak, are marking time. Cancellation of war orders on quite a large scale has been taking place, and it will take the market some time to readjust itself to the new conditions.

Some local jobbing houses are making efforts to stimulate trade by sending out notices to the effect that pledges are no longer required and that they are in a position to accept orders. There was also some little price cutting, for the most part in insulated wire and cable. Stocks are anywhere from two to four months, with a tendency to reduce advance ordering from one hundred and twenty to sixty days.

The removal of restrictions on new building operations not exceeding $10,000 and in special cases up to $25,000 may to some extent offset cancellation orders, and heavy business along new construction lines is expected in the spring. Stocks on hand in most lines are in good shape to take care of these requirements.

Labor changes in the war industries, strictly so-called, are noticeable, and some of the largest concerns are already adopting means to lay off help that has proved itself the most inefficient. Prices continue very firm. It is generally conceded that the peak has been reached and that any change from now on will probably be downward. Raw materials are still being held in government control, and no large dealings are expected before the new year.

LAMPS.—The demand for lamps is increasing as the season advances, and supplies on hand are large enough to take care of needs in this country. There are large foreign orders in the market, both from Europe and South America, awaiting shipment.

WASHING MACHINES.—These products are still showing great popularity, and the supply except in one or two small sizes is far behind the orders on hand. Two agencies this week stated that there was not a copper washing machine to be had in the market for quick delivery. Such machines as are on hand are of the galvanized-iron type.

MOTORS.—Owing to the cancellation of numerous war contracts, many factories which were under consideration and in the market for motors of the larger type have now withdrawn their inquiries, and there has been a considerable falling off in demand. Fractional motors, on the other hand, show increased demand and sales.

USED APPARATUS.—One of the largest second-hand dealers reports a slight slackening in demand the past week. Supplies on hand are good, and not much material is coming on the market. Prices show no change.

WIRE.—With the exception of code and outpost wire, stocks on hand appear to be in better shape, and it is now possible to get No. 14, single-braid, in fair quantity. One large jobber reports that he is now able to obtain 25,000 ft. a month.

POLE-LINE MATERIAL.—Owing to the lack of new construction during the war supplies on hand of pole-line material are good and shipments prompt. With the continuance of mild weather new central-station extension work may be looked for immediately.

CONDUIT.—So far as can be learned no change has yet taken place in the conduit situation.

BOSTON

Jobbers continue extremely busy in spite of the cessation of hostilities. No extended cancellation of government contracts has so far been noted in this district, although some plants are about to establish the straight eight-hour day without overtime or Sunday work. No price changes have as yet been announced, but it is generally felt that the top has been reached in practically all lines. Shading here and there would not be surprising in the future. Stocks are low on the whole. The abandonment of priorities on army supply material will soon begin to affect deliveries favorably. Jobbers have begun to send out notices to their salesmen on the road to accept orders for any kind of material and in any amounts within reason. The wholesalers stand ready to absorb a much larger output of washing machines and other labor-saving devices when these are obtainable. Labor shortages are still acute in the trade, and as yet no extended movement has begun from war plants into the civilian-need establishments. The central stations are pursuing a conservative policy as to expansion, preferring in many cases to await the termination of extraordinary financing on the part of the government and the arrival of a lower price for money. Little change is to be seen in credits and collections since the signing of the armistice, but the early resumption of building operations is expected to lead to better business among the contractors and consequent improvement in their credit. The tone of the trade is very optimistic, once the corner can be turned of labor readjustment.

APPLIANCES.—Sales have held up well, and if the supply of appliances increases in the near future, as seems likely, the market appears ready for expansion along staple lines. Little change is to be seen in the volume of business since the close of hostilities.

FIXTURES.—Jobbers are well stocked, and as soon as building operations are resumed on a substantial scale they will be ready to meet requirements by shipments from unusually well-assorted and complete styles. Jobbers have bought very sparingly of fancy fixtures this year.

MOTORS.—Stocks are gradually increasing, and some inquiries are being received from sources outside war plant buyers. Prices hold firm. As soon as building operations get well started a brisk demand for motors is anticipated from all sorts of industrial plants, especially in connection with re-conversion work.

ARC-WELDING APPARATUS.—The outlook is good for increased business in this class of equipment. Deliveries are being quoted about thirty days f.o.b. factory. The continuance of shipbuilding activity will help this trade.

RADIATORS.—Retail sales are fairly satisfactory, but continued mild weather has retarded the flow of these units into the consumers' hands. Some complaint is heard in central-station appliance circles that hardware dealers have been supplied with electric radiators in preference to the former sales agencies.

INDUSTRIAL ELECTRIC TRUCKS.—Business holds up remarkably well despite the increased cost of battery equipment. The volume of business compares very favorably with that of a year ago. Inquiries are coming in well.

LAMPS.—It is too early to see any results of the close of hostilities on the lamp market. Stocks of standard lamps are in good shape, but it is likely to be many months before the supply of miniature is equal to the demand. Prices remain steady. The continuance of the shipbuilding program and expected central-station expansion are looked upon as factors in an early enlarged market.

WIRE.—Business continues very brisk. Many important government orders are being filled, and it is believed by manufacturers that the work of reconstruction abroad will call for large shipments. Close control of prices is expected to continue for some time.

CHICAGO

Absolute market stability is in evidence on every hand. Concerns which have war contracts that one might expect would be the first to be canceled have been notified to go ahead. In cases where cancellations have been made they appear to have been made with great discretion. Jobbers report that inquiries are coming in in good volume and that while orders are somewhat smaller than in the past week they are still numerous. The jobbers have received no cancellations as yet to speak of. There have been no price advances, but at the same time there have been no declines. It is positively stated by reliable jobbers that the sacrificing of stock is the last thing they contemplate. All are fairly well supplied with stock, but there are apparently no serious over-stocks.

The outlook for business in the coming year is certainly excellent. In the railroad field it is reported that building construction will eclipse anything that has been known in recent years. A survey of work which will be begun immediately in Chicago shows that the total amount is about $103,000,000. This is practically all municipal work. Activity among the meat packers still continues.

COPPER WIRE.—The Chicago situation in the smaller sizes of wire has reached a level where it is now expected that it will be six months before a competitive condition again prevails. Manufacturers who supply Chicago distributers make absolutely no promises as to delivery. The situation is particularly bad in No. 14. Accurate news as to the intention of the government concerning its program for the production of outpost wire is eagerly awaited.

CONDUIT.—The stocks of conduit are improving. Shipments are still being made on priority, however. Up to the present time it has been possible to secure conduit on Class A and Class B priorities, but in no case have there been any shipments made on Class C.

HEATING DEVICES.—Manufacturers of heating devices have been notified that they may increase their production 25 per cent. This puts them back on a 75 per cent peace footing.

SPECIALTIES.—Jobbers' stocks of these goods are adequate.

OUTDOOR SUBSTATIONS.—There is considerable activity in connection with apparatus designed for operation on lines supplying mines.

FARM PLANTS.—The Farm Power and Light Manufacturers' Association will not submit its case to the War Industries Board. This decision was reached, following the signing of the armistice, at a meeting of the executive committee of the association in Chicago during the week.

ATLANTA

The quantity of orders placed locally with manufacturers since the armistice was signed shows a slight decrease over the previous week. This is accounted for by the reaction from news of peace and momentary thought on the part of some buyers that prices are due for a slump. The volume of business transacted through jobbers and distributers remains comparatively the same, with small decreases in the higher-priced appliances. Opinion prevails that for the next three months buyers will mark time until conditions become more settled. The lifting of restrictions on certain lines of building will open up a market for a substantial quantity of supplies, offsetting to some extent the decrease in government orders.

Very little can be learned at this time regarding the outcome of work already planned for military establishments in the Southeast. Reports have come in to the effect that additions to Camp Jackson, Columbia, S. C., have been stopped and that 4000 workmen have been released. It is thought that work will continue on the artillery range at Camp Bragg, Fayetteville, N. C., and the tank school at Raleigh, N. C. The letting this week of a million-dollar wiring contract to the T. H. McKinney Electric Company, Atlanta, for the Camp Benning small-arms school at Columbus, Ga., indicates that this camp will be permanent and that the project will be carried through to completion. Electrical construction at this camp will include an 8-mile pole line to connect with the Columbus Power Company's system.

The production of brass is announced as being off 40 per cent. Daily requirements are 3,220,000 lb., while daily production is 1,450,000 lb. Dealers report some cessation in buying, affecting the total volume of business during the last loan campaign and continuing up to this time. Certain appliances, however, are moving briskly.

HEAT REGULATORS.—Distributers report sales on these as being good. Although they have advanced about $2 each this fall, no decrease in sales has been noted. Stocks are ample and shipments good.

APPLIANCES.—Washing machines are going rapidly and incoming shipments do not satisfy the demand. There has been an increased movement in vacuum cleaners this week, accompanying the removal of restrictions on manufacture by the authorities. A substantial demand has opened up for grid stoves and grills. A big market exists for irons. It is impossible to supply the present demand and great difficulty is experienced in securing small lots to handle insistent requirements. Inquiries for electric ranges are increasing, which indicates a latent demand for these when deliveries improve.

BATTERIES.—The sale of dry cells has picked up during the week, and it is expected that the volume of business in these will continue to grow from week to week as the cold weather advances. Deliveries are fair.

SEATTLE—PORTLAND

The signing of the armistice has created a condition of great uncertainty in the minds of most people as to what the future will bring forth. Many opinions are being expressed as to the probable changes in sales of power equipment. The situation is developing rapidly and is being watched with keen interest by all manufacturers. The tendency of the manufacturers seems to be toward curtailing stocks of motors and transformers instead of maintaining a six months' supply. An order has been issued in the Portland district for cutting stocks to four months. This order has not reached Seattle to date but is anticipated. While orders have been received from the East to put into effect more rigid enforcements of the rule relative to establishing a case of necessity before permitting a sale of electrical material, the signing of the armistice has had the effect of holding orders in abeyance temporarily. It is known that many industries requiring equipment will be in the market as soon as government restrictions are removed. Certain restrictions of the War Industries Board have already been removed, and the prospects are that others will follow immediately. This may more than offset any depression caused by the closing down of government work. While it is felt that generally throughout the country the result of peace will be to cause a very marked decrease in demand for small motors and equipment for some time to come, it is the general opinion that such will not be the case in the Northwest because of the character of the work locally.

That the end of the war will give a tremendous impetus to Seattle's huge foreign trade, because of the removal of numerous restrictions now placed on imports and exports as well as in the movement of vessels, is the consensus of opinion among authorities. In carrying out the announced program of renewing the activities interfered with by war the Navy Department has advised that plans are being laid to go ahead immediately with the development work at the Bremerton Navy Yard. This means expending money already appropriated for the purpose, including $329,000 for a power plant and distributing system. In addition, it was announced that the construction program for larger ships at Bremerton will be carried out and keels laid as soon as possible. Already several large yards are making preparations to build larger wooden vessels, from 12,000 tons to 14,000 tons. It is reported that many wooden-ship orders are in sight from French, Italian and Greek interests for ships ranging in tonnage up to 4500 tons. Spruce production for war purposes has been halted in the Pacific Northwest upon telegraphic orders from Washington. The lumber industry of Oregon and Washington is confronted with the most remarkable and difficult transition period in its experience, and the maintenance of the organization perfected to carry on strict war production will depend upon the ability of the industry to adjust itself to directly opposite conditions.

The influenza ban in Northwest cities has been lifted, and both jobbers and retailers report that business is rapidly assuming normal proportions along all lines. The Electrical Contractors' Association of Portland announces that there is considerable activity along certain lines as indicated by calls for bids on new work.

SAN FRANCISCO

To the electrical fraternity of California the past week brought a rather unexpected but most welcome announcement. All present power restrictions are rescinded, and yet there will be enough energy to care for war-work demands as well as for normal service. With the completion of new reservoirs and new connecting lines a most welcome surplus will be shortly available for domestic electrification.

As yet the signing of the armistice has not appreciably affected California electrical business. Shipyards are still busy on their contracts, and as the electrical equipment of a boat is usually purchased at the very last, and as the end of 1919 is officially designated for the completion of such contracts, there will still be a great deal of such business in the future. Food shipments must continue as in the past, if not in even greater volume, so that the numerous California canneries and food factories will require maintenance and extension material and, through good wages, will continue to place much money in circulation. Building restrictions are practically removed, and only the approach of winter and a predicted rainy season can limit the dammed-up flood of contracts.

SCHEDULE MATERIAL.—Sales of standard sockets and switches have considerably lessened, special marine types being demanded for ships and rather rough porcelain types being necessary or acceptable elsewhere. Rosettes have sold well because lack of conduit has let down the barriers against the use of knobs and tubes. As soon as many long-pending building deals can be financed and again set going these standard lines will, it is predicted, more than make up for lost time.

HEATING DEVICES.—Barring a return of the influenza epidemic, California expects the biggest electrical Christmas on record. A welcome bit of news was the government's curtailing to 25 per cent the 50 per cent restriction on factory output. Considerable price uncertainty exists, three popular lines having advanced, while others are as yet stationary.

CONDUIT.—Black, galvanized and sherardized conduit and fittings are still the lines of poorest stock, greatest demand and poorest delivery from the factory.

LAMPS.—Standard lamps are again short, and some effort is being made to help the situation by combing out dealers' stocks that are disproportioned. Lamps rated at 40 watts and 50 watts are rather scarce, and all odd voltages require nearly a month for delivery.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61 00
No. 12 solid	71 00
No. 10 solid	90 00
No. 8 solid	106 00
No. 6 solid	145 00
No. 10 stranded	95 00
No. 8 stranded	115 00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185 00
No. 8 stranded	235 00
No. 6 stranded	370 00
No. 4 stranded	575 00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+30% to $73 20
Coil to 1000 ft	List

	No. 12 Solid
Less than coil	+30% to $85 20
Coil to 1000 ft	List

Twin-Conductor

	No. 14 Solid
Less than coil	$115.00
Coil to 1000 ft	100.00

	No. 12 Solid
Less than coil	+20% to $162.00
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1 5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1 5 std. pkg	+30% to 12%
1/5 to std. pkg	+5% to 20%
Std. pkg	18% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 45 – $0 46	$0. 45—$0 47
2 to 50	40	40— 41
50 to barrel	.35— .36	.36— .37
Barrel lots	32— 329	.33— .339

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 40 to $0.45	$0.40 to $0.45
12 to 50	35 to .39	.35 to .39
50 to barrel	.319 to .362	.329 to .382
Barrel lots	.289 to .332	.299 to .342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5 00
3/8	250	7 50
½	100	10 00
¾	50	13 00
1	50	21 00
1¼	50	26 00
1½	25–50	35 00
2	25–50	45.00
2½	25–50	52 00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75 00	$63 75— 69 75
3/8-in. double strip	75.00— 82.50	72.00— 75 00
½-in. single strip	100 00	85 00— 93.00
½-in. double strip	100.00—110.00	96 00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75 00	$63 25 to $63 75
3/8-in. double strip	78.25 to $90.00	71.25 to 75 00
½-in. single strip	100.00	75 00 to 85.00
½-in. double strip	105.00 to 120.00	93.00 to 100.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0.05½	1	$0 25
¼	.06	1¼	.33
3/8	.09	1½	40
½	.12	1¾	47
5/8	.15	2	.55
¾	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$25.60–51.70	$24 60–35 20	$23.00–30.25
¼-in.—	30.00–56.40	28.00–38.40	26.00–33 00

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$44 00–60.00	$30.00–33 00	$26.50–29 15
¼-in.—	48.00–65.00	33 50–36 00	29.00–31.80

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
¼	$0.08½
3/8	.08½
½	.08½
¾	.11½
1	.17
1¼	23
1½	.27½
2	.37½
2½	.58½
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0 05	$0 19
3/8	.06	.19
½	.07	.19
¾	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1 10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	7% to 7 1%	9% to 9 1%
2500 to 5000 lb.	10% to 10 1%	12% to 12.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+5.5% to 3.5%	+3.5% to +1.5%
2500 to 5000 lb.	+2.5% to +0.5%	+5% to 1.5%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$6.00 to $7.00
Discount	20% to 30%

CHICAGO

List price	$6.00 to $7.00
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	Lis
3-amp. to 30-amp	100	$0.25
35-amp. to 60-amp	100	.35
65-amp. to 100-amp	50	.90
110-amp. to 200-amp	25	2 00
225-amp. to 400-amp	25	3.60
450-amp. to 600-amp	10	5.50
600-Volt		
3-amp. to 30-amp	100	$0 40
35-amp. to 60-amp	100	60
65-amp. to 100-amp	50	1.50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5 50
450-amp. to 600-amp	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	30%
1/5 to std pkg.	41% to 45%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	30%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$6.00 to $9 37
1/5 to std. pkg.	5.25 to 7 00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8 00
1/5 to std. pkg	7.00

Standard packages, 500. List, each, $0.07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	85
75-watt—C	50	70
100-watt—C	24	1 10
200-watt—C	24	2 20
300-watt—C	24	3.25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4⅜-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30 47—$40.77
Coil to 1000 ft	27 42— 30 22

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$38.00
Coil to 1000 ft.	28.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24 00

CHICAGO

Net per 100	$23.93 to $30 00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30 00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30 00
103—C.A., 9, 4R, B 1½	25 00
106—F.A., 7, C.S., 1½, 3 R.	20 00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%	20%
$10.00 to $50.00 list	36%	31%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20%	10%
$10.00 to $50.00 list	30%	20%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std pkg	5%
1/5 to std. pkg	15%
Std. pkg.	25%

PORCELAIN CLEATS—UNGLAZED,

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$21.00 to $34 00
1/5 to std. pkg	17.85 to 28.90

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$21 00–24 15
1/5 to std. pkg	17 85-21 00

Standard package, 2200. List per 1000, $20.00–21.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.—Solid Nail-it—	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg	$16 00 to $22 00	$32 00
1/5 to std. pkg	13.60 to 18 70	27 20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid Nail-it—	Std. Pkg. 4000 N.C.
Less than 1/5 std. pkg	$13.00–$18 40	$32.00–$36 80
1/5 to std. pkg.	11 50– 16.00	27 20– 32 00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0 33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List
1/5 std. pkg.	10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0.80
60-amp. S. P. S. T.	1 20
100-amp. S. P. S. T.	2 25
200-amp. S. P. S. T.	3 48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1 20
60-amp. D P. S. T.	1 78
100-amp. D. P. S. T.	3 38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T	1 80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T	5 08
200-amp. 3 P. S. T	7 80
300-amp. 3 P. S. T.	12 00
Low Grade:	
30-amp. S. P. S. T	$0.42
60-amp. S. P. S. T	74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T	2.70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T.	1 22
100-amp. D. P. S. T.	2 50
200-amp. D. P. S. T.	4 50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1 84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6 76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15% to +10%
$10 to $25 list	+10% to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5% to list
$10 to $25 list	List to 8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 15%
$10 to $25 list	List to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15% to 16%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0 28
5-amp. single-pole, ind.	250	32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0 45
10-amp. three-way	50	70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List to 10%
1/5 to std. pkg	10% to 16⅔%
Std. pkg	18% to 25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0 34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list.	Net to 30%	Net
$2.00 to $10.00 list.	10% to 35%	5%
$10.00 to $50.00 list.	20% to 37%	10%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list.	25% to 40%	20% to 30%
$2.00 to $10.00 list.	25% to 50%	20% to 40%
$10.00 to $50.00 list.	25% to [illegible]	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price.	$6 00 to 6 50
Discount.	20% to 30%

CHICAGO

List price.	$6 00 to $7.00
Discount	20% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.54–$0 66
No. 18, full spools	.52– .56

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.65 to $0.71
No. 18, full spools.	.55 to .595

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$20 00–$25.00	$15.00–$17.00	$15.00–$15.75
12	23.58– 27 09	21 62– 29.09	17.68– 23 22
10	30 20– 37 80	27.45– 32.40	23.47– 32 40
8	42 74– 53.34	38 85– 45 72	33.21– 45 72
6	61.50– 84.42	55 35– 72 36	52.58– 55 48

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$25.00	$18.00–$25.0	$15 50
12	$29.46– 31.44	29.46– 31.44	25.54– 31.44
10	41 10– 43.84	41.10– 43.84	34.62– 38.36
8	57 00– 61 76	57.00– 61 76	50.18– 54 04
6	85.31– 97 68	85 31– 85.47	77 21– 85 47

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$39 75 to $44 00
25 to 50 lb.	39 75 to 42.00
50 to 100 lb.	38.75 to 40.00

CHICAGO

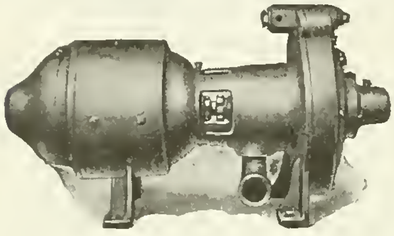
	Per 100 Lb. Net
Less than 25 lb	$41 00 to $41 76
25 to 50 lb	39 75 to 40 76
50 to 100 lb.	38 75 to 39 76

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Three-Bearing Steam-Driven Lighting Sets

Built for generating electrical energy wherever steam is available, the Lucey Manufacturing Corporation, Woolworth Building, New York City, is making a steam turbine and an electric generator in one complete unit. Two sizes are obtainable, a ¾-kw. machine and a 1½-kw. outfit which generates electricity for sixty 25-watt lamps or their equivalent.



TURBO-GENERATOR SET READILY INSTALLED

The two sizes are very similar in design, each being assembled on a single base and having a small steam turbine mounted on the same shaft with a 110-volt direct-current dynamo. The shaft is supported on three ball bearings and the entire mechanism is completely inclosed. It is said that there is little vibration with the "Turbolite," as the device is called. There is a governor in the turbine wheel which may be adjusted without disassembling the machine. Steam pressure of from 75 lb. to 150 lb. will result in the outfit running at from 2500 to 3000 r.p.m. Because of its simplicity and portability it is said to be adapted for construction work and ship lighting besides other uses.

Interchangeable Cut-out Bases

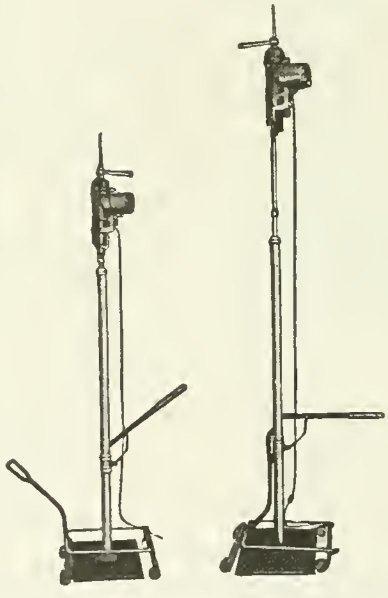
The use of "Noark" tap straps now enables the same "Noark" cut-out bases to serve on either branch or main lines, thus reducing the quantity of material needed by wiremen and the stocks carried by supply houses.

The cut-out bases are obtainable in two ampere capacities, 0-60 and 61-200, in one-pole, two-pole and three-pole sizes, and in various styles and voltages. The contacts are secured in the porcelains without screws passing through from underneath, consequently doing away with waxed counterboxes, yet interposing a solid insulating body between the live metal parts and the surface upon which the bases are mounted. While securely positioned the contacts are purposely loose, enabling them to maintain perfect junction with the ferrules of fuses. The tap straps are made in five different kinds for each style of base.

Many combinations are said to be made possible by these interchangeable bases and tap straps which are being made for National Electrical Code fuses by the Johns-Pratt Company of Hartford, Conn., and are being distributed by the H. W. Johns-Manville Company of New York City.

Floor Stand for Portable Drill

In drilling holes in ceilings for wiring the vibration of a portable electric drill resting on his shoulder is annoying to the operator. To obviate this disadvantage A. J. Grenzig of 370 Pearl Street, Brooklyn, N. Y., has invented and is manufacturing a holder for portable drills. Not only does this stand hold the drill in a firm operating position, but it may also be wheeled about.



READY TO BE WHEELED ABOUT AND IN STATIONARY POSITION

Heavy pipe forms the upright structure of the device, which is equipped with a cast-iron base and a set of wheels. A handle is furnished which when resting against the post draws the wheels above the floor, insuring a firm foundation on the base, but which drops the wheels to the floor when drawn out to move the stand around. The height and pressure of the drill are regulated by a lever on the side which moves the post upward and downward.

Bench-Type Buffing and Grinding Motors

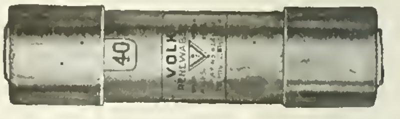
A number of sizes of double-wheel buffing and grinding motors for bench work have been added to its line of pedestal type grinders by the U. S. Electrical Manufacturing Company of Los Angeles, Cal., which the makers say have proved very useful in shipbuilding and other shops.

The alternating-current motors of the rigid riveted-frame type range from 0.5 hp. to 3 hp. and are totally inclosed, having exposed laminations to facilitate heat radiation. Multiple machine-wound coils of enameled cotton-covered wire form the stator windings, all connections being incased in heavy cotton-covered paper tubes. Rugged squirrel-cage rotors are used and the shaft runs in ball bearings. Provision is made for lubrication by liberal reservoirs from which grit and dust are excluded by sealing rings incorporated in the housing.

Spindles are of heavy one-piece steel construction, while the grinding seats are adjustable in all directions and, if desired, can be removed. The wheel guards are said to be sturdily constructed and the waterpots can be swung out of the way under the table of the grinder. The manufacturers furnish either push-button control or no-voltage-release switches as extra equipment if so desired.

Renewable Fuse with Visible Ampere Rating

Both ferrule and knife-blade styles may be obtained in the renewable fuses being manufactured by the Volk Manufacturing Company, Westport, Conn. Better arc-suppressing qualities are said to be obtained from these fuses because the fusible link is not fastened to the contacts on the inside but is folded over so that a small portion lies on the exterior of the fuses underneath the contact caps. In this way a larger amount of arc-smothering material is placed inside the fuses than if the link contact blocks occupied some of this space. Another feature pointed out by the manufacturer is the current mark-



VISIBLE END OF FUSIBLE LINK CONTAINS AMPERE RATING

ing on the end of the link that is visible on the outside of the fuse. This assists in preventing renewing fuses with improper ampere links. A screwdriver is the only tool necessary to reload the knife-blade type.

Portable Conveyor

A considerable saving in both time and labor in loading, unloading and piling operations is said to be effected by the portable machine shown in the accompanying illustration and made by the Brown Portable Conveying Machinery Company of 105 La Salle Street, Chicago. Many different kinds of material may be handled by the conveyor, the manufacturers stating that sugar and flour in bags can be loaded or unloaded with the same ease and celerity that boxes and baled hay are piled up. Warehouses, freight yards and factories are the fields of activity for this machine, which is operated by a 3-hp. type C. S. Westinghouse motor.

FOR INDOOR AND OUTDOOR LOADING OR UNLOADING AND PILING

Ornamental Sewing Lamp

Having a complete sewing outfit, pegs for spools of thread, and with the base hollowed out as a receptacle for buttons and other accessories, a lamp has been put on the market by the American Lamp Company, 506 South Wabash Avenue, Chicago. The lamp is made in two styles, a floor height and a portable-table size. Hand-carved wood having a rubbed mahogany finish is used for the base and pedestal, while the shade is metal, finished on the outside in mahogany with decorations and on the inside with aluminum for reflection purposes. Cutler-Hammer push-buttons and Benjamin swivel plugs are a part of these sewing lamps, which are supplied with a length of silk cord.

Double-Duty Spotlight

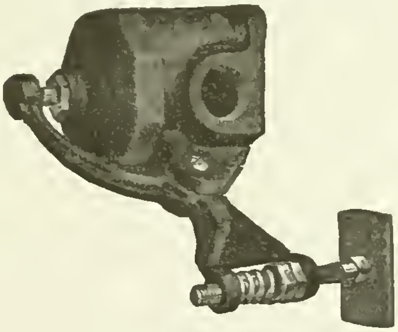
For use as a conventional automobile spotlight and likewise as a danger signal, the "Red Spot" searchlight has been placed on the market by the F. W. Wakefield Company of Vermilion, Ohio. Back of the bulb in the spotlight is a red cylinder which, upon the operation of a button, incloses the bulb and converts the light from white into red. Protection is thus afforded from approaching cars while making roadside repairs. When the red light is turned toward the rear it may serve as an emergency tail-light or to give notice that the car has been stopped in the line of traffic. This feature might be used to advantage by trucks engaged in urban distribution repair work.

Because the rotary switch, socket, lamp and cylinder are in one complete unit it is said they can be removed from the back of the spotlight without risk of damaging the reflector. Heavy-gage steel with the enamel baked on is utilized for the outside shell, which is made to be dust-proof, water-tight and moisture-tight and to eliminate vibration and rattle.

A searchlight mounted on a pedestal base may also be obtained for use on yachts and motor boats.

Marine Water-Tight Door Switches

The door switches which are illustrated here are designed for the purpose of acting instantaneously when the door to which they are attached is opened even slightly. The devices are water-tight and made rugged throughout in order to stand up under the marine service. The mechanisms are positive and quick in action; less than 0.25 in. (0.8 cm.) movement in the door actuates the switch and makes or breaks the circuit.



WATER-TIGHT, INDIRECT-ACTING, LEVER-TYPE SWITCH

They are made in two types, termed direct-acting and indirect-acting. In the direct-acting the plunger impinges directly against the door. In the indirect-acting type the door actuates a lever plunger protected by a spring against slamming or shocks. Both types are adjustable for any direction of conduit entrance and may also be adjusted for varying widths of door frame. They are manufactured by the Benjamin Electric Manufacturing Company, 806 West Washington Boulevard, Chicago.

Electrically Started Lighting Plant

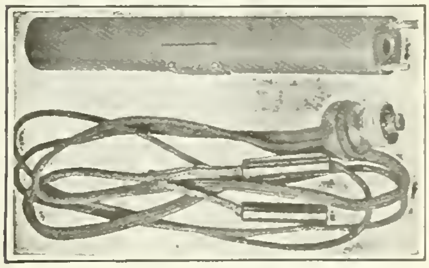
For lighting farms and isolated buildings the Roberts-Hamilton Company of Minneapolis has developed a direct-connected engine and generator plant, including a switchboard and storage batteries. In starting the plant the generator is used as a motor to crank the engine. Power for operating machinery is provided by a pulley on the shaft. Six sizes of these plants, known as the "Rohaco," may be obtained with generators ranging from 40 volts and 25 amp. to 50 volts and 30 amp., some of which use lead batteries and others Edison batteries. The engine is of single-cylinder, jump-spark design and is directly connected to the ball-bearing generator. Voltmeter, ammeter, back-of-board rheostat, inclosed fuses and a starter and contactor switch are mounted on the switchboard.

Low-Voltage Field Rheostats

Moderate-priced field rheostats for use on farm-lighting plants, battery-charging outfits, etc., are being manufactured by the Knoeller Electric Company, De Pere, Wis. The cases of these units are of cast iron, with cast-iron covers, and the contact buttons are mounted on a slate base. The usual style provides twenty-five steps. To protect the resistance units from deterioration from heat and moisture the resistance wire is wound on asbestos tubes and coated with several layers of high insulating fireproof cement. The handwheels are made of seasoned oak properly treated in oil and given three coats of enamel. Rheostats for mounting either on the front or the rear of switchboards can be supplied.

Electric Heater for Use with Medicinal Solutions

In warming solutions for medicinal purposes it is often essential that an even temperature be maintained. With this end in view the William H. Dalton Company of Salem, Mass., is making an electric heater which incloses the tubing carrying the solution from the supply to the point of application so that as the solution is needed it is heated to an even temperature. By using a light-dimming socket in conjunction with the heater it is possible to lower or raise the temperature of the solution by varying the amount of current fed to the heater. Connecting plugs and cord are supplied with the heater as well as a plug for insertion in the ordinary light socket, thus making it possible to carry the heater wherever needed.



INCLOSES LIQUID-CARRYING TUBE

Trade Notes

SMOKING LAMP SPECIFICATIONS.—The Bureau of Steam Engineering of the Navy Department has issued a set of proposed specifications for smoking lamps and cigar lighters.

THE COMBUSTION CHAMBER.—The Under-Feed Stoker Company of America, Chicago, has changed the name of its monthly publication from the *Publicity Magazine* to the *Combustion Chamber*.

FRENCH PRODUCTION OF LAMPS.—The present production of incandescent lamps in France is between 15,000,000 and 20,000,000 lamps per year. This may be doubled in the near future, according to M. A. Larnaude, writing in a recent issue of the *Bulletin* of the Société Internationale des Electriciens.

FIRING INSTRUCTIONS IN FOREIGN LANGUAGES.—Complete instructions for the best operation of Jones underfeed stokers have been printed in Polish, Portuguese and Italian by the manufacturers, The Under-Feed Stoker Company of America, Harris Trust Building, Chicago. These are ready for distribution and will be mailed on request. Instructions in English are of little use to boiler-room labor of foreign birth as a rule.

OCEAN SHIPPING PREFERENCE RULES FOR SOUTH AMERICA.—The War Trade Board, after consultation with the shipping control committee of the United States Shipping Board, announced on Nov. 11 the adoption of a new procedure known as W. T. B. R. 301, effective Nov. 18, 1918, for the obtaining of ocean shipping preference for shipments of any commodity, excepting coal, coke, and fuel oil, which are (a) destined to the following countries on the eastern coast of South America, viz., Brazil, Uruguay, Paraguay and the Argentine, or (b) destined to any country or colony by way of Brazil, Uruguay, Paraguay and the Argentine.

ENGLISH EXPORTS FOR AUGUST.—During August last England's foreign trade in electrical goods and machinery was as follows, according to the London *Electrical Review*:

	August	Increase or Decrease	Eeight Months, 1918, Increase or Decrease
Imports:			
Electrical goods	$334,620	—$151,970	—$1,038,655
Machinery...	4,620,500	+530,950	+9,415,230
Exports:			
Electrical goods	$831,155	—$455,705	—$3,747,450
Machinery...	6,824,940	—1,396.815	—13,583,935

ISSUANCE OF EXPORT LICENSES.—The War Trade Board announced on Nov. 8 that the regulations heretofore prescribed as to the signing of applications for export licenses, as set forth in W. T. B. R. 214, issued Sept. 10, 1918, have been rescinded. The regulations requiring the filing of powers of attorney have also been rescinded. In order to facilitate the work of filing applications for export licenses, the War Trade Board will now accept applications if it shall appear from the application itself that it bears the personal signature, in ink, of the consignor or of some person to whom the consignor has delegated the duty of signing applications. Shippers will be held responsible, as heretofore, for all statements made upon applications and for full compliance with all rules and regulations of the War Trade Board, and their attention is called to the following provision contained in the form of export license: "By accepting or acting under this license the person to whom the same is issued warrants the correctness and truthfulness, (1) of all answers made and statements contained in the application filed with said board for this license, and (2) of all information given in response to any further requirements of said board in connection therewith, which application and information are by reference made parts hereof."

IMPORTANT LABOR PRECEDENTS.—Since the establishment of the National War Labor Board in April, 1918, 673 cases have been filed with the board for adjudication. The board has made awards and otherwise disposed of 358 industrial disputes in war and essential industries, and 315 cases were awaiting settlement Nov. 1. Among the cases establishing important precedents were: Smith & Wesson Company, Springfield, Mass., and Bridgeport, Conn., munitions plants, enforcement of board's decision by government action; Western Union Telegraph Company, discrimination against union members forbidden; Bethlehem Steel Company, right of men to bargain collectively affirmed; St. Joseph Lead Company, right of employers to refuse recognition of unions affirmed when no such arrangements were in force prior to controversy; Waynesboro and Galesburg cases, minimum wages based on cost-of-living determination; American Locomotive Company, Schenectady, N. Y., overtime payment on basic eight-hour day schedule, to be calculated for time over forty-eight-hour week divided into six daily periods of eight hours; newsprint paper manufacturers, readjustment of wages at specified periods; railway awards of July 31, financial recommendation that legislature and public service commission take action to enable companies to pay wage advances awarded by permitting increased rates for transportation. The last principle was also established for commodity prices by award in newsprint paper case.

EXPORT LICENSES VALID UNTIL USED.—The War Trade Board announces that, except as here set forth, all export licenses issued on or after Nov. 15, 1918, and all export licenses which were unexpired on Nov. 15, 1918, will be valid until used, unless revoked, notwithstanding that such licenses are stamped as expiring on Nov. 15, 1918, or subsequently thereto. Collectors of customs and the Post Office Department have been advised accordingly. The foregoing rule does not apply to licenses for the exportation of any commodity to Norway, Sweden, Denmark proper, European Holland, Iceland, the Faroe Islands, Switzerland or Greece. The regulations with respect to the preparation and filing of shippers' export declarations remain in effect.

SALE OF FRANKLIN ELECTRIC BRINGS NO SALE CHANGES.—The capital stock of the Franklin Electric Manufacturing Company, Hartford, Conn., as announced in the ELECTRICAL WORLD last week, has been purchased by the Westinghouse Lamp Company. The Westinghouse Lamp Company announces that the corporate identity of the Franklin Electric Manufacturing Company will continue, and that manufacturing operations and sales activities will be conducted under the management of the present personnel. The only notable change among the officers of the Franklin Electric Manufacturing Company has been the election of Walter Terry as president, succeeding the late Jonathan Camp. Both the Franklin Electric Manufacturing Company and the Westinghouse Lamp Company are manufacturers of "Mazda" incandescent lamps.

THE 1919 LYONS (FRANCE) SAMPLE FAIR.—American Consul Clarence Carrigan, in a report calling attention to the fact that many catalogs intended for exhibition at the 1918 sample fair in Lyons, France, did not arrive in time, suggests that it is not too early for American manufacturers and exporters to begin preparations for the 1919 Lyons fair. The 1918 fair was highly successful, the consul submitting nearly 1200 "trade opportunities" growing out of the American catalog exhibit held under the auspices of the American Consulate in Lyons. Even greater results are looked for from the 1919 fair, which will be held in March, and for this reason the consul is anxious that no American firm desirous of participating should fail because of delay in forwarding catalogs. The consulate plans to hire space at the fair and to exhibit American trade catalogs free of charge as in previous years. Consul Carrigan suggests that the display of actual samples, rather than catalogs only, would be preferable wherever this is possible.

COMPANY ADOPTS LIBERAL POLICY TOWARD BOYS RETURNING FROM UNITED STATES SERVICE.—Employees of the Robbins & Myers Company, Springfield, Ohio, who have been in the United States military or naval service will receive, upon their return, substantial evidence that the company appreciates the sacrifices they have been making. The company has decided that, so far as possible, every man who has been in active service or training for active service shall upon his release have his old job back. In cases where it proved impossible to hold open positions the men returning will be provided with something offering compensation equal to what they were receiving at the time they left. Time spent in the nation's service will be regarded exactly the same as time spent in the service of the company so far as service bonuses and insurance policies are concerned. This means that the men who have been gone for any considerable length of time will find upon their return that both their company insurance and their service bonus rate have increased. The company states that "this will be accomplished without in any way displacing or 'demoting' any of those employes who have served the company so faithfully during the present trying period of labor shortage. The company feels that these men and women who have helped bridge the gap are equally entitled to substantial proof of its appreciation."

FOREIGN-TRADE STATISTICS TO BE REVISED AND EXTENDED.—An important revision and extension of the monthly, quarterly and annual foreign-trade statistics published by the Bureau of Foreign and Domestic Commerce, Department of Commerce, are announced to take effect in the near future, probably on Jan. 1. More than 1500 new items will be added to the export classification and the number of import items shown will be materially increased. The plans now nearly completed provide for an enlarged classification for both imports and exports, instead of the two classifications at present used, and instead of the present alphabetical arrangement of items by commodities there will be a more general assembling of items under great groups. As early as last spring the Bureau of Foreign and Domestic Commerce publicly invited suggestions from business men. Adaptability to mechanical tabulation has been kept in mind in making the changes. As there is now a bill in Congress providing for the publication of annual trade statistics by calendar instead of fiscal years, it is possible that the change in classification will coincide with a change to calendar-year figures. Those in favor of the change to the calendar year argue that it will conform to the business year of practically all American industries and will also facilitate comparison with statistics of most foreign countries, which are now compiled on a calendar-year basis.

REPAIR OLD FANS AND SAVE METALS.—The Emerson Electric Manufacturing Company, St. Louis, Mo., which with the other manufacturers of fan motors has pledged itself to the War Industries Board for the conservation of material and labor in every possible way, including in the pledge a provision to encourage the repair of electric fans now in use, has addressed the following statement to its customers: "The junk pile undoubtedly receives each season a large number of electric fans which could be repaired at reasonable expense and made suitable for one to five years' additional service. Even fans which are ten years old, if they are Emerson induction fans, can usually be made just as serviceable as new at an expense of less than one-half the cost of a new fan. The higher prices which it has been necessary to charge for new fan motors during the past year have undoubtedly stimulated the repair business, but it should be susceptible of further increase by well-directed efforts on the part of lighting companies and dealers. It is not too early even now to carry out plans to get the fans in for repairs. Delays in transit under present conditions are not infrequent and must be reckoned with. Many kinds of material are difficult to procure promptly; this sometimes delays the progress of repair work. Central stations and dealers who have fans in their stock which need repairs should by all means send them in now. Do not wait even until Jan. 1. There is no indication that fan motors will be more plentiful or lower in price during 1919, and the congestion of repair work as the season draws near will doubtless be correspondingly increased."

THE AUSTRALIAN MARKET FOR ELECTRICAL GOODS.—The market of Australia for electrical machinery and equipment of every kind is important, and certain to grow rapidly, according to a report on the trade of Australia prepared by the trade commission of the commonwealth and abstracted in the London *Electrical Review*. Various schemes for the production and transmission of electrical energy are under consideration at present, but are held up. The United Kingdom's chief competitor in this trade is the United States, although Italy and Sweden also contribute. As regards appliances other than machinery, Japan has made rapid progress. Recently, a Japanese firm introduced a wire-covered cable with a label attached to the coil hearing the letters "C.M.A.," the obvious inference by the uninitiated being that the firm is a member of the Cable Makers' Association. As the result of representations made by the trade commissioner to the Department of Customs, it has been decided to regard the letters "C.M.A." or the word "Association," when unqualified, as indicating that the manufacturer of the goods is associated with the British Cable Makers' Association and that the goods have been manufactured in accordance with the specifications of that association. It has also been decided that statements such as "Guaranteed equal in all respects to C. M. A. product of similar grade" may be used on wires and cables manufactured by non-members of the Cable Makers' Association provided that the goods are thereby correctly described. This decision appears to throw on the Customs Department the obligation of seeing that the goods are correctly described. Exports to Australia and Tasmania for the year 1912 were as follows: England, $3,662,189; United States, $1,114,875 (1912-13); Germany, $455,600. During the fiscal years ended June 30, 1914, 1915, 1916 and 1917 the exports from the United States to Australia were respectively as follows: $1,404,793, $1,970,202, $1,776,355 and $1,321,854.

THE OHIO BRASS COMPANY has moved its New York office from 30 Church Street to 1781 Hudson Terminal Building, 50 Church Street.

THE AMERICAN VULCANIZED FIBER COMPANY of Wilmington, Del., has become a member of the Rice Leaders of the World Association.

HICKEY & SCHNEIDER, INC. has transferred its New York office to its factory at Elizabeth, N. J., where all communications should be sent hereafter.

THE BALTIMORE ELECTRICAL SUPPLY COMPANY, 307 North Calvert Street, Baltimore, Md., announces that its office at Atlanta, Ga., has been closed.

THE WESTERN ELECTRIC COMPANY has moved its supply department at Cincinnati, Ohio, from 129 Government Square to 310-312 Elm Street.

THE MECHANICAL APPLIANCE COMPANY, Milwaukee, Wis., has moved its Detroit (Mich.) office from 117 Larned Street, West, to 955 Woodward Avenue.

A. G. CHAPIN has been appointed New England manager of the National Conduit & Cable Company, Inc., and the National Brass & Copper Tube Company, Inc., with headquarters at 200 Devonshire Street, Boston, Mass.

THE LUMINOUS UNIT COMPANY, St. Louis, Mo., has moved its Boston (Mass.) office from 232 South Building to 217 Old South Building, and its Cincinnati (Ohio) office from 515 Johnstone Building, to 318 Johnstone Building.

S. M. MOORE, for the past six years connected with the New Haven (Conn.) office of the General Electric Company, has been appointed service manager of the New England Engineering Company, with headquarters at Waterbury, Conn.

THE PERFECLITE MANUFACTURING COMPANY, lighting fixture manufacturer, has recently moved into new quarters at 119 Main Street, Seattle, Wash. The company was formerly located in the Century Building in the same city.

THE STANDARD & BRONZE MANUFACTURING COMPANY, Pittsburgh, Pa., manufacturer of lighting fixtures, has opened its new showroom at 636 Penn Avenue, Pittsburgh, where the entire eight floors will be given over to the manufacture and display of its products.

THE QUASI-ARC WELDTRODE COMPANY, INC., formerly of 107-109 Lafayette Street, New York, announces that, owing to the necessity for largely increased space, it has moved to its new offices, factory and laboratories at Atlantic Avenue and Warwick Street, Brooklyn, N. Y.

THE LIBBEY GLASS COMPANY of the General Electric Company suffered a loss through fire a week or so ago amounting to $110,000. Fortunately the fire was confined to what was known as the "old plant." This plant, which manufactures lamp bulbs, was acquired by the General Electric Company only a short time ago.

LACLEDE-CHRISTY, St. Louis, Mo., manufacturer of refractory materials, is informing customers that it has a considerable stock of all standard firebrick ready to ship and is prepared to give unusually quick delivery on any special shapes that may be desired.. The concern has been accumulating this supply in anticipation of the reconstruction market.

THE H. C. ROBERTS ELECTRIC SUPPLY COMPANY, Philadelphia, Pa., and Syracuse, N. Y., is distributing two styles of alcohol torches, one of which has a thumb-screw adjuster for the blowpipe, while the other style uses a spring to change and hold the pipe in position. This company is also marketing a portable hand-operated pipe-bending machine and a fixture block fitting four sizes of canopies.

KOCH & SANDIDGE, 19 South Wells Street, Chicago, are marketing a small-sized storage battery utilizing pasted lead electrodes, but which is called a dry battery because the electrolyte is held absorbed. These batteries, which are manufactured by the Stolp Company of Chicago, are rechargeable and may be obtained in 0.5-amp. to 5-amp. capacities.

THE FEDERAL PORCELAIN COMPANY reports that its new porcelain factory at Carey, Ohio, is now in full operation for the manufacture of all standard porcelain insulators, such as solid knobs, split knobs, telephone knobs, cleats, tubes, etc. The plant is built with every modern improvement, is of six-kiln capacity, and is conveniently located on three railroads, providing excellent shipping facilities.

THE ASSOCIATED ENGINEERS COMPANY, 180 North Dearborn Street, Chicago, has recently developed and placed on the market a signal lamp to take the place of a bull's-eye lamp in indicating oil-switch positions on switchboards. Among the advantages of this lamp pointed out by the makers is that switchboard-panel cracking is not possible as is sometimes the case with built-in signal lamps, which heat excessively.

C. B. HUGHES, who has been connected with the Minerallac Electric Company, Chicago, for six and one-half years, has been placed in charge of the sales of the insulating varnishes and wood-preservative oils of the Sherwin-Williams Company in the Middle Western district, with headquarters at Chicago. Mr. Hughes was sales manager of the Minerallac Electric Company and prior to his connection with that concern was employed for six years by the Chicago Telephone Company.

THE ELECTRIC FURNACE COMPANY, Alliance, Ohio, it is reported, is planning the removal of its plant shortly to Salem, Ohio, where property has been purchased for the purpose of securing a building adapted to the growing needs of the company. The Electric Furnace Company is engaged, according to the latest reports, in filling government orders for melting furnace equipment, and it is understood that at the new location the working force will be increased from 60 to 200 or 300 men.

EDWIN G. HATCH, 120 Broadway, New York City, is now manufacturing and shipping in large quantities Bergman tubing, a form of conduit usel quite extensively in South America and the Far East. This conduit consists of a paper tube wound spirally and impregnated with some asphaltum compound, this paper tubing being covered with a thin soft-brass tube with its edges crimped together. The tubing is being made in 9-mm. and 11-mm. sizes with plain sleeve couplings attached to each 3-meter length.

BROWN-WHITE, INC., Colonial Trust Building, Philadelphia, has recently been formed to take over the business of the Frank W. Watts Company, manufacturers' agent, of the same address. The company now acts as agent for the Electric Machinery Company, of Minneapolis, Minn., Delta Star Electric Company, Chicago, Ill., Ideal Electric & Manufacturing Company, the National X-Ray Reflector Company, of Chicago, and the Harris Pump & Supply Company of Pittsburgh. H. R. Smith, district manager of the Electric Machinery Company, has recently joined the company.

THE WEYANT ELECTRICAL COMPANY, INC., New York City, export agents for electrical manufacturers, has recently undergone a change in organization. W. R. Weyant has resigned as treasurer and Henry J. Rivoire has been elected in his place. Charles M. Weyant is succeeded by Leo D. Barrer, who will assume the duties of general manager in addition to those of export manager and vice-president of the company. A warehouse is maintained at 222 Madison Street, Brooklyn, N. Y., where a large stock of electrical supplies is carried for immediate shipment. The company represents the following manufacturers for export: Harvey Hubbell, Inc., Bridgeport, Conn.; Hoyt Electrical Instrument Works, Penacook, N. H.; Connecticut Electric Manufacturing Company, Bridgeport, Conn.; Brady Electric & Manufacturing Company, New Britain, Conn.; Viking Electric Company, New York City; Incandescent Lamp Products Company, Newark, N. J., and the Jewel Lamp Company, Newark, N. J. The Weyant Electrical Company has agents in the Philippine Islands, Shanghai, Dutch East Indies, Spain, Portugal, Argentina, Brazil and Chili, and it is the intention of the company from now on to confine itself mainly to foreign trade, in view of the increasing volume of exports.

Trade Publications

BELT CONVEYORS.—All phases of the belt conveyor are covered in catalog No. 175 from the Jeffery Manufacturing Company of Columbus, Ohio.

HOISTING MACHINERY.—A fifty-six page catalog entitled "Brown Hoist" gives illustrated descriptions of the products of the Brown Hoisting Machinery Company of Cleveland, Ohio.

ADJUSTABLE LIGHTING FIXTURE.—The Raymo adjustable fixture for store and office lighting is listed and illustrated in two leaflets from the Moran & Hastings Manufacturing Company, 16 West Washington Street, Chicago.

WASHING MACHINES.—The One-Minute Manufacturing Company of Newton, Iowa, has issued a forty-page catalog describing and illustrating its hand-power, electric-power and belt-power washers, cleaners and iceless refrigerators.

POWER-PLANT DEVICES.—A set of bulletins dealing with "Yarway" power-plant devices and contained in a binder inscribed "Engineering Devices for the Power Plant" has been prepared by the Yarnall-Waring Company of Philadelphia.

WEATHERPROOF AND MOTOR PLUGS.—Circular No. 158-25M distributed by Harvey Hubbell, Inc., Bridgeport, Conn., has for its topic weatherproof plugs and plugs for motor-equipped devices requiring separable plug connection.

BELTING.—"Standardized Leather Belting" is the title of a forty-page booklet published by the Graton & Knight Manufacturing Company of Worcester, Mass. Much useful information and many rules and tables are included in this publication, which is obtainable upon request.

FLOODLIGHTING.—"X-Ray Floodlighting" is the name of a new booklet published by the National X-Ray Reflector Company. It explains the important part floodlighting is playing in the war. Protection lighting, as well as outdoor lighting for night work, is discussed. Several new reflectors are featured in the book.

MARINE LIGHTING AND SIGNALING APPARATUS.—Panelboards, lever-type and direct-acting watertight door switches and revised list prices form the subjects of several sheets issued by the Benjamin Electric Manufacturing Company, 806 West Washington Boulevard, Chicago, for addition to its marine lighting and signaling apparatus catalog.

STORAGE BATTERIES.—Copies of the new editions of several sectional catalogs may be obtained from any sales office of the Electric Storage Battery Company, Philadelphia. Catalog Section SLI covers "Exide" batteries for starting, lighting and ignition service, price list section SLP lists parts of batteries in section SLI, while price list section MS lists up-to-date types of "Exide" batteries for replacing obsolete styles and the parts for these older batteries.

New Incorporations

THE VESTA BATTERY SERVICE COMPANY of Newark, N. J., has been incorporated with a capital stock of $25,000 by L. M. Boice and C. R. Pinney. The company proposes to specialize in battery construction and do repair work, etc.

THE STANDARD INSULATION COMPANY of East Rutherford, N. J., has been incorporated by G. J. and L. G. Lange and Sterling von Winkle. The company is capitalized at $200,000 and proposes to manufacture electrical equipment and devices, etc.

THE POWER MAKER COMPANY of New York, N. Y., has been incorporated with a capital stock of $100,000 by H. Auerbach, H. H. Smith, 834 Sterling Place, Brooklyn, and S. Andrews, 12 Locust Street, Flushing, N. Y. The company proposes to manufacture power plant equipment, etc.

THE CENTRAL NEW JERSEY POWER COMPANY of Morristown, N. J., has been incorporated by John W. Melick, Arthur S. Pierson of Morristown and Edward Wegman of Yonkers, N. Y. The company is capitalized at $125,000 and proposes to construct and operate an electric light and power plant in Morristown.

New England States

LEWISTON, ME.—The voltage of the power plant of the Lewiston, Augusta & Waterville Street Railway Company at Deer Rips has been increased from 11,000 volts to 22,000 volts. New electric transmission lines are being erected to Brunswick and Bath to supply additional energy. New equipment, including transformers, has been installed at the Bath station of the company.

PORTLAND, ME.—The Emergency Fleet Corporation of Philadelphia, Pa., is planning to build a dry dock at Portland, to cost about $2,100,000.

WATERVILLE, ME.—The Central Maine Power Company is installing a new generator at its Rice Rips plant. High-tension transformers of 650-kva. capacity each will also be installed.

PORTSMOUTH, N. H.—Plans have been prepared by the Emergency Fleet Corporation of Philadelphia for the construction of a 5000-ton dry dock at Portsmouth, to cost about $900,000.

PORTSMOUTH, N. H.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Nov. 25 (extension of date from Nov. 18) for the installation of electric traveling cranes in the machine-shop extension (Specification 3502).

BOSTON, MASS.—Drawings have been prepared for the proposed floating dry dock, shops and repair plant, involving an expenditure of about $10,000,000 at Jeffries Point, Boston, Mass., for the Emergency Fleet Corporation, Philadelphia, Pa.

HAZARDVILLE, CONN.—Work has begun on the construction of a new power house near the site of the old "Horseshoe" dam in "Powder Hollow." The power station will be erected on the north side of the Scantic River and will generate about 250 hp. The property was acquired last summer by Howard D. Gordon and William W. Howard from the Hercules Powder Company of Wilmington, Del. The new owners propose eventually to engage in extensive wool and textile manufacturing business. The work is in charge of the Ellison Construction Company of Hartford.

MILFORD, CONN.—The Selectmen have signed a contract with the United Illuminating Company of New Haven for lighting the streets of the town with electricity for a period of five years. The contract provides for about 400 lamps. It is hoped to have the system installed by Jan. 1, 1919.

WATERBURY, CONN.—The Connecticut Light & Power Company has petitioned the Public Utilities Commission for approval of the method of constructing an electric transmission line from Bunker Hill in Waterbury to its generating station at Oxford, on the Housatonic River.

Middle Atlantic States

ALBANY, N. Y.—Contract has been awarded by Burdick & Son, Hamilton and Mosher Streets, to the McCann Building Company for rebuilding its factory recently damaged by fire. New machinery, it is understood, will be purchased by the company, including metal-working apparatus, electric motors, etc. The cost is estimated at $25,000.

BROOKLYN, N. Y.—Improvements are contemplated by the Bureau of Yards and Docks, Navy Department, Washington, D. C., to the Brooklyn Navy Yard, consisting of thirteen portable buildings for general plant extensions. A new shop for light machine work, electrical repair operations and other service will also be erected, to cost with equipment about $800,000. Plans are also being prepared for rebuilding shipway No. 1, to cost about $400,000.

BUFFALO, N. Y.—Bids, it is reported, are being asked by G. Elias & Brother, 965 Elk Street, Buffalo, for the construction of a gas-producer house, boiler house and coal-storage building at Elk Street and the Buffalo Creek Railroad

MALONE, N. Y.—Bids will be received by Captain John A. Coffey, secretary of State Board of Armory Commissioners, 158 State Street, Albany, for addition to State Armory including construction, heating, sanitary and electric work. Plans and specifications may be consulted at the above office, at the New York office of the Department of Architecture, room 1715 Tribune Building, and at the Department of Architecture, Capitol, Albany. Lewis F. Pilcher is state architect.

NEW YORK, N. Y.—The United Electric Light & Power Company, 130 East Fifteenth Street, is planning to erect a new power station, 40 ft. by 50 ft., at 201st Street and Harlem River.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 2 for electric traveling cranes for machine and electric shop at the local navy yard, to cost about $12,000 (Specification 3609).

NIAGARA FALLS, N. Y.—Plans are under consideration by the Electro Metallurgical Company, Union Street, Niagara Falls, for an addition to its plant, to cost about $14,000.

NEWARK, N. J.—Plans are being prepared by the Rubber & Celluloid Products Company, Wilson Avenue, Newark, for rebuilding its plant, recently destroyed by fire, causing a loss of about $100,000. The new building will be 42 ft. by 390 ft., one and two stories high, to cost about $50,000.

SOUTH AMBOY, N. J.—Contract has been awarded by the Raritan River Railroad Company to the Austin Company, 1319 Filbert Street, Philadelphia, Pa., for erection of engine house at its local yards, to cost about $200,000.

WEEHAWKEN, N. J.—The plant of the Independent Lamp & Wire Company, Gregory Avenue, was recently destroyed by fire, causing a loss of about $75,000.

ALTOONA, PA.—The Pennsylvania Railroad Company is planning to enlarge its shops at Altoona and Juniata, for which authorization has been received from the United States Railroad Administration. The plans provide for additional electric and steam power for both the Altoona and Juniata shops, and new equipment to be purchased will include turbines, rotaries, transformers, switches and transmission lines. New stokers will be installed under the present boilers at the Altoona machine shops. An extension, 240 ft., will be built to the Juniata erecting shop, and other changes will be made to increase the output of locomotives. The cost of the work is estimated at $2,000,000.

MARIETTA, PA.—The Pennsylvania Railroad Company is planning to erect a new engine house, machine shop, general shops, power house and other buildings on a site recently acquired in Marietta. The cost is estimated at about $500,000.

PHILADELPHIA, PA.—Permit has been taken out by the Pennsylvania Railroad Company for the construction of an engine house at Forty-ninth Street and Gray Avenue, to cost about $80,000.

PHILADELPHIA, PA.—Extensive improvements including the erection of railroad shops and buildings are under way at the South Philadelphia yards of the Pennsylvania Railroad Company near Greenwich Point. The cost of the buildings with equipment is estimated at $1,000,000.

PITTSBURGH, PA.—Bids, it is reported, are being asked by the Duquesne Light Company for a machine shop, 25 ft. by 100 ft., one-story, to be erected near its electric plant on Brunots Island.

BALTIMORE, MD.—Contract has been awarded by the Baltimore & Ohio Railroad Company for the construction of a repair shop, 90 ft. by 240 ft., one-story, at Gilmore Street, to Frainie Brothers & Haigley, 18 Clay Street, to cost about $175,000. H. A. Lane is chief engineer.

CLAY, W. VA.—A company has been formed by a number of citizens of Clay County for the purpose of distributing electricity purchased from the Hartford (W. Va.) Power Company in Clay Court House, the county seat, for lamps and motors. It is proposed to extend the Elk River transmission line of the Hartland Power 4 miles to the town as well as installing a distribution system here.

HARTLAND, W. VA.—The Hartland Power Company is extending its Elk River transmission line westward. This extension will add three new coal-mining companies to its customers. A further extension of this line has been requested by the Ritenour Coal Company, which has offered to pay the cost of the work.

WEBSTER SPRINGS, W. VA.—The Webster Springs Water & Electric Light Company is planning to install an electric light plant. M. V. Tracy of Webster Springs is engineer.

PORTSMOUTH, VA.—Contract has been awarded by the Emergency Construction Company, Law Building, Suffolk, Va., to the Ulen Contracting Company, 38 Dearborn Street, Chicago, Ill., to increase the capacity of the power house, etc., in connection with improvements to the Portsmouth, Berkley and Suffolk water supply. The total cost of the work is estimated at $2,000,000. The work will be done under the supervision of Captain Moore, R. H. Gordon and H. Q. Kennedy of the United States Army.

RICHMOND, VA.—Orders have been placed by the Virginia Railway & Power Company for a new battery of boilers for its Reeves Street power plant.

RICHMOND, VA.—Arrangements have been made whereby the surplus power generated at the municipal electric plant will be sold to the Virginia Railway & Power Company.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Mare Island, Philadelphia and Charleston, Schedule 3519—brass, copper and bronze wire. Norfolk and Puget Sound, Schedule 3523—slow and pothead wire. Various yards, Schedule 3526—resistance and fuse wire; Schedule 3527—electrical wire; Schedule 3528—magnet wire. Washington, D. C., Schedule 6984½—15 motor-driven lathes; Schedule 7027½—electric wire and 5000 ft. duplex cable; Schedule 7041½—8000 radio head telephones; Schedule 7053½—400 charging panels and 300 resistance unit spares. Brooklyn, Schedule 7025½—brass and copper wire; Schedule 7121½—75 motor pumps and spares. Eastern yards, Schedule 7026½—6300 flashlights. Norfolk, Schedule 7054½—one motor-generator; Schedule 7108½—Cable and copper wire. Gloucester, Schedule 7059½—two storage batteries. New York, Schedule 7066½—1200 insulators. Quantico, Va., and Miami, Fla., Schedule 7067½—field buzzers, telephone batteries and switchboards. Newport, Schedule 7070½—500 lb. annunciator wire; Schedule 7101½—sheet copper. Pensacola, Schedule 7075½—generator and gasoline engine. South Brooklyn, Schedule 7080½—three 10-kva. transformers. New London and Brooklyn, Schedule 7085½—4000 ft. phosphor-bronze wire. Further information may be obtained on application to the above bureau.

North Central States

DETROIT, MICH.—Contract has been awarded by the Board of Education for construction of power plant on Henry Street, between Second and Third Streets to Worswick Brothers, Hedges Building.

DETROIT, MICH.—The Capital Issues Committee of the Federal Reserve Board has authorized the city controller to issue $200,000 in bonds for the purchase of property adjoining the municipal electric light plant on Atwater Street. The property will be used for the erection of an addition to the municipal plant and for a high-pressure pumping station for the fire department.

GOODRICH, MICH.—M. A. Jerome is installing an electric lighting plant in Goodrich and would like to receive information on street-lighting equipment for lighting small towns.

GRAND RAPIDS, MICH.—Work has begun on the construction of the new power plant of the Widdicomb Company.

MASON, MICH.—The McLean Construction Company, 176 West Monroe Street, Chicago, Ill., will build two one-story stamp mills, 132 ft. by 150 ft. and 250 ft. by 300 ft., at Mason, to cost about $250,000. J. W. Hoff, 301 Wesley, Oak Park, Ill., is engineer.

OTTER LAKE, MICH.—C. C. Tinker, owner of the local electric light plant, is connecting another town on his transmission system and is installing larger equipment at the local plant. At present steam power is used, but eventually gas-producer engines will be installed to drive the plant. The plant now serves the towns of Otter Lake, Fostoria and Millington with electricity.

CLEVELAND, OHIO.—Work has begun on the erection of additional buildings in connection with the Harvard Avenue plant of the Aluminum Castings Company, including a building, 90 ft. by 120 ft., for melting department; another, 70 ft. by 240 ft., one and two stories, for sand department, and a third, 120 ft. by 280 ft., for finishing and shipping department.

DAYTON, OHIO.—Contract has been awarded by the National Cash Register Company, Main and K Streets, for the erection of a steel warehouse, 150 ft. by 540 ft., to the Ferguson Company, 6523 Euclid Avenue, Cleveland, to cost about $200,000

NILES, OHIO.—The Engle Aircraft Company has petitioned the City Council to extend the municipal transmission line through East Park Avenue to supply electricity to its plant. The cost of the extension is estimated at $7,000, which will include all the transformers and other equipment at the plant. The Engle company will equip its works for electrical operation as soon as the Council can make arrangements to extend the power line.

PINEVILLE, KY.—Bonds to the amount of $75,000 have been voted to rebuild the Bell County Courthouse, destroyed by fire. Contract, it is understood, will be awarded about the first of the year.

NORTH MANCHESTER, IND.—The Indiana Public Service Commission has granted the Browne Mills Electric Company permission to issue $43,000 in bonds.

PERU, IND.—Work has begun on the foundations for two additions to the local works of the Pittsburgh Model Engine Company, one 40 ft. by 240 ft. and the other 30 ft. by 180 ft., to cost about $100,000.

DU QUOIN, ILL.—The Union Colliery Company of DuQuoin is constructing an all-steel tipple at its mine, 5 miles south of Du Quoin. The mine will be equipped for electrical operation throughout and will have a capacity of from 5000 to 6000 tons per day. The present capacity is about 400 tons daily.

GREENUP, ILL.—Plans are under consideration by the Town Council for rebuilding the municipal electric light plant, recently destroyed by fire.

PITTSFIELD, ILL.—The Board of Supervisors has awarded contract to R. E. Funk of New Canton for the installation of an electric lighting plant at the county farm. The proposed plant will provide for 100 lamps.

DEPERE, WIS.—Contracts have been awarded by the DePere Manufacturing Company for the erection of a new shop, 100 ft. by 100 ft., equipped with a 30-ton electric traveling crane. The company manufactures boilers, etc.

RHINELANDER, WIS.—The Robbins Lumber Company is considering the erection of an addition to its plant to cost about $25,000. New electric generating equipment and woodworking machinery, it is understood, will be purchased.

SHEBOYGAN FALLS, WIS.—The property of the Falls Roller Mills of Sheboygan Falls has been purchased by Captain Ernest Gonzenbach, formerly general manager of the Sheboygan Railway, Power & Light Company. The new owner, it is understood, is planning to enlarge the plant and install additional hydroelectric equipment and supply electricity for commercial purposes.

LITTLE FORK, MINN.—The Littlefork Light & Power Company is changing its system from direct to alternating current. The installation of the street-lighting system has not yet been completed. E. E. Polkinghorne is president and manager.

CHITWOOD, MO.—Pfaeffle & Kelly of Chitwood, is contemplating the purchase of new equipment, including engines, compressors, etc., to cost about $50,000, for their new milling plant.

GALENA, MO.—Plans are under consideration for improvements to the waterworks pumping station, to cost about $100,000. Burns & McDonnell of Kansas City, Mo., are engineers.

HUMANSVILLE, MO.—Plans are under consideration by the Humansville Electric Light Company for the erection of an electric transmission line from Caplinger Mills to Stockton, a distance of 8 miles. L. L. Mathis is secretary.

JEFFERSON CITY, MO.—The Commissioners of Cole County have awarded contract to Louis G. Schell, Moreau Drive, Jefferson City, to rebuild court house, recently damaged by fire. Separate contracts will be let for lighting and heating. The cost of the building is estimated at $150,000.

JOPLIN, MO.—Improvements and extensions are contemplated by the C. H. & M. Mining Company, including the construction of tramway, installation of scales, engine, etc., to cost about $6000.

KANOPOLIS, KAN.—Plans are under consideration for the installation of a motor-driven pump of from 3000 gal. to 5000 gal. capacity at the municipal electric light plant. George M. Beigley is chief engineer.

KANSAS CITY, MO.—At an election held recently the proposal to issue $400,000 in bonds to establish a municipal ice plant in Kansas City was carried.

KANSAS CITY, MO.—Contract for the erection of a pumping station has been awarded by the Kansas City Light & Power Company to Lonsdale Brothers, Bryant Building, Kansas City.

KANSAS CITY, MO.—The Kansas City Light & Power Company is planning to erect a substation on Twelfth Street near Bristol Avenue, to cost from $15,000 to $20,000. Sargent & Lundy, 72 Adams Street, Chicago, Ill., are engineers.

SCHELL, MO.—The Schell City Light Company is erecting an electric transmission line to Harwood, a distance of 6 miles, to furnish electrical service in the latter place. W. M. Wright is proprietor.

SUMNER, MO.—The Sumner Electric Company is erecting an electric transmission line to Forker to furnish electricity there and also to residences along the line. The company is contemplating erecting another line next summer. A. Stobaugh is owner and manager.

WAVERLY, MO.—The Waverly Electric Company is contemplating installing a duplicate generating unit soon for emergency purposes. The present equipment includes a 20-kva., three-phase, 60-cycle, 115-volt Fairbanks-Morse generator and a 25-hp. gas engine. William A. Bartlett is owner and manager.

STERLING, NEB.—Contract has been awarded by the city of Sterling for equipment for electric lighting plant to the Western Electric Company of Omaha, at $10,364. Grant & Fulton, Bankers' Life Building, Lincoln, are engineers.

CLARKSON, NEB.—All bids submitted for rebuilding electric lighting and pumping plants have been rejected by the city of Clarkson. The cost is estimated at $30,000. The Henningson Engineering Company of Omaha is engineer.

OCONTO, NEB.—Dr. J. L. Paine, owner of the local electric light plant, is planning to erect additional transmission lines in the residence section of the town, at a cost of about $500.

BENNINGTON, KAN.—Extensive improvements and extensions are contemplated by B. T. Markley, owner of the local electric light plant, in 1919, including erection of transmission lines to Niles and Verdi and installation of street-lighting systems in both towns and in two other towns. New equipment including a 100-kw. generator and an oil engine will probably be installed during 1919. George C. Markley is general superintendent.

FREDONIA, KAN.—Plans are under way to rebuild the plant of the Empire Electric Manufacturing Company at Fredonia, recently burned, causing a loss of about $75,000. The plant was devoted almost exclusively to the manufacture of Mogul and Empire storage batteries. R. H. Barber is president.

Southern States

ATLANTA, GA.—The Electric Products Company, recently organized, proposes to install electric lighting and power plants on farms in Georgia and Alabama. R. H. Martin, care of Southern Oakland Company, is interested in the company.

ATLANTA, GA.—Improvements are being made to the various substations of the Georgia Railway & Power Company. Work at the Boulevard substation will consist of increasing the capacity of the Lindale line transformer capacity to 6000 kva. This will be accomplished by the installation of two banks of three 1000-kva. transformers each, with a spare transformer for each bank. The transformers are to be connected 110,000 volts delta to 38,000 volts Y, and the two banks will be operated in multiple. Authority has been given for the purchase of spare transformers for the Lindale and Newnan substations.

ROME, GA.—Plans are under consideration by the City Commissioners for the installation of electric generating machinery in the waterworks pumping station to supply electricity for lamps and motors.

ANNISTON, ALA.—The Woodstock Operating Corporation is reported to be in the market for lifting magnets with electric generating equipment.

CLARKSDALE, MISS.—The installation of a 500-hp. water-tube boiler in the municipal electric light and water plants is under consideration by the City Commissioners. W. W. Pointer is superintendent.

COTTER, ARK.—The Dixie Dam & Power Company is planning to construct a hydroelectric power plant on White River. The plans provide for the construction of a dam across the river.

WYNNE, ARK.—Improvements involving an expenditure of about $25,000 are contemplated to the municipal electric light plant.

WESTLAKE, LA.—The Lock Moore Company is contemplating the construction of a sawmill plant, to cost about $200,000. G. Law is secretary.

SULPHUR, OKLA.—Plans are reported to be under consideration for the construction of a new power house at the pumping station.

OKLAHOMA CITY, OKLA.—The Morgan Packing Company is negotiating with the Oklahoma Gas & Electric Company for additional energy, 500 kw., to provide for machinery now being installed in the plant.

BURKBERNETT, TEX.—The Central Power & Service Company is contemplating the construction of a steam power plant to furnish power for the well-drilling outfits in this vicinity. The company will also furnish power for the municipal water supply.

Pacific and Mountain States

SPOKANE, WASH.—Work will soon begin on the installation of the new street-lighting system to be furnished the city by the Washington Water Power Company under contract. The new lamps, which are of the nitrogen-filled type, will replace the old carbon arcs, which have been in use nearly twenty-five years. The new contract is for a period of ten years and calls for 1410 lamps at $52,170 per year.

HOLTVILLE, CAL.—Extensive improvements are contemplated by the Holton Power Company to its local auxiliary plant provided that the company can be assured of 140 second-ft. daily continuous flow from the Imperial Irrigation District. The cost of the proposed work is estimated at between $50,000 and $100,000.

MARE ISLAND, CAL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 2 for electric traveling cranes for structural shops, at Mare Island. The cost is estimated at $275,000 (Specification 3240).

PALMDALE, CAL.—The installation of in the Antelope Valley section, to cost new electrically operated pumping plants, about $500,000, is reported to be under consideration by the Palmdale Irrigation District.

SAN FRANCISCO, CAL.—The Public Utilities Committee of the Board of Supervisors has agreed to report in favor of accepting the offer of the Yosemite Power Company to lease what is known as the Gold Rock ditch in the Hetch-Hetchy Valley for $200 per month.

SAN FRANCISCO, CAL.—Arrangements, it is reported, have been completed by the Pacific Gas & Electric Company for the construction of a new substation at Knight's Landing, Yolo County, to cost about $250,000. The company also contemplates the erection of a new electric transmission line through Sycamore to a point near Colusa.

SANTA BARBARA, CAL.—Plans have been prepared by the Board of Education for the erection of a machine shop for the technical and manual training school.

MANVILLE, WYO.—The Town Council has granted J. E. Gallivan, H. G. Twiford, W. W. Austin and others a franchise to construct and operate an electric lighting system in Manville.

Canada

BURRARD INLET, B. C.—The American Nitrogen Products Company is contemplating the erection of a nitrogen plant at Lake Buntzzen, to cost about $300,000.

VANCOUVER, B. C.—The British Columbia Electric Railway Company, it is reported, is considering alterations and some new construction work at its station on Carroll Street.

BRANTFORD, ONT.—A by-law has been introduced in the City Council providing for issuing $100,000 in debentures for extending the tracks of the municipal railway in the Terrace Hill district. The by-law is to be submitted to the ratepayers for approval at the municipal election on Jan. 1.

BROCKVILLE, ONT.—The Canada Carriage Works are reported to be planning to rebuild their plant lately destroyed by fire. The loss is estimated at about $500,000.

ST. CATHARINES, ONT.—The Board of Education is planning to erect a technical school, to cost about $400,000.

TURBINE, ONT.—Contract has been awarded by the International Nickel Company of Copper Cliff for a power development at Trubine, to cost about $2,000,000, to the Fraser Brace Company, 83 Craig Street, West Montreal, Que.

Record of Electrical Patents

Notes on United States Patents

1,281,251. Measured-Service Telephone System; Roy C. Gifford, Chicago, Ill. App. filed Nov. 14, 1906. Pay station of any calling subscriber is under control of called substation, so that toll is collected or assembled by answering subscriber.

1,281,268. Insulator; Arthur O. Austin, Barberton, Ohio. App. filed May 29, 1916. Strain due to unequal expansion and contraction of parts may be relieved without breaking or impairing insulator.

1,281,280. Electric Furnace; Jens O. Boving, London, England. App. filed Sept. 4, 1917. Hydraulic and electric power used automatically to regulate supply of electricity.

1,281,285. Electric Fuse; Leonard B. Buchanan, Woburn, Mass. App. filed Nov. 27, 1914. Indicator showing whether fuse is blown does not come in contact with fuse strip.

1,281,288. Method of Controlling an Electric Circuit and Designating Same; Jerome M. Carley, East Greenbush, New York. App. filed March 7, 1918. Only one nut need be released to open circuit.

1,281,309. Protective Unit; William Dubilier, New York, N. Y. App. filed Feb. 9, 1918. Cannot be removed without breaking circuit to be protected.

1,281,338. Locking Device; John O. Gargan, Brooklyn, N. Y. App. filed May 13, 1918. Holds movable plates of condenser in fixed position without strain.

1,281,346. Motor Controller; Maurice M. Goldenstein, Milwaukee, Wis. App. filed July 3, 1916. Motor-driven units and their controllers must be coupled before joint operation is possible.

1,281,347. Motor Controller; Maurice M. Goldenstein, Milwaukee, Wis. App. filed Oct. 26, 1916. For automatically stopping motor upon a predetermined variation of speed from a given value.

1,281,348. Automatic Telephone-Exchange System; Charles L. Goodrum, New York, N. Y. App. filed April 26, 1915. Abnormal number of calls in one group of lines taken care of without providing surplus finders.

1,281,372. Electric-Battery Depolarizer; Major E. Holmes, Lakewood, Ohio. App. filed Jan. 7, 1916. Consists of molybdenum trioxide combined with a basic oxide or ammonium phospho molybdate.

1,281,376. Panel Construction; Albert J. Horton, White Plains, N. Y. App. filed July 14, 1913. Number of panel sections may be varied to meet different requirements, and rheostat of one capacity may be substituted for one of different capacity.

1,281,392. Expression-Controlling Means for Electrically Operated Musical Instructions; John F. Kelly, Pittsfield, Mass. App. filed Nov. 27, 1914. Perforations in music roll of piano control sound volume of notes.

1,281,399. Method and Means for Measuring Electrical Energy; Heinrich Landis, Zug, Switzerland. App. filed April 5, 1915. To make charge for energy consumed proportional to apparent units consumed.

1,281,402. Method for Uniting Railway Rails; John C. Lincoln, Cleveland, Ohio. App. filed Feb. 6, 1914. Edges of fishplates upon both sides of rail ends directly welded to heads and flanges.

1,281,409. Electric Battery; Edward L. Marshall, Fremont, Ohio. App. filed Feb. 18, 1915. Paste is applied to lining of dry cell in uncooked condition, to insure uniform contact and consumption of zinc.

1,281,421. Process of Manufacturing Dry Cells; Lloyd R. Rhoades, Fremont, Ohio. App. filed Feb. 21, 1918. Paste is sprayed on bibulous lining.

1,281,422. Electric Signal; Herbert J. Sanderson, Pittsburgh, Pa. App. filed Oct. 8, 1917. Two lamps in front of automobile and two in the back may be operated in pairs or independently.

1,281,454. Electric Welding; Alexander P. White, Caldwell, N. J. App. filed March 15, 1917. Current for joining sheets together is applied in circular path.

1,281,459. Telephone-Exchange System; Ray S. Wilbur, Lyndhurst, N. J. App. filed March 8, 1918. Signaling means for central energy-type systems.

1,281,482. Electric Circuit Protector; Sydney N. Baruch, Oakland, Cal. App. filed June 15, 1914. To eliminate possibility of motor or other electrical apparatus burning up from either an overload or because current after being cut off line comes back on again when motor is at standstill.

1,281,515. Railway Block-Signal System; Winthrop M. Chapman, Needham, Mass. App. filed Feb. 26, 1913. To enable a car in backing out of entering end of a block to count off a car and to permit a car to enter a block against danger signal and then back off block without interfering with operation of signals.

1,281,517. Splice for Conductors; Lewis W. Chubb, Edgewood Park, Pa. App. filed Jan. 5, 1915. Means for making a splice or a clamp between two connections that could not be effectively and economically clamped or soldered for electrical use.

1,281,518. Shielding System for Vapor Converters; Lewis W. Chubb, Edgewood, Park, Pa. App. filed Oct. 7, 1915. Power arc may be directed and controlled and short-circuiting, reverse arcing and other harmful phenomena minimized.

1,281,521. Furnace; Edgar F. Collins, Schenectady, N. Y. App. filed Nov. 10. 1917. Particularly suitable for heating objects of great dimensions such as large-caliber guns, turbine and engine shafts.

1,281,524. Direction Signal for Automobiles; Harry G. Craft, Clarksdale, Miss. App. filed May 2, 1917. Illuminated semaphore arms can be raised on each side of car.

1,281,527. Arc Lamp; William A. Darrah, Wilkinsburg, Pa. App. filed Oct. 3, 1913. Internal circulating system precludes accumulation of deposits upon inner surface of arc-inclosing globe.

1,281,533. Switch Lock; David J. Dolan, Detroit, Mich. App. filed March 7, 1918. When in neutral position switch establishes circuit which intercepts and grounds any current going through system.

1,281,550. Device for Aiding the Hearing; Morris Friedman, Brooklyn, N. Y. App. filed March 31, 1916. Microphonic transmitter amplifies sound waves.

1,281,553. Multiple Blow-Out Fuse: Henry J. Gagnon, Cohoes, N. Y. App. filed Nov. 22, 1917. Contains means for indicating when fuse has been blown.

1,281,561. Rail Bond; William D. Hamer, Indianapolis, Ind. App. filed Aug. 9, 1915. Rail bond is forced into hole having larger diameter at bottom than at top.

1,281,564. Swell-Regulating Mechanism for Organs; William E. Haskell, Brattleboro, Vt. App. filed Feb. 7, 1917. Special perforations in note roll of automatically operated organ actuate swell shades.

1,281,593. Telephone Set; Charles H. Lehman, New York, N. Y. App. filed Aug. 21, 1917. Transmitter and receiver are protected by the casing and form a seal for each other when box is closed.

1,281,604. Method and Apparatus for Carrying Out Chemical Reactions by Means of Magnetically-Spread-Out Electric Arcs; Anton V. Lipinski, Zurich, Switzerland. App. filed March 6, 1918. Provides for continuous operation.

1,281,611. Telephone System; Eric R. Lundius, Brooklyn, N. Y. App. filed Dec. 26, 1917. False operation of ring-up relay overcome.

,281,636. Method of Electric Welding; Thomas E. Murray, Jr., Brooklyn, N. Y. App. filed Feb. 6, 1918. Being briefly subjected to an abnormally high ampere current causes weld to be of equal strength with rest of material.

1,281,637. Method of Electric Welding; Thomas E. Murray, Jr., Brooklyn, N. Y. App. filed Feb. 6, 1918. When joining two contact areas where length is greater than width higher ampere strength current is necessary than if length and width were equal.

1,281,658. Liquid Gage; Frank I. Remy and Benjamin P. Remy, Indianapolis, and Arthur Berger, Anderson, Ind. App. filed Jan. 10, 1916. Indicator may be located at some distance from the tank for mounting in an automobile.

1,281,673. Method and Apparatus for Producing High-Tension Unidirectional Discharge; James E. Seeley, Los Angeles, Cal. App. filed Oct. 15, 1918. Impulses are substantially free from low-tension current.

1,281,678. Electrical Insulator; Alexander B. Simpson, Jersey City, N. J. App. filed April 21, 1914. Hollow tube contains joints of connected wires.

1,281,684. Electric Signaling; George O. Squier, United States Army, and Louis W. Austin and Louis Cohen, Washington, D. C. App. filed Aug. 14, 1916. Messages are transmitted of different frequency from that used in duplex system.

1,281,698. Joint for Lighting Fixtures; Morris E. Surfacem, Decatur, Ill. App. filed Jan. 31, 1916. Detent concealed from view prevents complete rotation of fixture.

1,281,716. Process for Making Molded Conductors; Samuel Trood, Wilkinsburg, Pa. App. filed Oct. 3, 1916. Brush for collecting current on dynamo consists of metal and graphite, soapstone or other lubricating materials.

1,281,730. System of Control; Charles C. Whittaker, Wilkinsburg, Pa. App. filed Aug. 7, 1916. Relates to induction motors which are governed by means of liquid rheostats or the like.

1,281,742. Wireless Telegraphy and Telephony; Prof. Dr. Hendrik Zwaardemaker, Utrecht, Netherlands. App. filed July 23, 1918. Sensitiveness of the thermic telephone, serving simultaneously as detector, considerably increased by working with polarization.

1,281,743. Arc Lamp; Christian Aalborg, Wilkinsburg, Pa. App. filed March 20. 1913. Electrodes fed and regulated to permit decreasing length of lamp.

1,281,744. Electric Heating Unit and Method of Making the Same; Charles C. Abbott, Pittsfield, Mass. App. filed March 29, 1918. Sheathed wire is embedded in the surface of a metallic member preferably by forging the two into intimate thermal relation.

1,281,745. Arc Lamp; F. Alexander, New York, N. Y. App. filed Dec. 10, 1914. One automatic feeding mechanism regulates two or more arcs in series.

1,281,750. Locking Device for Impulse Starters; Frederick W. Andrew, Brooklyn, N. Y. App. filed June 29, 1918. When actuating spring is rendered inoperative driving and driver parts of starter are locked together.

1,281,767. Telephone-Receiver Holder; Charles F. Corgan, Portland, Ore. App. filed April 24, 1918. Swinging receiver and holder into position for use releases switch lever.

1,281,796. Arc-Lamp Electrode; Isador Ladoff, Wilkinsburg, Pa. App. filed June 20, 1914. For producing a relatively steady arc and comprising arcing material mixed with a compound of uranium.

1,281,811. Testing System; Louis A. Mortimer, New York, N. Y. App. filed March 8, 1918. Employed in testing apparatus of telephone systems.

1,281,826. Electric Switching Device; Erich Philippi, Berlin, Germany. App. filed Feb. 26, 1914. For a number of conductors, transformers or other electrical apparatus, which are to be connected in circuit or disconnected from circuit through a protecting resistance.

1,281,827. Engine Starting and Lighting System; Leo. A. Phillips, Milwaukee, Wis. App. filed Aug. 5, 1914. Controlling devices are provided for insuring charging the battery at predetermined rate.

1,281,849. Strain Insulator; William Schaake, Pittsburgh, Pa. App. filed Jan. 14, 1918. Substantially requires no machine work, and practically all of the elements may be assembled by hand.

1,281,857. Process for Recovery of Battery Fluids; Samuel H. Sheib, Richmond, Va. App. filed Nov. 30, 1917. To save caustic soda and zinc by-product and rejuvenate used alkaline electrolyte.

1,281,862. Current-Collecting Device; Robert Siegfried and Herbert G. Jungk, Pittsburgh, Pa. App. filed Oct. 13, 1917. Relates to the collector rings of alternating-current motors.

1,281,863. Rectifier System; Karl A. Simmon, Wilkinsburg, Pa. App. filed April 25, 1914. Voltage strains in power for railways are symmetrically distributed.

1,281,872. Inclosed Switch; Alexander K. Sutherland, New Britain, Conn. App. filed Nov. 5, 1917. To prevent unauthorized tampering and to necessitate opening of switch before switch casing can be opened.

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The Spirit of Discontent

SURELY these are days of discontent. Nation wars against nation, people against people, system against system. In fact, society seems to be in a state of turmoil, and interest in all forms of organized work is hard to maintain. Our great political parties are rent with dissension, labor and capital are as far apart as ever, systems of collegiate instruction are all upset, our national engineering societies are at their wits' end to interest their members, clergymen face empty benches, and nothing seems to satisfy. Such a condition of affairs may be healthy or detrimental, depending on how the issue is met. Properly directed, the spirit of discontent may lead to higher, nobler and better things; misdirected or ignored, it may terminate in social chaos and utter disorder. If we have robbed the world of anything contributing to its happiness and well being, we must find something better to take its place, and that quickly.

There is no better evidence of a man's belief in the fair administration of a public utility than his willingness to put his money into its securities, and no better security for square dealing as between the utility and the people. The idea of a public service corporation as a public trust with direct moral responsibility to those whom it serves has never been more strongly enforced than by campaigns to take consumers into partnership. Besides, the larger the number of consumer-stockholders the better the evidence of the closeness of a public utility to the community.

A "Pull Together" Conference

IN THE large convention to be held next week at Atlantic City under the auspices of the United States Chamber of Commerce the business men of the great industries of the country have their first good opportunity to formulate the general reconstruction policies which they feel necessary for the welfare and prosperity of the nation. If what is done at the important conferences planned there is based on a broad and fair conception of the rights and interests of all parties concerned, it will serve to crystallize a now uncertain public sentiment into definiteness, so that effective results may grow from it. It will be of most value as it presents the desire for sincere coöperation between industry, capital and the government authorities who are wielding a vast measure of control over all affairs in this juncture. It is a time when big deeds, the world-wide vision, are needed but in carrying them on to realization the helpful aid of every element in the country is needed in a hearty "pull together," with no one lagging but every one doing his share.

War-time restrictions on production have proved to be blessings whose effect on the future of industry cannot now be fully estimated. Capital has been conserved, material saved, labor released and sales and distribution problems simplified. Moreover, industry is perfectly satisfied with the change, and there are indications that hysterical competition will never again make itself known. For such achievements many thanks.

Demand Meters

IN ANOTHER column C. F. Mathes brings to the front from the standpoint of a practical meter man the present status of the demand meter. There are some useful indicating meters of this type on the market, especially well adapted for a certain proportion of the work of a central station; but as a strictly practical matter many requirements are insufficiently met even now. If one merely wishes to know the maximum power called for by any consumer, the facts are ascertainable with comparative ease. This crude form of demand reckoning has, however, very serious faults. Of course, at best the actual maximum demand is an indication of only one factor, and not always the most important one, in the requirements of the consumer. In many instances the time of the demand and the continuance of the maximum demand period are very much more serious factors in a proper demand charge than the actual maximum.

There are several types of curve-drawing instruments which meet the requirements fairly well, but they are expensive and require considerable attention. Mr. Mathes points out clearly the practical difficulties encountered in attempting to use on any considerable scale instruments of this class. Perhaps the fundamental trouble is that they belong rather to the category of laboratory apparatus than to that deliberately fitted for permanent use on distributing circuits, which is an entirely different problem. Just how far it is desirable for a supply company to go into the use of a system of charging which requires meters of this class is perhaps a dubious matter. One cannot altogether avoid the feeling that the demand system is a thing for special rather than general application and that the present tendency toward simplification of rates should be encouraged, rather than the addition of intricacy up to the point where highly specialized and somewhat troublesome apparatus is required to do the work.

Gloom no longer pervades our streets. Our signs and windows once more blaze forth with welcome light, and the whole country rejoices in the removal of the ban that kept them so long darkened. What an impressive tribute to electricity our "white ways" are!

Improvements in Distribution

THE paper by S. Bingham Hood on the rearrangement of electrical distribution in Minneapolis points a moral worth the consideration of many a station manager. For years past the general and especially the residential load in the city had been steadily increasing, and with it came the usual story of installing more copper and more transformers, changing feeders and taking other steps to improve the distribution. Such changes, as is always the case, were merely symptomatic in character, effecting some improvement but not reaching the root of the trouble. Finally the time came when something had to be done, especially in the residential district. The existing system was one built up from 2300-volt single-phase feeders and mains serving the lighting and small motor load. It also included some 2300-volt three-phase feeders supplied from the general 13,200-volt main system. Gradually the usual thing happened. Regulation went from bad to worse and automatic regulators reached their capacity. At last, after careful study of the situation, the distribution was changed over to a 2300-volt star-connected system with a common neutral. On the secondary side the lines were interconnected throughout each phase section much as in ordinary direct-current networks.

The additional feature of a somewhat unfamiliar character found on this system is use of the common neutral as between primary and secondary. Both primary and secondary neutrals would be grounded to meet ordinary requirements, and if well grounded would be kept at earth potential. In a properly designed system neither carries much current and their union in the way plainly shown in Mr. Hood's article involves no particular difficulties. The engineer will find the study of the details here disclosed of very great interest, showing the extremely practical way in which the three-phase, four-wire system may be made to do the full duty required of it with a minimum of trouble and expense and greatly improved regulation. Mr. Hood states that the saving on the primary mains was 50 per cent. There was additional gain in the power circuits, and by grouping the power banks of transformers the fullest advantage could be taken of the diversity factor. In one instance eighteen transformers aggregating over 200 kva. were replaced by three 30-kva. units. The saving in transformers has been an important addition to the saving in copper. The regulation has been greatly improved and the reliability of the installation in all respects materially increased.

It is curious how long it has taken for the Y-connected three-phase distribution with neutral to come into its own. It is one of the most flexible and valuable distribution systems known and its disadvantages are mostly imaginary. There are scores of plants in the country which would gain great advantage from its adoption, and we trust that Mr. Hood's telling account of the Minneapolis work will encourage other engineers to follow his example.

Economies almost unbelievable were effected in the operation of public utilities during the war. Though loads increased fuel was saved, and where water power was utilized to the limit coal shortage was mitigated. Refined in the furnace of affliction, central stations are more firmly established than ever. Let them now set an example of unselfish service for industry and the public welfare.

New England Transmission Networks

WE RECENTLY described the interconnection of a large group of plants in Connecticut with incidental connections outside. In the current issue we present some interesting details of the situation in Massachusetts, and especially around Boston, as disclosed by an A. I. E. E. paper of L. L. Elden, electrical engineer of the Boston Edison company. The accompanying map gives at a glance the general situation. The starting point of the general power distribution from the hydroelectric end is the system of the New England Power Company, with its main station at South Vernon, Vt., and several important subsidiaries. From the steam end of the situation the Boston Edison company, with an output of something like 300,000 kw.-hr. per annum, occupies the center of the stage. It is the result of the gradual absorption and connection of something like forty plants. An interconnection is now being built between the Boston system and the lines of the New England Power Company at Clinton, thus enabling useful exchange of power at this point. Further, the New England Power Company is about to be connected with the system of the Shore Line Electric Railway Company at Norwich, Conn., and there are immense opportunities for the addition of further linkages stretching from Newport to Portsmouth, N. H. As yet much remains to be done to complete any such north and south interconnection, but it is a logical necessity of the power situation and sooner or later will be accomplished.

There seems comparatively little opportunity in this territory of largely increasing the water-power development in such sense at least as will cut down greatly the need for steam. The Turners Falls company is a big addition to the hydroelectric capacity, but it has already established a considerable steam station recently described in our columns, and the whole hydroelectric power in Massachusetts and Connecticut scarcely exceeds 125,000 kw., only a modest proportion of the total demand. This situation renders the need of interconnection imperative for the full utilization of the water power and for the maximum benefits to be obtained from the diversity factor. This latter is a large item in the situation, and Mr. Elden estimates that on the immediate south side of Boston alone there is a diversity in peak loads of some 5000 kw. For the complete utilization of the natural resources in water power and their reinforcement by cheap steam power the fullest measure of interconnection should be secured at the earliest possible moment.

Profits on manufacturing operations this year are not all fat. They must be calculated with a weather-eye open for the visit of the tax collector next year. What a relief it will be to have the war costs move some day into the hazy past and leave the way open for a profit that can be figured in advance with reasonable accuracy!

Government Operation in Politics

THE essential fact is that government operation of public utilities on a large scale was started in this country as a pure war measure. With the patriotic public spirit sweeping all classes of people there was no disposition to withhold any military aid which the Washington authorities wanted. Truly, they had but to ask and it was given to them. There has been no stint in what the nation stood ready to offer in order that righteous victory might be won for our cause. Were it lives or property, the country as a whole surrendered personal liberties and rights with a willing heart for the benefit of the national aim. That was as it should be; there is no complaint to make over what was done in a noble cause. Events moved rapidly, and then we had the President's historic words addressed to Congress: "The war thus comes to an end." And, taking his message as the mark of a new era, industries began steps to get established on the changed basis which peace means. It was and is still a critical time to weigh policies, national and individual, as they affect the prosperity and welfare of all. One of the most vital of these, which touches the very roots of our governmental and industrial life, is that of public ownership or operation of great utilities. Whether it is presented as private ownership with public operation, public ownership with private operation, or public ownership and public operation, is not so important as it is that there be an economically just decision on the question of whether public or private agencies will render the better service at the lower cost.

But will the question be decided on economic grounds? Centainly in the present situation it is in the fore as a controversial political issue and promises so to continue. It is difficult to put any other interpretation upon recent events at Washington. The authorities are operating the carriers, the telegraph and telephone systems, and they appear to want to strengthen and extend their control over the operation of these properties. This is illustrated most clearly by the Postmaster-General's act in taking over the cable systems and by his decision to combine the two competing telegraph systems, supplemented by the announced desire that the radio systems shall be brought under government control. The members of the Cabinet move with hasty step to tighten their hold on the classes of privately owned properties whose control they were given for war purposes. If the war is at an end—and the clean stripping of our enemy's military and naval resources confirms the President's conclusion—why should it be necessary to do anything but return these properties to their owners? They were taken for a purpose as specifically intended and described as anything on earth could be—they served that purpose; now they should revert to those from whom they were taken. If government ownership or operation is to be the issue, the agitation of that issue should be begun, not when the government holds a control secured by the aid of the warm patriotic fervor which moved the nation, it should be begun after the spirit of the law has been fulfilled, after the properties have been surrendered.

Any other course than this would mean that properties taken for one purpose may be kept for another purpose; it would mean that systems acquired as a war agency may be incorporated into the permanent government organization. If so radical a change in government function is to take place, it should be made only after careful appraisal of the real merits of the separate policies.

It was an experiment to have the government assume the direction of the properties in war time. We believe that experiment under war conditions could not fairly reveal the strength or weakness of government control sufficiently to justify a permanent decision on the basis of that test alone; but control extended over the postwar period as authorized by the law is at least a reasonable test of the efficiency of governmental direction. The government raised railroad rates during the war to a higher level than the railroad corporations would have been likely to dare to do, and it gave a quality of service that compared unfavorably with that given by the corporations before the war. These conditions, however, were in part the abnormal results of war. Now with the more orderly conditions of peace, the government should be able to test thoroughly the efficiency of its coördination of the properties, and this is true of those under the Postmaster-General as well as of those under the Director-General of Railroads. At the end of the periods provided by the laws for war-time control of these agencies it will be possible to form an intelligent estimate, based on fact, of what the government has done If the government control has been wisely directed and if it has yielded benefits to the public greater than those received under private control, there ought to be no objection on the part of the authorities to a comparison that would support this claim.

Consider for a moment what privately operated business industries of the country did under the same war strain that the government confronted. Take the steel industry or the different branches of the electrical industry which were directly affected—electrical manufacturers, central stations or jobbers. Production was hampered by the enlistment and drafting of men for military service. But in spite of restrictive fetters on labor and materials the production curve ran sharply upward. The military necessities of the times called for the most strenuous efforts on the part of privately owned and operated industries, and these efforts were put forth with a vigor and intensity unsurpassed in history and with results which will go down into history only second to the sacrifice of our brave men. Our industries made a record in big production under private initiative which governmental bureaus will have hard work to duplicate.

Practice and Preach Conservation

By Leading Their Communities in Fuel Conservation in the Reconstruction Period and Afterward Central Stations May Sustain Interest in This Subject and Render a Public Service

THE WINDSOR STATION TRANSLATES INTO DEED THE MOST ADVANCED ENGINEERING PRACTICE OF THE INDUSTRY

REVIEWING the lessons of the war applicable to central stations, one fact stands out sharp and bold above others: The principle of mass production, the ideal of the industry for many years, has received a great public indorsement that might never have been given under normal conditions. National government officials, members of Congress, magazines and newspapers of general and other than electrical circulation, many individuals, have accepted the principle of concentration on which the strength of the industry rests. It remains for the executive officials and operators of the systems to hold and strengthen the place in public estimation that this experience has given.

Experiences during the war will accelerate the further development of the essential principle of mass production. When the output of one system reaches its maximum of efficiency there are new possibilities of economy to be realized if two or more systems are linked together. And the principle has another unique application when two companies join together for the purpose of building a generating station which shall be interconnected with both of their systems. The construction of the Windsor (W. Va.) plant of the American Gas & Electric Company and the West Penn Power Company as a joint enterprise to supplement the existing facilities of the two systems translates into deed the most advanced engineering practice, the best economic thought of the industry. It blazes the path to future progress.

Mass production, first a vision, then a fact, is now generally recognized as an element in the economic welfare of the country. It will serve still more effectively as an aid in selling service under the new conditions. It shows customers and prospective consumers what specialized production really means in economy and reliability. It has a new potency when laid as an argument before electric railways to induce centralization of power generation and distribution in the community. With added force it teaches the isolated plant owner the wastefulness of two stations when one can carry the load with plain economy of fuel and labor and other costs. The public service commissions learned quickly that the avoidance of plant duplication, the elimination of duplicate capital investment, was a factor in cheapening the cost of service. Now the basic principle of central-station service has world-wide acceptance. It should not be ignored in the wider application of electricity for trunk-line railroad operation.

Entering and ending the war with plants highly developed on this principle, the central-station industry cannot fail to benefit from the governmental indorsements of its economic position. It cannot be otherwise than encouraging to the men in the industry that the rank of their properties when the resources of the country were put to the searching test of war was so high. They are entitled to this encouragement as a tribute to achievement in the past, as a stimulus to project the underlying principle still further in future years.

The central station had continual contact with war agencies of the government. It was seen promptly by the Fuel Administration to be an economical consumer of fuel. This recognition, stimulated by the compelling necessity of saving fuel, was expressed by representatives of the Fuel Administration in many ways throughout the country. The large problem of this essential war-making organization was how it could best overcome the appalling shortage of coal which the enforcement of the war program made inevitable.

The interest of the Fuel Administration was not in the central station as such or in the isolated plant as such; it was not in the pure economics of the situation; it was simply to effect fuel saving for the nation at war. The Fuel Administration is still concerned as a war-time agency in protecting the country against wasteful coal consumption. But there is no prospect in sight that its work will be long continued. It was able to stimulate interest in coal conservation because of the war needs and the patriotic compliance of citizens with the spirit of its regulations. When the factor of the war no longer exists, when there is no appealing or ruling body at Washington, the central stations can take up in part the work of keeping public interest alive and keen on the vital question of conservation of fuel resources. Even though there is selfish business advantage for them in so doing, they can meet the issue in a broader spirit than that of every-day commercialism. They can preach as well as practice conservation and make continual appeals for fuel economy an element in their service to the public.

For certainly the wasteful practices of fuel consumption in old days are intolerable; they are unjust to this generation and to those that will follow. They not only deplete the precious and irreplaceable fuel stored by nature, but they stimulate over-rapid production. Even though the stimulation of coal production in pre-war days tended to keep the price down, it reached the point where probably some coal was marketed at less than the fair cost level; and this kind of a condition leads in time to reaction. In any event the price of coal is a part of the cost of service which the central station will have to pass on to the public, but the conservation of coal is an issue which is inseparable from the future of the industry and the public welfare.

With its established basic principle, its recognized economy of operation, its steady striving for improvement in load factor, plus its fine war-time record, the central station can logically continue to show how its output can be used most economically in the service of the community. It is a work in which the different departments may coöperate to excellent advantage. It touches purchasing, plant operation, new business, advertising, public policy.

Meeting the Problems of the Reconstruction Era

HENRY I. HARRIMAN

"In MEETING the problems of the reconstruction era, a gradual diminution of federal control of industry in general should be brought about," said Henry I. Harriman, president of the New England Power Company and of the Boston Chamber of Commerce, to a representative of the Electrical World. "Under peace conditions the necessity for governmental price fixing and for the control of output, material and the labor supply will grow less and less. The regulation of public utilities by state commissions along constructive lines should be continued in preference to any program for the federal regulation of rates, capitalization and service.

"As to the labor situation, it will be an advantage that the return of our victorious troops from foreign service will be gradual, thus tending to reduce the shock to the labor market which might result from a return *en masse*. While there may be some fall in the price of labor when peace is fully established, it is to be hoped that this will be commensurate with a corresponding reduction in the price of materials and the cost of living. Industrial development suspended by the war should go forward as soon as possible. The market for many products hitherto classed as non-essentials must be supplied. The extension of electric service into every commercially justified field should be encouraged to the limit.

"The time is now more than ever ripe for the passage of legislation by Congress which will permit the development of water power on the public lands and on navigable streams. The importance of such legislation as a real conservation measure is not easily exaggerated. Waste of power in economically justified developments is not in accord with the spirit of the new era and should not be allowed to continue. Capital should be encouraged to flow into electrical expansion work. Efficiency engineering and research should be given the utmost support; fuel economy should be continued and increased, and the interconnection of electric systems favored wherever commercial considerations warrant this policy.

"Foreign trade should be cultivated with energy; coöperation should be the slogan of the new era, and a broader conception of the engineer's opportunities for usefulness should be adopted. The engineer is needed in public affairs, and in the reconstruction work of the world which has already begun his services will be scarcely less important, if such a comparison can be made, than in the war."

Complete Electrification of Sugar Mills

Extensive Application of Motors in This Industry Is of Recent Origin—Very Satisfactory Results Obtained in New Cuban Mills, Showing the Possibilities That May Arise in This Field as It Is Developed

BY CLARENCE G. HADLEY
Superintendent and Chief Engineer Palma Sugar Company, Central Palma, Oriente, Cuba

AT THIS time, when the world is feeling the shortage of sugar and when the accelerated production of this commodity is necessary to the welfare of many peoples, it is fitting that the part electricity is playing and can play in the production of sugar should be appreciated.

In the sugar industry, as in most industries where steam-driven machinery has been applied for many years, progress in the use of electric drive is made only one step at a time. The first application of this modern form of energy about sugar mills was for the lighting of the mills and yards. After this a few motors were installed for minor services, where they proved so successful that it was decided to utilize them throughout the boiling department for the operation of the numerous pumps, thus doing away with the very serious losses from condensation in the long and complicated steam lines needed to operate the corresponding small steam engines. When this point was finally reached, even in the most modern mills and not by any means in all of the mills, the progress of electric drive was halted temporarily.

The steam-driven cane-grinding mil' is a very satisfactory piece of equipment, and the older mills are inclined to stick to a well-tried friend. There has even been much doubt expressed by sugar men whether electric motors could be built for the service. However, in 1913 the Central Amistad sugar mill, at Guines, Cuba, was completely electrified by the Kelvin Engineering Company of Havana and New York. This was the first complete application of its kind, so far as the writer knows, in the world, and for that reason the electric motors were mounted on temporary bases alongside of the old steam engines. After one year's experience the engines were removed and the motors were installed in permanent locations. During 1915 the firm of Diebert, Bancroft & Ross of New Orleans constructed four sugar mills, all of the same size and design. This was the first attempt to reach standardization in this class of construction.

The original plans of the Palma Sugar Company were for the installation of steam engines for the mills and electric drive for all other parts of the house, but General Mario G. Menocal, President of Cuba and principal owner of the Palma Sugar Company, decided to have electric drive installed throughout. Accordingly what are known as the Florida and Palma mills were completely electrified. Both were rated at 1000 tons of cane per day, and both operated in a way to give the greatest satisfaction from the start.

At the end of the first crop it was decided to enlarge the Palma mill, increasing the capacity by 150 per cent. This was done, and a new mill was added of the capacity of the enlarged original The mill comprises grinding houses on one side and sugar warehouses on the other, the latter with a maximum capacity of 140,000 bags of

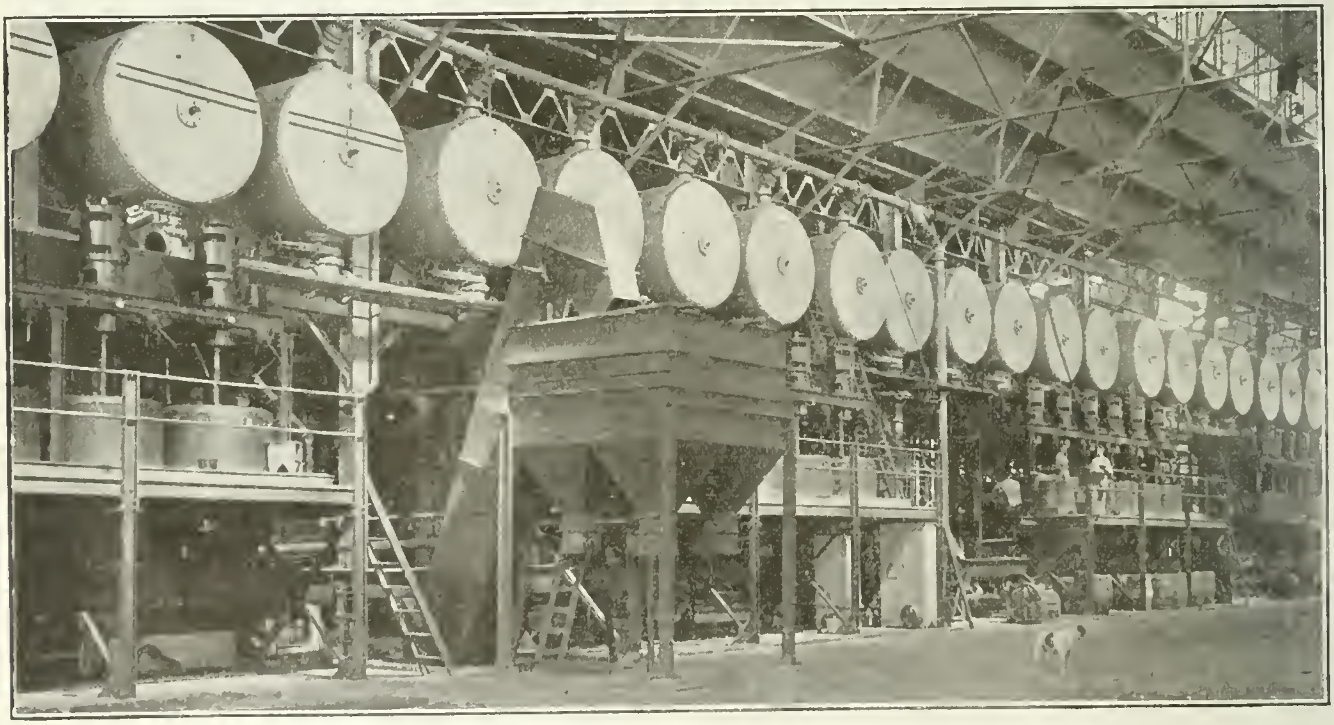


FIG. 1—VERTICAL-SHAFT MOTORS UNDER CRYSTALLIZERS DRIVE CENTRIFUGALS BELOW

325 lb. (147 kg.) each. A brick building covered with stucco houses the electric generating plant.

Practically all sugar-mill electrification on the island is being made at 480 volts, 60 cycles, three-phase. This system is best adapted to the service, as the potential is not likely to be fatal in case of accidental contact, the conductors are not of excessive size, and the constant-speed characteristics of the squirrel-cage motors are well adapted to use with the numerous centrifugal pumps. The few variable-speed motors installed are of the slip-ring type, all controlled by electrical contactors and resistors, with master switches at the most convenient operating point.

The unit of the cane-grinding equipment is the single mill, consisting of two large horizontal rollers with a third roller riding on top and held down by hydraulic pressure maintained by accumulators so as to exert a pressure of from 250 tons to 400 tons on the cane passing between the rolls. The required number of mills are assembled in tandem with slat conductors between them to conduct the cane from one set of rolls to the next. The surface speed of the rolls is about 25 ft. (7.6 m.) per minute, and the opening between the rolls varies from $\frac{3}{4}$ in. (19 mm.) to $\frac{1}{16}$ in. (1.6 mm.). The mat of bagasse when expanded is about 6 in. (15 cm.) thick.

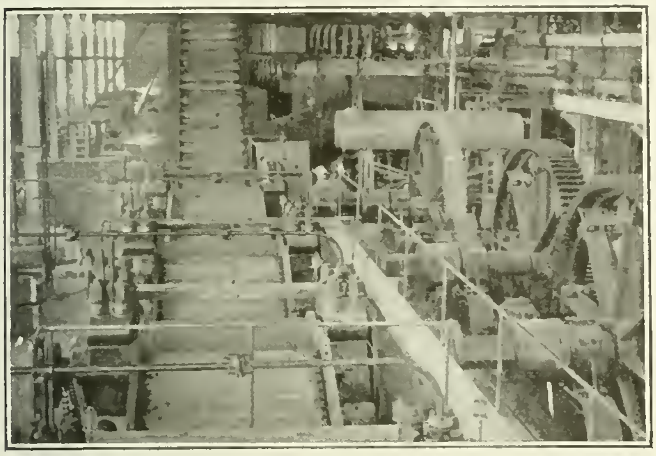


FIG. 2—CANE-GRINDING EQUIPMENT OPERATED BY VARIABLE-SPEED MOTORS

In this plant two tandems are installed, each consisting of five three-roller mills and one two-roller crusher. The rolls are 34 in. (86 cm.) in diameter by 72 in. (182 cm.) long, and the crusher is 32 in. by 72 in. (81 cm. by 182 cm.). Each tandem is operated by three variable-speed motors rated at 250 hp. each. Master switches are installed on a platform overlooking the entire tandem so that one man operates the group and regulates the feeding of the cane to the crusher. The operator has in front of him three ammeters showing the load on each of the mill motors and is thus enabled to regulate the speeds of the various motors, holding each to approximately full load all the time. With steam-engine-operated mills this speed variation is accomplished by changing the governor, but as there is no indicating device it frequently happens that in the desire to crowd each mill and get the most sugar out of the bagasse the rolls become choked and refuse to take the feed. With electric drive this is avoided, for when a "choke" is incipient the meter reading begins to crawl up and the operator relieves the load by reducing the speed of the preceding mill or increasing that of the mill which is choking.

In addition to the speed control by resistance, provision has been made in the power plant to split the busbar into two parts by means of an oil switch so that when it is desired to operate slowly while waiting for the arrival of more cane the mills may be operated at reduced frequency and voltage by using one turbine for the mill supply and one for the sugar-house load. Under normal conditions, however, the sectionalizing switch is closed and the whole house operated at 60 cycles.

All main leads are carried overhead on insulators on the roof trusses, but from the points where taps are taken off for the various motors the wires are carried in metal conduit so that ample protection is provided for the men and the wires.

Fuel and Steam Requirements

The steam plant consists of fourteen horizontal return tubular boilers rated at 225 boiler-hp., but frequently operated at 300 hp. or even 380 hp. as shown by steam-flow meters employed. Bagasse or ground cane is used as fuel in a special type of Dutch oven, and would be sufficient to supply all steam needed for grinding the cane and boiling the juice were it not for the increased economy realized when additional water is sprayed on the bagasse as it leaves all but the last mill. In Palma this maceration water is held at about 15 per cent of the weight of the cane so that this additional water must be evaporated. In consequence thereof it is necessary to burn fuel wood amounting, under continuous operation, to the extent of 2.4 per cent of the weight of the cane, and running higher for the whole crop owing to necessary shutdowns for cleaning, repairs or lack of cane.

Steam is supplied at 150 lb. (10.5 kg. per sq.cm.) pressure to the electric plant and at 80 lb. (5.5 kg.) pressure to the boiling house. The exhaust steam from the turbines is used at from 1 lb. to 5 lb. (70 gm. to 350 gm. per sq.cm.) pressure for the first heating of the juice to the boiling point and for evaporation to syrup, while live steam is used for the final evaporation to a grain in the evaporating pans.

The sugar-boiling house contains two quadruple effects for evaporating the juice to syrup and six evaporating pans for boiling the syrup to a grain. The vacuum system in use for this boiling is a combination of the central vacuum system and the individual system. Each body which operates under vacuum has an independent jet barometric condenser while the non-condensable gases are removed by two short-belt-drive Ingersoll-Rand vacuum pumps and two Westinghouse-LeBlanc dry vacuum pumps. Provision is made for respraying all or any part of the condensing water in case it should become necessary during the hottest weather.

In its final stage the sugar is separated from the molasses by twenty-four centrifugals having baskets operating at 850 r.p.m. and each driven by direct-connected vertical motors with high resistance rotors. These motors are connected to the line by quick-make-and-break oil switches combined with a band brake for stopping The entire centrifugal installation was furnished by Pott, Cassells & Williamson, Motherwell, Scotland.

The dried sugar is packed in the bags and loaded into cars or piled twenty-five bags high by a Brown portable piler.

The accompanying table gives a list of the various motors used in the mill. The equipment of this mill has been obtained from a wide variety of manufacturers, and all of it is operating with entire satisfaction and gives promise of continuing to do so.

MOTORS EMPLOYED IN CUBAN SUGAR MILL

Type of Duty:	Motors Installed Number	 Total Hp.
Variable-speed mill and conveyor drive....	10	1565
Centrifugal pumps	28	919
Geared pumps and belt drives............	34	215
Centrifugals	24	360
Total	96	3059

The Demand-Meter Situation

Critical Discussion of Demand Meters, Pointing Out the Advantages That Are Gained Through the Use of Well-Known Types of These Instruments and Remedies for Some of the Troubles Encountered in Their Practical Application

BY C. F. MATHES
Meter Foreman of the Trinidad (Col.) Electric Transmission, Railway & Gas Company

INSTRUMENT manufacturers have devoted considerable time to the perfection of demand meters and have accomplished admirable results, but there still remains the necessity of reducing the attention required, assuring long-sustained accuracy, making the instruments adaptable to various services and reducing the first cost. Obtaining these factors devolves partly upon the manufacturers and partly upon the users, because even with the best-made equipment satisfactory results cannot always be obtained unless the apparatus is properly applied, installed and maintained.

For this reason the writer will point out the classes of service to which several well-known types of demand meters are particularly suitable and then outline some troubles which have been experienced with each. In view of the fact that the advantages of each type are passed over rather briefly and more space is devoted to troubles, the writer wishes to warn readers against forming the impression that the demand meters on the market have nothing but disadvantages. Instead, it is hoped that the experiences which are related here may suggest improvements to manufacturers and help users perform their part in obtaining satisfactory operating results.

The advantage of an indicating meter, such as the Westinghouse type RO, lies in the fact that a combined watt-hour meter and demand meter are combined in one case and the demand-meter element requires no extra connections, contact device or paper charts. This instrument, moreover, is not so expensive as other types or combinations of instruments and is easily installed, owing to its compactness and to its not requiring extra conections. The maintenance of this instrument is negligible, as the indicating demand hand can be read and reset at the regular reading period. Owing to reasonable first cost and there being no extra maintenance features to speak of, this is an excellent meter for small installations where the revenue derived does not warrant the use of the more elaborate equipment suitable for larger installations.

Importance of Time at Which Peak Occurs

Considering installations of moderate or large size, however, a type RO or similar instrument will hardly answer the purpose of defining a consumer's demand charge. Such installations generally require knowledge of the time at which their peak load occurs and just how much of a peak is attained at that time. The writer has attempted to use an ordinary indicating type of demand meter on just such installations, with the result that at some time or other the consumer will complain about his high demand charges. In such cases the watt-hour-meter and demand-meter element would be checked for correctness. After this, what conclusive argument could be presented to the consumer? It could be said that the demand meter was correct, and evidently the high demand in question occurred at some time or other during the time elapsed between meter readings.

Curve-Drawing Meters and Their Characteristics

In such cases, where the consumer and central station desire to know the exact time as well as the amount of peak demand, the only recourse is to install a curve-drawing wattmeter or a curve-drawing demand meter, such as a General Electric type G-2. Now, unless the installation is large enough to warrant the expense of a curve-drawing wattmeter with the necessary instrument transformers as permanent equipment, it may not be desirable to use this type of instrument, as first cost is considerable, and owing to the necessity of changing charts, winding the clock, refilling the pen and frequently checking the accuracy of the element, the cost and maintenance of such an instrument may be too great to warrant its use on small installations. When a central-station company gets several of these instruments on its lines over a widely scattered territory, the general result is that it takes all of one man's time to look after them, as the nature of each load has to be studied to get the proper speed for the paper feed, and the instrument must be kept in proper time and otherwise maintained.

With the Westinghouse types of graphic wattmeters, having self-winding clocks, the writer has had considerable trouble in keeping the clocks going. The clocks do not seem to have strength enough to carry the proper re-roll attachments, and it has not been found advisable in most cases to attempt to use the re-roll attachment but to catch the used paper in a basket or other receptacle set under the instrument. Trouble has also arisen because of the failure of contacts to release after the cam has traveled past the point where they should release. In such cases the motor will wind the spring to such a tension that the spring will break from its fastenings on the shaft.

Solutions of Difficulties with G-2 Meters

Regarding the General Electric type G-2, the writer is glad to note the departure from the pen-and-ink system used on other instruments. The specially prepared chart, however, has given trouble in other respects. On certain outdoor substations it has been noted that in zero weather the stylus will not make a line on the chart, and then again on installations where the meter is liable to have the sun strike it the charts will turn purple all over. This makes it impossible to read any lines that may have been made by the stylus. In places where the meter is subjected to extremely low temperatures the writer has found it practicable to install several carbon lamps in the meter house to provide a little heat. A home-made thermostat installed to regulate the heat in the instrument itself has also been seen elsewhere. This heat in the instrument was provided by two 10-watt lamps mounted on a wooden block in the instrument case between the clock mechanism and the outer case. The latter scheme provided heat behind the chart, as it was found that one of the two lamps could be mounted almost behind the stylus and one slightly to the right of the terminal block in the lower part of the instrument, the burning of both lamps being regulated by the thermostat. On installations where it was possible for the sun to spoil charts it was found advisable to take an old chart and paste it on the inside of the glass cover of the instrument.

The disadvantages of this type of meter, other than those already outlined, are that the clock has to be wound and the chart changed once each week, a procedure which is almost identical with the maintenance features of the curve-drawing wattmeter types. For instruments installed at distant points from the meter department headquarters the writer endeavored to have switchboard attendants, electricians or others change charts and wind clocks on these meters, but succeeded in getting only fair results. It was found that charts would be left on from eight to ten days and the clocks allowed to run down; also, the charts would be put on carelessly and the stylus arm handled improperly, thereby throwing the instrument out of calibration. The stylus would be started from a point below zero, and in many cases the stylus would start at a time interval from the knurled nut that holds the chart in position. Conditions of this kind made it impossible to obtain a true demand on certain installations; so the writer found it safer, though more expensive, to have a company meterman take care of the instruments entirely.

On several meters it was found that the stylus arm would not return to zero at the end of one time interval and would continue on the second time interval on the same line. In some cases the stylus would go over the top of the chart and stick there until it was discovered on the next visit of the meterman. In other cases the double time interval would not reach the top of the chart and the stylus would be reset at the end of the second interval. In cases of this kind it was often hard to decide whether the line was a legitimate demand peak or a double interval. The cause for this double interval was found to be in the slide gearing arrangement. A little oil applied to the gear shaft and the working of the gear on the shaft has about eliminated this trouble. With the early types it was necessary to remove the entire face plate of the meter to get to the sliding gear and its shaft. In the later types a round hole has been provided in the face plate, so it is possible to inspect the gear and shaft without removing the face plate.

Trouble with the contact-making mechanism for these meters was also encountered. Cams were found upon which the brushes had worn round grooves in the sharp points of the compound cams, thereby allowing the brushes to make continuous contact when the condition of the cam became bad. In this matter the writer is now experimenting with a fiber cam, with good results so far. Regarding meters that had two-point and three-point cams it was found rather difficult to calibrate the meters on light load. This was partly due to the unequalized friction. To overcome this difficulty it was found practicable to take enough disk revolutions on the light-load check to allow the cam to make two complete revolutions. After taking several checks at light load in this manner, good accuracy could be attained. On the more recently purchased contact devices it was found advisable to have cams with ten or fifteen points to equalize the friction on light loads better.

It is interesting to note, from several experiments, that the type RO meter will invariably show a higher demand when installed on the same load as a type G-2. This is evidently due to the different principles upon which the two meters operate and the inability to keep them in step in regard to the time intervals.

The General Electric type M line of demand meters have similar drawbacks to the RO type, inasmuch as they are only suited to small installations where a demand indication is seldom or never questioned. Aside from this, they require a contact device installed on a regular watt-hour meter, extra wiring, and, unless the scale is calibrated for the particular installation, an odd constant is derived, which also holds true for the G-2 meter.

Critical Discussion of the Type RA Meter

The Westinghouse type RA meter, only recently put on the market, has not received much comment as yet, and it is probable that a number of companies have not experimented with it. The combination of a watt-hour and a demand meter in the same case, similar to the RO type, is a good feature, although the pen, ink, paper and clock nuisance is still manifest. The extra work seems to be put on the watt-hour meter register in the shape of additional gearing and pen arm. It is another type of meter in which the writer believes trouble will arise on light-load calibration should the register accumulate any friction from dirt, and dirt is bound to get into the instrument because of the continual removal of the cover to wind the clock springs and for changing of charts. The location of meters is not always the cleanest place in the world, and the cover of the type RA meter, which is only sheet metal, does not fit very well. The tendency seems to be for the sides, top and bottom to bulge out, which leaves openings for dust to get in. The stiffer cover of the RO type seems far superior to the sheet-metal cover of the RA type, which is presumably used to reduce weight. The clock, having a very high-grade watch type of escapement, would also be sensitive to this accumulating dust. It seems that the escapement should be protected by a covering of some kind.

The mechanical construction on the Esterline types of graphic meters seems to be an improvement in this respect. The entire clock mechanism is inclosed and is about as free from the accumulation of dust as it is practicable to make a clock mechanism for curve-drawing instruments. The clearance for the paper charts between the metal framework supporting the spools seems to be very small, and a very close adjustment of the paper is necessary in order to assure its proper travel. Should the paper become out of alignment only slightly, the chart will not travel. It is also an instrument that would hardly allow handling by other than company employees, as it is necessary to remove the cover each time the clock requires winding or charts are to be changed or any adjustments made. Should other than company employees work on the meters, it would not be possible to seal them, and unscrupulous persons would have the watt-hour meter adjustments, which really govern the action of the demand element, available for tampering.

POWER REQUIREMENTS FOR DRIVING LIME PLANTS

Small and Unsound Blocks of Marble Crushed, Burned and Hydrated by Means of Electricity in New England Plant

ELECTRICITY is being used extensively as a motive power in the plant of the Vermont Marble Company not only to carry on the ordinary work of such a plant, but in crushing, burning and hydrating small and unsound blocks or marble usually considered as waste. For this by-product work over 500 hp. in motors is used, 25,000 kw.-hr. to 30,000 kw.-hr. being consumed each month. The ratings of the motors required for different purposes are indicated in the accompanying tabulation. Twenty-seven of these motors, with a total horsepower of 462, are induction motors, and three motors, used on the crane, are direct-current series type, having a total rating of 55 hp. Except for the kiln and crusher motors, which are of the wound-secondary type, all of the induction motors are of the squirrel-cage type. Wound rotors are used in the two cases mentioned to afford sufficient starting torque for the crusher and to permit operating the kiln at any speed between one-third and full speed.

Owing to the fact that power must never be shut off for more than a few minutes because of the warping of the revolving kiln which might result, a reliable power supply had to be assured. This has been obtained from a central station over two 11,000-volt lines. One bank of three 200-kva. single-phase transformers can be connected to either of these lines to step down the voltage to 460 volts. If any one of the units should fail, the rating of the others is sufficient to carry the load in open delta.

The waste marble comes to the plant in various sizes. If the blocks are over 12 in. (30 cm.) in thickness, they are transported by slings hung from a crane to the jaw crushers. From these pieces smaller than 12 in. pass to a gyratory crusher, which reduces the marble to 2-in. (5-cm.) fragments or less. These pieces are then elevated and screened, the rejected material being run through rolls that reduce it to 0.5 in. (13 mm.) thickness or less. All of the material is then elevated and conveyed into storage and kiln bins. The foregoing operations involve 272 hp. in equipment. This can reduce 25 tons of stone per hour from blocks 150 cu.ft. (4.3 cu.m.) to stone 0.5 in. in thickness or less.

The crushed stone is fed automatically from the kiln bin into another bin by cradle feeder. The kiln is built after the familiar cement design and is belt-driven by a 30-hp. variable-speed motor geared to give ten speeds from 0.55 to 1.5 r.p.m.

TABLE I—CRUSHING DEPARTMENT

Machine	Motor, Hp.
Jaw crusher, 60 in. by 48 in	150
Gyratory crusher, No. 6 McCully	50
No. 1 elevator	7.5
Screen	7.5
Rolls, 36 in. by 16 in. superior	35
No. 2 elevator	10
Conveyor	5
No. 3 elevator	7.5

TABLE II—KILN DEPARTMENT

Machine	Motor, Hp.
Coal crusher	10
Bin conveyor	5
Coal elevator	7.5
Producer conveyor	5
Producer drive	5
Kiln (rotary), 20 ft. by 8 ft	30
Dust conveyor	5
Cooler	10
Lime elevator	10
Total	87.5

TABLE III—HYDRATING DEPARTMENT

Machine	Motor, Hp.
Hydrater	15
Raymond mill	5
Raymond mill	5
Separating fan	20
Separating fan	20
Bagging machine	15
Total	80

TABLE IV—MISCELLANEOUS MACHINES

Machine	Motor, Hp.
Air compressor	15
Pump in cooler pit	3
Pump in quarry pit	2
Barrel elevator	2
Total	22

For hydrating the lime the Kritzer process is used, which consists essentially of stirring the mixture of lime water through 75 ft. (22.9 m.) of 24-in. (61-cm.) piping. As the powder which issues from one end of the stirring tube may contain grit or other impurities, it is air-separated by means of Raymond mills, cyclones and canvas tubes. This material is packed in bags by a Bates bagging machine. This department has six motors and can produce 4 tons to 5 tons of hydrated lime per hour.

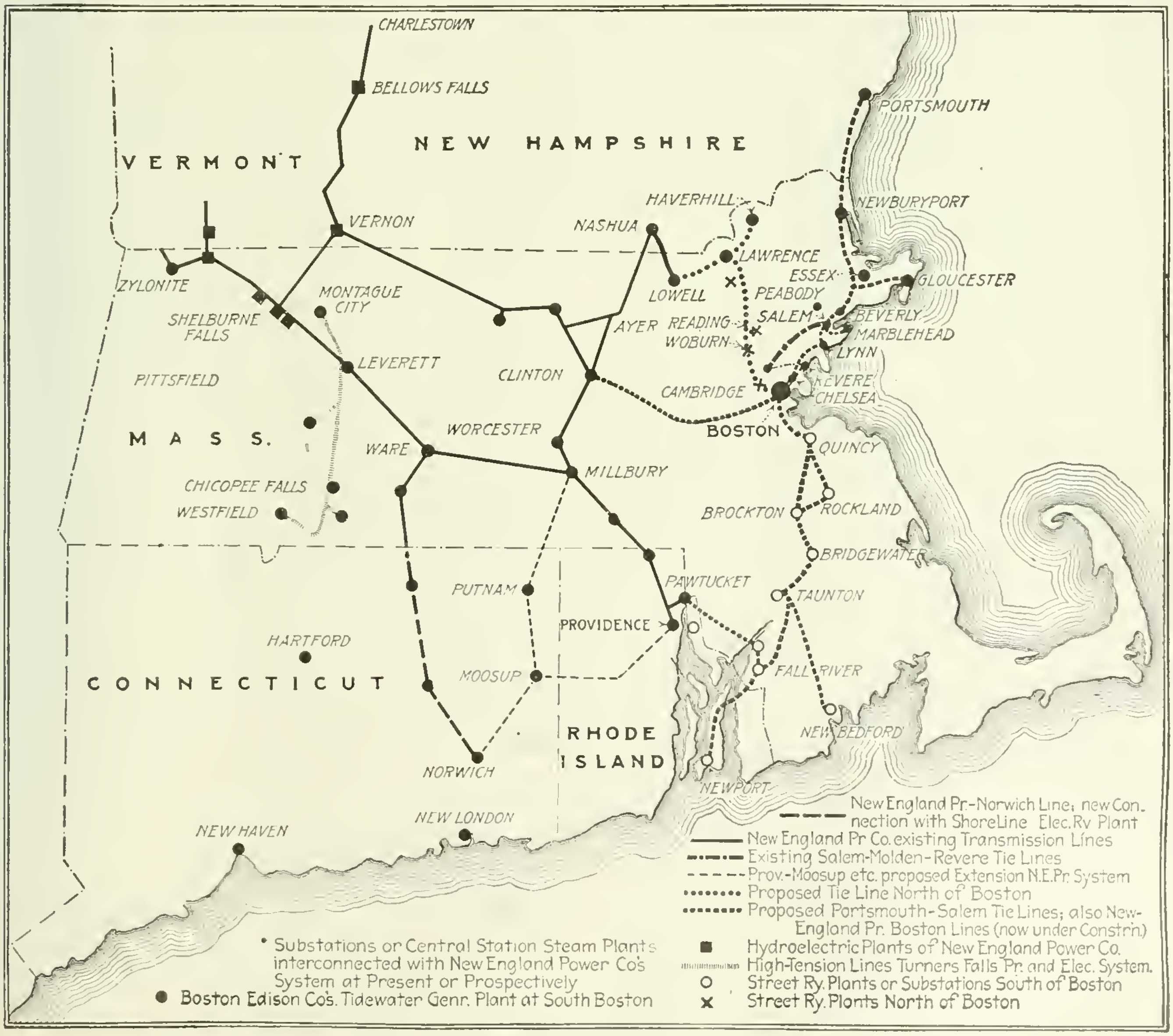
Besides the equipment described, the plant has a cooper shop with a capacity of 500 barrels per day. These are delivered into the kiln building automatically as needed by a barrel elevator and run.

More Light on New England Interconnection

Estimated Savings to Be Exceeded—Convenient Energy-Exchange Arrangements—Water Power Oversold—Railroad Electrification Possible Without Buying New Generators—Price at Which Tie-Line Energy Can Be Sold

THE more the New England transmission system and central-station interconnection problem is studied, the better it looks from the standpoint of saving fuel and releasing plant capacity for the demands of an increasing power market. The latest determinations in this matter were given by L. L. Elden before the Boston Section of the American Institute of Electrical Enginers Nov. 5. Extended articles[1] on interconnection results and prospects in New England have been published in the ELECTRICAL WORLD, but a brief résumé is given below of the additional information now available, especially in relation to the economies anticipated by including various electric railway generating plants situated north of Boston in the general scheme.

The broad plan of interconnecting plants south of Boston is at present in abeyance, partly on account of the right-of-way situation and partly because of the immediate difficulties confronting those desiring to raise money under present conditions. Step by step, however, a good deal is being accomplished, as the accompanying map indicates. Thus, a transmission line is now under construction between the Boston Edison company's system and the New England Power Company's system at Clinton, Mass., and the latter company is shortly to be connected with the Shore Line Electric Railway Company's new steam plant near Norwich, Conn. Operating figures available since the publication of the foregoing articles on interconnection indicate that


CHARLESTOWN
BELLOWS FALLS
NEW HAMPSHIRE
VERMONT
VERNON
ZYLONITE
SHELBURNE FALLS
MONTAGUE CITY
LEVERETT
PITTSFIELD
MASS.
CHICOPEE FALLS
WESTFIELD
WARE
WORCESTER
MILLBURY
CLINTON
AYER
NASHUA
LOWELL
HAVERHILL
LAWRENCE
READING
WOBURN
PEABODY
SALEM
ESSEX
GLOUCESTER
BEVERLY
MARBLEHEAD
LYNN
REVERE
CHELSEA
CAMBRIDGE
BOSTON
PORTSMOUTH
NEWBURYPORT
QUINCY
ROCKLAND
BROCKTON
BRIDGEWATER
TAUNTON
PAWTUCKET
PROVIDENCE
FALL RIVER
NEW BEDFORD
NEWPORT
PUTNAM
MOOSUP
NORWICH
HARTFORD
CONNECTICUT
RHODE ISLAND
NEW HAVEN
NEW LONDON
New England Pr-Norwich Line; new Connection with ShoreLine Elec.Ry Plant
New England Pr Co. existing Transmission Lines
Existing Salem-Molden-Revere Tie Lines
Prov.-Moosup etc. proposed Extension N.E.Pr. System
Proposed Tie Line North of Boston
Proposed Portsmouth-Salem Tie Lines; also New-England Pr. Boston Lines (now under Constr'n)
Hydroelectric Plants of New England Power Co.
High-Tension Lines Turners Falls Pr. and Elec. System
Street Ry. Plants or Substations South of Boston
Street Ry. Plants North of Boston
Substations or Central Station Steam Plants interconnected with New England Power Co's System at Present or Prospectively
Boston Edison Co's. Tidewater Genr. Plant at South Boston

ELECTRICAL INTERCONNECTIONS WHICH ARE UNDER WAY OR HAVE BEEN MADE IN MASSACHUSETTS the savings estimated on the 1916 basis will be exceeded when the interconnection is accomplished, in view of the increasing loads and outputs which are a feature of the electrical supply situation within the territory.

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[1] See issues for March 2, 1918; June 8, 1918; June 29, 1918; Aug. 10, 1918, and Aug. 17, 1918.

The expansion of the Boston Edison system during the last fifteen years furnishes an excellent instance of the benefits of interconnection. This company has taken over about forty plants in this period, the combined output of which ten years ago was about 100,000,000 kw.-hr. yearly. The average coal consumption was then about 4 lb. (1.8 kg.). The output is now about 300,000,000 kw.-hr. a year, and under the best operating conditions, with 2 lb. (900 gm.) of coal per kilowatt-hour there is being effected a yearly fuel saving of about 600,000,000 lb. (272,000,000 kg.). The fact that the numerous small plants have been shut down and that the system is supplied almost entirely from one or two tidewater stations does not invalidate the good results which have followed the interconnection of the central-station systems into a comprehensive single property.

PRODUCTION STATISTICS FOR PLANTS NORTH OF BOSTON, FOR YEAR ENDED JUNE 30, 1917

	Station Generating Capacity, Kw.	Maximum Load, Kw.-hr.	Kw.-Hr. Generated	Total Coal, Lb.	Lb. per Kw.-hr.
Bay State St. Ry. Co. (Chelsea)	3,950	3,700	12,412,000	34,753,600	2.8
Lynn Gas & Electric Co.	11,739	5,300	15,289,960	40,280,000	2.95
Bay State St. Ry. Co. (Lynn)	3,950	3,860	12,783,276	34,642,678	2.71
Total	19,639	12,860	40,485,236	109,676,278	2.709
Suburban Light & Power Co. (Revere)	1,400	2,000	2,387,300	833,056	3.5
Malden Elec. Lt. Co.	4,424	4,230	12,257,920	37,428,765	3.053
Salem Elec. Lt. Co.	13,437	8,800	22,333,990	41,673,600	2.09
Bay State St. Ry. Co. (Salem)	4,850	2,994	10,068,574	23,963,206	2.38
Peabody Municipal Plant	850	800	3,431,000	12,438,720	3.625
Marblehead Municipal Plant	600	400	1,046,415	6,783,920	6.49
Beverly Gas & Elec. Co.	1,875	1,240	3,141,605	10,928,000	3.896
Bay State St. Ry. Co. (Gloucester)	1,500	720	2,241,904	10,200,663	4.55
Gloucester Electric Co.	1,500	900	2,378,572	7,864,640	3.307
Total	30,436	22,084	59,287,280	152,114,570	2.56
Bay State St. Ry. Co. (Essex)	440	310	658,220	3,100,216	4.71
Ipswich Municipal Plant	380	300	500,478	3,012,800	6.02
Bay State St. Ry. Co. (Byfield)	500	384	758,009	3,994,136	3.95
Newburyport Gas & Electric Co	3,525	2,200	3,568,282	11,917,040	3.34
Total	4,845	3,194	5,484,989	22,024,192	4.015
Cambridge Elec. Lt. Co.	14,412	7,000	21,240,567	50,617,280	2.383
Bay State St. Ry. Co. (Woburn)	3,750	3,140	10,302,882	24,726,917	2.4
Reading Municipal Plant	1,000	750	1,238,019	4,987,808	4.03
Lowell Elec. Lt. Co	11,840	7,000	23,481,243	54,228,160	2.31
Bay State St. Ry. Co. (Lowell)	4,300	2,805	14,499,868	33,204,698	2.29
Lawrence Gas Light Co.	12,350	2,973	1,089,470	9,150,400	8.40
Bay State St. Ry. Co. (Lawrence)	3,365	2,706	8,743,657	21,334,523	2.44
Haverhill Electric Co.	4,937	3,750	9,599,020	29,536,954	3.077
Bay State St. Ry. Co. (Haverhill)	2,200	1,666	5,587,523	15,030,437	2.69
Total	58,154	31,790	95,782,249	242,817,177	2.535
Grand total	113,074	69,928	201,039.754	526,632,217	2.62
Spare capacity	43,146	Saving at 2 lb kw.-hr		124,644,647 55,645 tons	0.62
Value of equipment released (at $80 per kw.)	$3,451.680	Saving at $8 a ton, $445,160 yearly			

Ten years ago, excluding electric railway and municipal plants, the total output of the central stations in Massachusetts was about 200,000,000 kw.-hr., and the average fuel consumption was 3.5 lb. This output has now risen to about 849,000,000 kw.-hr., of which 565,000,000 kw.-hr. is steam-generated with an average fuel consumption of 2.61 lb. (1.2 kg.) per kilowatt-hour. If all these plants were interconnected to-day and were economically operated, an average fuel consumption of about 2.25 lb. (1 kg.) could be realized, and this would mean an annual saving of about 140,000 tons of coal, representing $700,000 at $5 per ton, or $1,112,000 at $8.

In the district from Portsmouth, N. H., to New Haven, Conn., the generating capacity of the central stations is approximately 1,000,000 kw. The total load of these plants does not exceed 75 per cent of the combined ratings and in individual groups of stations probably does not exceed 60 per cent. Few of the plant groups which are or would be naturally associated from the electrical standpoint are over 50 miles (80 km.) apart, and the total distance from group end to group end is not much over 250 miles (400 km.), the maximum width of the groups being about 90 miles (145 km.) over all. Enormous advantages would result from the interconnection of the plants within this area beyond present benefits. To-day oversold water-power systems are drawing upon steam reserves in every direction. Little or no additional investment in generating equipment would be required to realize the benefits of interconnection in the area shown on the map. In the steam-driven central stations contracts with water-power companies now usually contain a provision that only non-peak service need be furnished to the hydroelectric companies. The recent contract executed between the Boston Edison and New England Power companies provides that only surplus energy need be furnished the latter by the former.

It appears doubtful if any very substantial water-power developments can be made in future in Massachusetts or Rhode Island on a basis which will materially reduce the need for steam-plant service on a large scale. The New England and Turners Falls companies have together developed about 80,000 kw. in hydroelectric generating capacity, and the total water-power developed in Massachusetts and Connecticut probably does not exceed 125,000 kw. Future developments by the water-power utilities are likely to include a very substantial increase in their steam-plant facilities. Thus, the Turners Falls company has recently placed in operation at Chicopee Junction, Mass., a steam plant which may be developed in future to a rating of 100,000 kw., now supplementing about 35,000 kw. in water power. The New England Power Company purchases probably 50 per cent more steam power than it generates in its hydroelectric plants. Its connection with the Boston Edison company will provide for the supply of about 15,000 kw. off-peak energy to the New England lines, and arrangements will be made so that by water cooling the transformers can be forced to deliver 20,000 kw.

It is of interest to note that studies of railroad electrification requirements between Boston and Providence indicate that the entire train service between the two cities could be supplied without the purchase of a single additional generator if interconnected central-station service were made available for this work. The load, based on early analyses, would probably be in the vicinity of 20,000 kw.

The accompanying table gives the estimated savings in fuel on the 1917 basis of outputs and consumptions which might be realized in twenty-five steam plants north of Boston through interconnection and centralized operation. By including railway plants previously omitted in these estimates it appears that interconnection from Newburyport south would release 43,146 kw., the total generating capacity of these stations being 113,074 kw. and the sum of the peak loads 69,928 kw. The 1917 output of these plants was 201,039,754 kw.-hr., and the average coal consumption was 2.62 lb. (1.2 kg.) per kilowatt-hour. The range of unit fuel consumptions in the individual plants was from 2.09 lb. to 8.4 lb. (950 gm. to 3.8 kg.) It appears that with operation on the interconnected basis there would be an annual saving of at least 124,644,647 lb. (57,000,000 kg.) of coal, representing at $8 per ton $445,160 per year. At the low figure of $80 per kilowatt of plant rating, the value of the generating facilities released by interconnection would be $3,451,680.

So far the central stations north of Boston have not shown any great interest in the interconnection problem, with the exception of the Salem, Malden and Revere companies, operated by C. H. Tenney & Company of Boston, whose tie line and its results have been described in the ELECTRICAL WORLD. On the south of Boston limitations connected with the Bay State Street Railway Company's right-of-way for its existing transmission line from the Quincy station to Fall River have held back development. The financial situation of the Bay State company, which is at present in the hands of a receiver, makes definite steps toward coöperation difficult. Continued study of the situation on the south of Boston indicates that there would be a diversity of peak loads of about 5000 kw. About 54,000,000 kw.-hr. would probably be transmitted yearly over the proposed tie line, and there would be an assured profit in the plan for all companies and plants sharing in it. With coal at $8 per ton an estimated tentative fair price at which energy could be sold to the coöperating plants off the tie line on the south of Boston is 1.1 cents per kilowatt-hour. This is based upon 2.25 mills miscellaneous costs, 7.14 mills fuel cost, and a profit to the transmission line of 1.5 mills. Some question has been raised regarding a possible reduction in efficiency of certain plants which would be shut down a part of the time, but the total price at which energy could be supplied off the tie line would be low enough more than to offset this slight increase in unit cost, if such an increase occurred in spite of skillful handling of the generating units and boilers of the stations associated with the program.

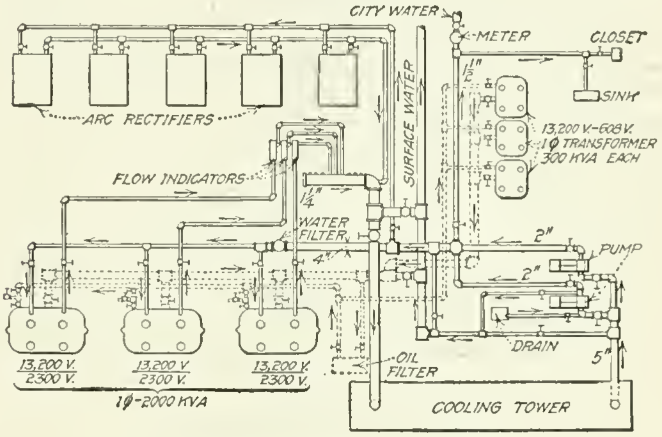
IN MOST of the countries of the world there will be a decided shortage of labor after the war. That country will best succeed which protects its workmen by improving their living conditions, guaranteeing a fair return for labor, protecting workmen and their families against accidents and idleness, and making workers better citizens. The country taking those measures will be the country that develops and makes products most economically. —*Edward N. Hurley.*

ARRANGEMENT FOR COOLING TRANSFORMERS IN SUBSTATION

Water from Cooling Tower Forced Through Units in Multiple and Circulation Checked by Flow Meters

An interesting arrangement for cooling 2000-kva., 13,200/2300-volt transformers is employed in a new substation built by the Worcester (Mass.) Electric Light Company. Normally the water is circulated through the transformer cooling coils on a closed system involving the use of a cooling tower erected in the substation yard. Make-up water is taken from the city mains. The circulation is maintained by the use of double-suction, single-stage, centrifugal Goulds pumps, direct-connected to 2-hp., 220-volt General Electric induction motors. This type of pump was selected as being more efficient than a single-suction pump. As one unit is continuously operated, even a small saving in energy at present prices of coal is deemed worth while.

The pumps draw water from the cooling tower and deliver it to a bus line terminating in a filter. Beyond the filter a branch pipe leads into each large transformer casing, and from the cooling coils of the latter the discharge water is carried through a riser to the operating room two floors above, where it passes through a flow indicator developed by the Spray Engineering Company. From the flow meters, which are mounted on a panel, the hot water is returned to a manifold, from which a connection leads back to the cooling tower. Metered make-up water is supplied to the system through a line connected into the transformer water supply main just beyond the pumps. The intake and outlet valves of each transformer of the water-cooled type are arranged so that any unit can be disconnected from the system without interfering with the others. Besides cooling the large transformers, this system of piping supplies water to the cooling coils of arc rectifiers also equipped with a Spray flow indicator.



COOLING SYSTEM FOR TRANSFORMERS

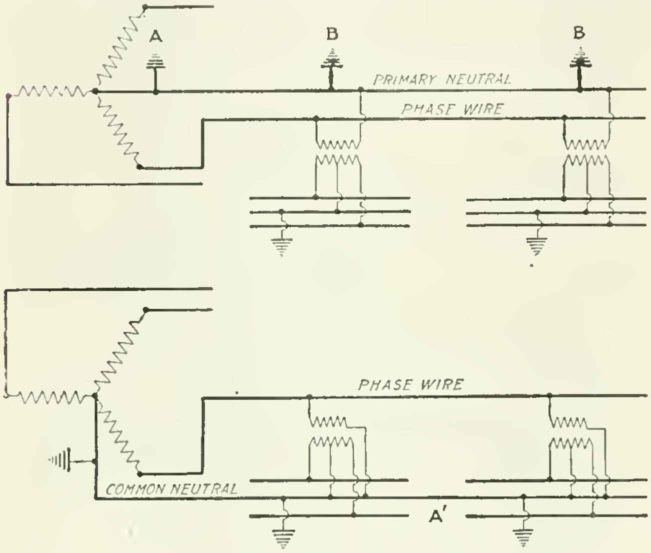
In general, the oil piping follows the same arrangement. All transformers are connected in parallel with the oil supply and discharge lines, and emergency drainage connections are included. A portable filter pump is used when it is necessary to change the oil. Either motor-driven water pump will handle the circulation required by the three main transformers and one spare unit of the same size. Space has been left in the pump room for the future extension of the pumping facilities.

Economical Increase Made in Distribution Capacity

Notable Saving of Copper and Transformers by Replacing Old Overloaded 2300-Volt System with 2300/4000-Volt Star-Connected, Three-Phase, Common-Neutral Primary and Interconnected Secondary

BY S. BINGHAM HOOD
Superintendent of Distribution Northern States Power Company, Minneapolis

THERE have just been completed in Minneapolis, Minn., extensive changes to a large section of the distribution system which serves the residential section in the south end of the city. The steady growth of this district had resulted in overloading the old system of mains and feeders to a point where good service was impossible. For some years past it had been found necessary to reinforce feeders, erect larger or more numerous transformers and increase the size of secondary bus lines. These changes were made as increased loads demanded, and, being purely local in their corrective character, did not result in a general betterment of the system as a whole.



FIGS. 1 AND 2—REGULAR AND COMMON NEUTRAL SYSTEMS

Realizing that such methods of correcting local troubles were leading nowhere, it was decided about two years ago to entirely revamp this section of the system. The old system consisted of a network of single-phase, 2300-volt primary feeders and mains serving lighting and small single-phase motor loads. It included also several three-phase, 2300-volt feeders supplying the larger power loads, principally along a narrow strip following the railroad which bisects this section of the city. These feeders were supplied from a local step-down station fed from the 13,200-volt main feeder network.

The power feeders were unregulated, but each lighting feeder was equipped with an automatic induction regulator. Excessive drop from increased loads not only resulted in exceeding the safe carrying capacity of the feeders themselves but made the voltage variation too great for compensation by the regulators. The natural result of this was that these feeders quite generally operated unregulated during the peak hours because every regulator was "up against" its limit stops. To make matters worse, the variation in drop between different sections of the same feeder was excessive, and, finally, the drop on secondary bus lines made service to the customers near their extreme ends anything but first-class.

The selection of the ultimate system was made a matter of most careful and extensive study, resulting in the adoption of the 2300/4000-volt star-connected primary three-phase system, using a common neutral. The secondary bus lines were interconnected throughout each phase section in a manner very similar to standard direct-current network practice. This "common-neutral" system is not by any means so well known or its advantages so well understood as they should be. It has been successfully employed for a number of years in several large cities, and in every case has given most satisfactory results both as to economy and reliability.

TYPICAL EXAMPLE OF 2300/4000-VOLT FEEDER LAYOUT

In order to show just what this system is and to demonstrate its extreme simplicity, Fig. 1 is given to illustrate a typical single-phase branch from a 2300/4000-volt feeder. Here are two short secondary bus lines, each supplied from its own transformer. The primary neutral is usually only grounded at point *A* in or near the substation. Each secondary neutral must also be grounded to comply with existing regulations. This method of operation has frequently resulted in serious trouble due to excessive currents during single-phase short circuits flowing over the primary neutral. Where this condition occurs the drop in pressure in this wire raises the potential to earth. In many cases this increase is sufficient to cause not only excessive voltage on the other two phases of the same three-phase feeder but also breakdowns in insulation.

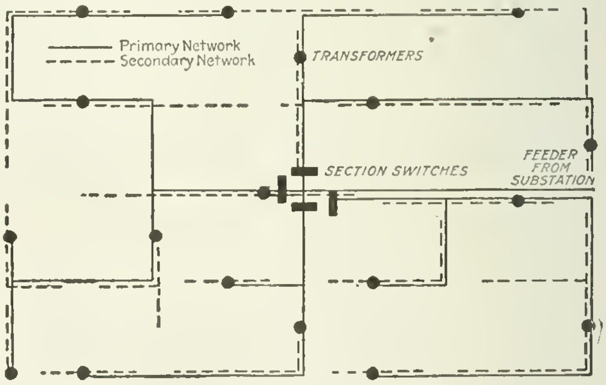
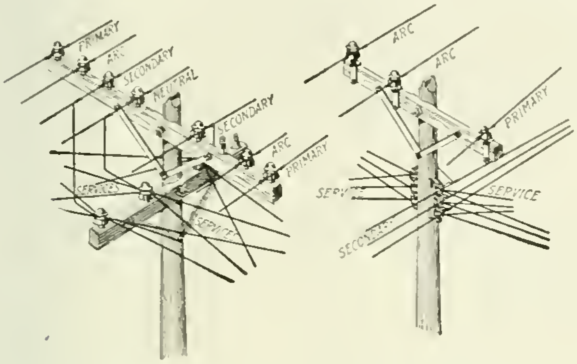


FIG. 3—ORIGINAL PRIMARY AND SECONDARY NETWORKS

In order to overcome such undesirable conditions it is quite generally the practice to place additional grounds at other points on this primary neutral, as indicated at *B*. This permits the earth to carry current in parallel with the regular metallic return. Under normal conditions the division of current over the two paths is such that no detrimental effects result. In the case of short circuits, however, the earth will carry considerable current and the increase in potential due to distortion of the neutral is averted. Under some conditions this method of operation has been found to affect seriously local communication circuits where close parallelism occurs. With the "common-neutral" system such interference has been found to be of very rare occurrence and to be practically negligible.

Referring again to Fig. 1, it is clear that two wires of the system, the primary neutral and the secondary neutral, are paralleling each other. Both of these are grounded and are presumably held at the same potential, and with a well-designed system each carries very small currents normally. It therefore follows that if these can be safely combined into one wire, considerable economy will be effected. The secondary neutral, if it complies with established requirements, must be "permanently and effectively" grounded. This means that the secondary ground must protect against high-tension crosses under the most extreme abnormal operation conditions. If it will do this, it most evidently will also protect against any normal operating condition; therefore these two conductors can be safely combined if the neutral grounds are what they should be. In order to obtain an effective ground, "water-pipe" grounds must be used or a considerable number of driven-pipe or rod grounds connected in parallel.



OLD NEW

FIGS. 4 AND 5—OLD AND NEW SERVICE CONNECTIONS ON POLE

Getting Away from Transformers with Taps for Odd Ratios

Referring to Fig. 2, it will be noted that the secondary neutrals have been interconnected at *A′*, placing all secondary grounds in parallel. This secondary neutral is extended back to the substation and connected to the neutral of the primary bank, which is grounded at the station also. In connecting the line transformers the primary lead to the phase wire is protected by a fuse, choke coil and compression-chamber lightning arrester. The other primary lead is carried around the case and connected solid to the secondary neutral lead. This is, briefly, what is termed the "common-neutral" system. With it only one-half the transformer auxiliary equipment is required, compared with a delta system or even a star system with the neutral grounded at the substation only.

A further advantage as regards transformers is the ability to use a standard twenty-to-one ratio transformer for ratios of nineteen to one, twenty to one and twenty-one to one without recourse to taps. These odd ratios are obtained by tapping the grounded primary lead of the transformer to either one or the other of the outer secondary leads, thereby converting a standard transformer into an auto-transformer. This scheme is often of value in serving a scattered territory from a single long feeder.

Not a Three-Phase Problem

In order to get a proper conception of this system it should not be considered as a three-phase problem, but as a straight single-phase proposition using a single potential-phase wire and a grounded return of negligible resistance. In starting this work of changing over the system, conditions were generally as illustrated in Figs. 3 and 4, where the former represents the primary arrangement and the latter the short sections of secondary bus served. The first step taken was to interconnect all the secondary neutrals in order to form a neutral gridiron throughout the entire district served. The gaps between sections varied from several spans to that represented by the gap across insulating breaker knobs inserted between adjacent bus sections. These small secondary sections were mostly composed of three No. 6 B. & S. wires attached to cross-arms on which both series arc and primary wires were carried. Service taps were taken off from buck arms. The transformers varied in size from 5 kva. to 25 kva. and were mounted at the tops of the poles, being hung from the regular line arm.

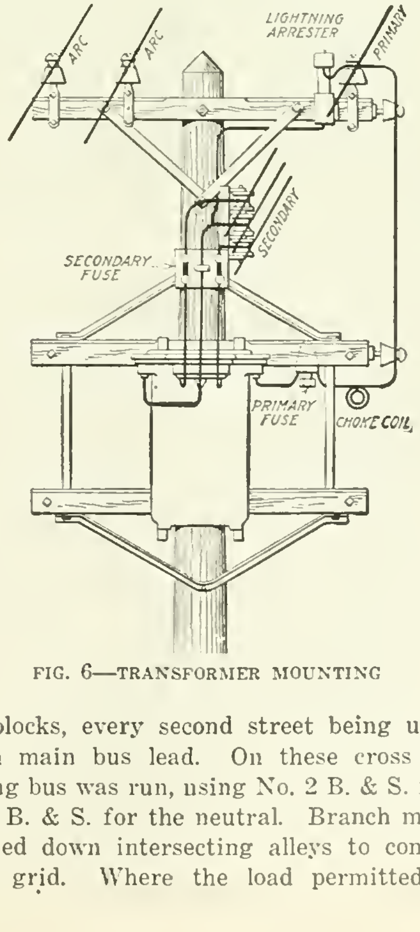


FIG. 6—TRANSFORMER MOUNTING

In revamping this system of secondary mains with a view to later interconnection, a standard size of transformer (20 kva.) was selected. These units were generally installed on the cross-town streets at intervals of three blocks, every second street being used for a cross-town main bus lead. On these cross streets a distributing bus was run, using No. 2 B. & S. for outers and No. 4 B. & S. for the neutral. Branch mains were then carried down intersecting alleys to complete the secondary grid. Where the load permitted existing mains were allowed to remain up, otherwise the outers were replaced with No. 4 B. & S., the neutral being left No. 6. In re-running these mains secondary racks were used in all cases. They were located 2 ft. (0.6 m.) below the lowest high-tension line arm. Services taken off from the same side as the line rack were attached directly to this rack. Those on the opposite side were supported by a service rack of the same type as the other. Fig. 5 gives some idea of the improved appearance of the rearrangement.

The various neutrals were run through solid between sections, the outers being sectionalized by inserting a standard porcelain breaker knob. When the final change-over was completed these outer breaks were bridged by a jumper type of fuse block using a multiple copper-link fuse designed especially for this system. Each section of the secondary was so laid out that with these breaks open the load would be correctly apportioned to the transformer serving the section.

Standard Transformer Mounting Reduces Pole Stresses

In rearranging the transformers they were mounted on a new type of "standard" framing located so that the transformer would be 4 ft. (1.2 m.) below the lowest line arm, the secondary line rack being placed midway in this pole space. Fig. 6 shows this framing and indicates its advantages as regards accessibility and decreased pole stresses in comparison with the old pole-top mounting. Each transformer was fused temporarily on both sides of the primary, one leg being removed upon completion of the change-over, as is explained later. The secondary fuse, shown just above the transformer, is a special outdoor type of black using the copper-link multiple fuse on outer wires. The neutral goes through solid and is held rigid by a clip.

The rearranged secondary would appear as shown in Fig. 7. This arrangement was employed over the entire district, in so far as practicable. In interconnecting, the fuses were of course left off those breaks which formed the division between primary sections served by different feeders and from different phases of the three-phase station bus.

The old primary scheme as shown in Fig. 3 was that of running out a pair of No. 4/0 feeder wires from the substation to a load center. From this center branch mains were taken off through disconnecting blocks or oil switches to the several sections of the district served. In rearranging the district the territory was so divided that, roughly speaking, there would be three new sections for two old ones. Each new section required one No. 4/0 wire (ground return). This plan required running one additional wire parallel to an existing two-wire feeder. Ultimately the nearest paralleling feeder was removed. This meant using three out of four No. 4/0 wires between the station and the load, or a net saving on feeders of 25 per cent. In addition to this saving, the feeder capacity was automatically increased on account of increased voltage by 50 per cent, and, assuming negligible return drop, the losses were reduced by 66 per cent under present loading and by 50 per cent when the ultimate increase of 50 per cent is made in loading.

To complete the return circuit, heavy neutrals were taken out of the substation and carried in four directions for several thousand feet, tapping the secondary gridironed neutral network at each intersection. With this arrangement the return copper cross-section was very large, and no dependence was placed on the carrying capacity of the earth returns. It should be mentioned here that water-pipe grounds were liberally distributed over this entire neutral network, in addition to a large number of older driven-pipe ground connections.

From the end of the No. 4/0 feeder wire of each single-phase section smaller single-wire primary mains were run. These were connected in a series of closed rings. This closed-ring feature is essential to successful operation of an interconnected secondary network, otherwise a break in primary will permit of a step-up-and-down transformation around the break. Such a condition, if permitted, forms the trap which has resulted in failure of so many interconnection schemes. The new primary arrangement is typically illustrated in Fig. 7. Comparing this with the old arrangement of Fig. 3 will show at once the gain in simplicity and uniformity in voltage distribution which must result.

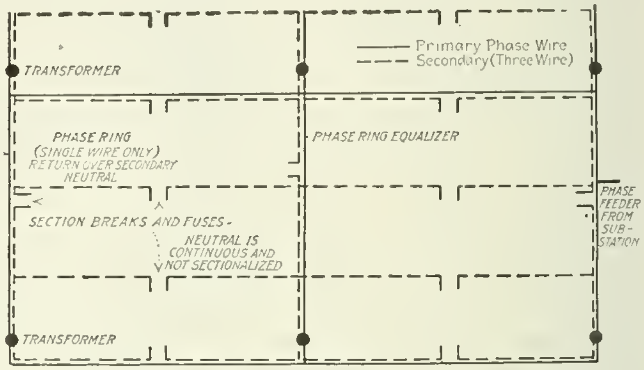

——— Primary Phase Wire
– – – Secondary (Three Wire)
TRANSFORMER
PHASE RING (SINGLE WIRE ONLY) RETURN OVER SECONDARY NEUTRAL
PHASE RING EQUALIZER
SECTION BREAKS AND FUSES -
NEUTRAL IS CONTINUOUS AND NOT SECTIONALIZED
PHASE FEEDER FROM SUB-STATION
TRANSFORMER

FIG. 7—NEW PRIMARY-PHASE SECTION AND SECONDARY NETWORK

Distinguishing Marks for Different Classes of Lines

In running these new primary lines, the old work, in so far as it was utilized, was overhauled, slack was pulled up, and the insulators were changed from glass to porcelain. A small 6600-volt porcelain insulator now is used to distinguish 2300/4000-volt primary wires from arc circuits. Secondaries, being on racks, possess a distinguishing mark for the low-voltage group. The old second primary was allowed to remain up until the time of change-over. It was reconnected where necessary to maintain the old circuit limits. Shortly before the change-over was made the old delta system was grounded and connected to the neutral network, this ground connection being attached to the *B* or middle busbar in the station. Following this, those single-phase circuits which were supplied from the *A-B* and *B-C* busbars were converted to common neutral return. In this conversion the old second primary was taken down, and the fuses, choke coils and compression chamber arresters were removed from the grounded side of the transformers. The driven-pipe grounds formerly used only for the arresters were at this time tapped also to the common neutral. As the change-over was made the various secondary sections were tested out for polarity and were interconnected through the jumper blocks and fuses between sections.

On the final change-over the station transformers were changed from delta to star. At the same time the distribution network still supplied from the *A-C* pair of busbars was cut loose, one end of these sections being then tapped to the new feed supplied from the *B* bus, the other being grounded to the common return. Later these middle sections were cut over at each transformer and the surplus wire was removed exactly as had previously been done with the *A* and *C* sections.

Statement of Results and Savings Effected

It will be clear from the foregoing that the saving effected on the primary mains as well as the line transformer auxiliary equipment was just 50 per cent. In addition, there was a saving due to simplification of the distribution layout, as can readily be seen from comparison of Figs. 3 and 7.

In converting the three-phase power circuits from delta to star considerable saving was effected by feeding small outlying power loads from overlaps from adjacent lighting feeders which were fed from different bus phases. This very considerably reduced the number of long but small three-phase primary branches in the system.

Where the power load was fairly well concentrated it was found economical to do considerable grouping. Most of the smaller power banks were operated open-delta, requiring either open-star operation or the installation of a third unit. By grouping these units advantage was taken of a wide diversity factor. In one case eighteen transformers, aggregating over 200 kva. in rating, were replaced by a single bank of three 30-kva. units. On the final change-over all that was necessary was to cut these remaining banks from delta to star on the primary side. In several cases customers were using the 2300-volt energy directly in their motors. For these auto transformers were installed, converting from 4000 volts to 2300 volts.

In this change-over the saving in transformers has been a very considerable economy. The total kilovolt-ampere capacity installed not only is less but those units released have been of the smaller sizes, having a greater value per kilovolt-ampere. These small sizes released will serve to fill demands for some time to come in those suburban sections where small units are needed.

Supplying Fluctuating Loads

A further economical feature of the interconnected secondary network worthy of note is its ability to supply fluctuating loads. With the old system of isolated secondary sections it was generally necessary to install individual transformers for rectifiers, X-ray outfits, single-phase motors, motion-picture machines and similar apparatus. All this equipment is now supplied from the regular secondary bus without noticeable interference with good lighting regulation.

The operation of this system is more than fulfilling all expectations. It has already successfully weathered several unusually severe lighting storms, these same storms having caused no end of trouble on the older system immediately adjacent to the district now served by the "common-neutral" system.

HIGHER COSTS PUSH UP EXPENSE OF PRODUCTION

Generating Costs Reflect Increased Fuel Prices and Emphasize Justice of Coal-Clause Principle in Contracts with Customers

Access to the cost sheets of four Massachusetts central stations handling peak loads of from 6650 kw. to 17,000 kw. during the last two years shows that the increased price of coal has had a striking effect upon operating expenses. A comparison of the station costs of these companies for two twelve-month periods terminating in 1917 and 1918 shows that, although the output at the switchboard of each company increased in some cases more than 40 per cent, the cost of coal was so much greater in each case that the cost of production per kilowatt-hour rose substantially, the larger part of the increase in unit expense being due to the fuel factor.

In 1917 the four companies each turned out from about 27,000,000 kw.-hr. to 40,500,000 kw.-hr., and their net production costs at the switchboard ranged from 6.78 mills per kilowatt-hour to 9.2 mills. The price of coal ranged from $4.935 to $5.73 per ton. Two of the plants are tidewater and two interior stations. In 1918 the outputs ranged from about 30,000,000 kw.-hr. to 51,000,000 kw.-hr., the prices of coal ranged from $6.47 to $8.28 per ton, and the net production cost per kilowatt-hour ranged from 8.95 mills to 12.75 mills. Three of the plants actually used less coal per kilowatt-hour in 1918. The labor costs at the stations examined did not show much change with one exception. The accompanying table of unit cost data is significant.

EFFECT OF INCREASED COAL COSTS UPON PRODUCTION EXPENSES

Plant designation:	A	B	C	D
Kw.-hr. generated, 1917....	$27,059,110	$21,872,900	$22,333,990	$40,507,750
Kw.-hr. generated, 1918....	30,286,260	31,529,200	33,103,670	50,896,500
Price of coal per ton, 1917...	$4.935	$5.07	$5.12	$5.73
Price of coal per ton, 1918..	$6.827	$7.76	$8.28	$6.47
Lb. coal per kw.-hr., 1917..	2.22	2.36	2 1	2.64
Lb. coal per kw.-hr., 1918..	2.10	2.31	1.93	3.1
	Cents	Cents	Cents	Cents
Coal cost per kw.-hr., 1917..	0.49	0.532	0.478	0 675
Coal cost per kw.-hr., 1918..	0.65	0.80	0.71	1.03
Labor cost per kw.-hr., 1917.	0.141	0.115	0.111	0.095
Labor cost per kw.-hr., 1918.	0.16	0.299	0.096	1.008
Total cost of manufacture per kw.-hr, 1917........	0.75	0 745	0 678	0.92
Total cost of manufacture per kw.-hr., 1918........	0.895	0.98	0.896	1.275

The load factors of the plants ranged from 29 to 37.5 per cent in 1917 and from 33.3 to 38.5 per cent in 1918. The plants responded well to the increased loads, but the increases in the price of coal were in general so great that even the most careful operation of the stations could not keep down the production cost as was desirable. The justice of the coal clause principle is vindicated by such results.

A thorough study of the cost sheets of these plants indicates that a plant of 10,000 kw. to 20,000 kw. rating is doing excellent work to-day in relation to its local opportunities if, with coal at an average of about $7 per ton, it turns out say 30,000,000 kw.-hr. a year at a net production cost of 9 mills at its switchboard, 6.5 to 7 mills of which is fuel expense and 1.5 mills or 1 mill of which is labor. As coal advances above $7 it is remarkably good practice to deliver energy at the busbars in medium-capacity steam turbine plants at 1 cent or under per kilowatt-hour.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

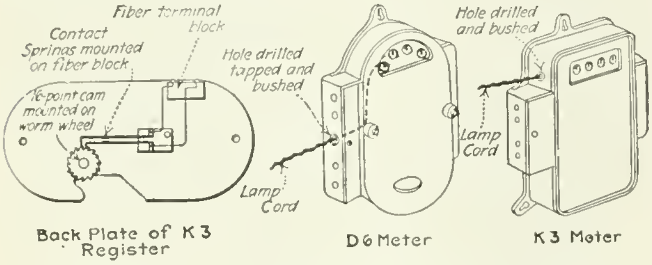
DEMAND-METER CONTACTS RENEWED IN REPAIR SHOPS

Considerable Money Saved by Not Sending Meters Back to the Manufacturers for Repairs but Making Them at Home

BY JOSEPH N. M'CLURG

Foreman Meter Department, Scranton (Pa.) Electric Company

By purchasing demand-meter contacts complete and mounting them in the repair shop, a central station has found that considerable economy can be effected. The manufacturer charges $1.50 for bushing meters and $2.98 for equipping the register with contacts. Contacts can be bought complete ready to mount for $1.98, including cam on worm-wheel shaft, adding 10 cents for $\frac{1}{8}$-in. (3-mm.) socket bushing and 3 ft. (0.9 m.) of lamp cord. It costs 90 cents to mount contacts on the register, drill, tap and bush the meter case and to test the meter after contacts are mounted on register. This makes a cost of $2.98 and saves $1.50 for each meter.


Fiber terminal block
Contact Springs mounted on fiber block
16-point cam mounted on worm wheel
Hole drilled tapped and bushed
Lamp Cord
Hole drilled and bushed
Lamp Cord
Back Plate of K3 Register
D6 Meter
K3 Meter

CONTACTOR ATTACHMENT FOR WATT-HOUR METERS

One of the problems of doing this work in the shop is to determine the value of one contact for the register. This is accomplished by finding the value of one revolution of the disk of the meter in watt-hours and then the relation between the revolutions of the disk and the revolutions of the worm wheel.

Rigidly attached to the same shaft as the worm wheel is a fiber cam or ratchet wheel. Two small brushes of phosphor bronze are arranged so that they rise and fall as they pass over the teeth of the wheel, thereby opening and closing an electric circuit. If the number of watt-hours recorded per revolution of the worm wheel is known, it is simple to determine the value of each contact. The worm wheel has 100 teeth, and one revolution of the worm on the shaft of the rotating element causes it to pass over one tooth; therefore it must take 100 revolutions of the worm to pass over 100 teeth or to cause the worm wheel to make one complete revolution. Then if 100 revolutions of disk equal 2.4 watt-hours (meter constant), one revolution of the worm wheel will equal 240 watt-hours. The cam being rigidly attached to the same shaft as the worm wheel must also have the same value per revolution; that is, 240 watt-hours. The cam used on this meter has twenty points; there being twenty points on the cam, it makes twenty contacts. Twenty contacts will thus equal 240 watt-hours, or one contact will equal 12 watt-hours.

This method of calibration can be reduced to a formula: Let M = value of one contact in kilowatt-hours; A = number of points on cam; B = revolutions of disk to one revolution of worm wheel; K_h = constant marked on disk (watt-hours); C = 1000 (number of watts in one kilowatt); then $M = (K_h \times B) \div (A \times C) M = (2.4 \times 100) \div (20 \times 100) = 0.12$ kw.hr. per contact.

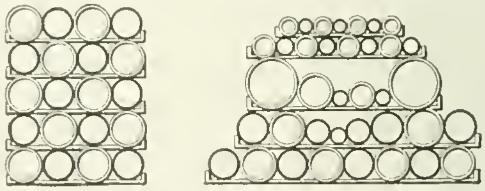
The contacts come in several different types for the different types of General Electric meters. They are I-14, D-6, DS-6, ID-3, IS-2, IS-3, DS-2, DS-4 and DS-5. The contacts for K-3 meters are different, and in buying them it is best to buy the worm wheel for K-3 register with the cam wheel mounted on shaft. It is advisable when using demand indicator on 440 volts to use a General Electric type V transformer for 440 = 110 volts. These are small size and built for use with the demand indicators.

SAFE METHODS OF PILING CONDUIT IN STOREROOM

Economy in Floor Space and a Minimum of Accidents Are Insured by the Use of the Plan Outlined Here

BY MATTHEW KING

In electrical storerooms stocks of electric conduit are generally kept in racks installed for this purpose, but when taken out to the job they are usually piled up in bundles in a pyramid form on the floor near where they are to be used. The amount that can thus be piled is limited by the width of the base of the pyramid formed. With any considerable quantity this must be made so wide that it is frequently in the way and as a result may be struck by passing hand trucks, etc., and the pile undermined. Severe accidents have been known to occur from this cause.



STRAP IRONS HOLD CONDUIT IN PLACE

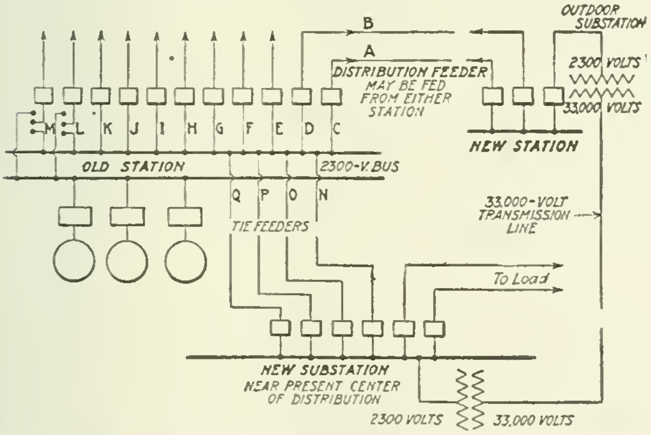
The accompanying illustration shows how a rectangular pile may be built of any width or height that obviates the danger of the pyramid pile and is of especial advantage where floor space is limited. Each layer of pipe is formed by two pieces of strap iron of convenient length and dimensions, each turned up at the end and placed as shown. Pipes of different diameters may be piled in one layer provided that the larger diameters are placed on the outsides. A pile of any width up to the limit of the straps may be built by simply changing the angle of the straps with respect to the pipe.

DISTRIBUTION CIRCUITS UTILIZED AS TIE LINES

Considerable Copper Saved in Laying Out New Central-Station System Necessary When New Power Plant Was Built for Central Station

Sometimes when a town or city is growing rapidly it so happens that the center of population is shifted in a certain direction. This shifts the center of the central-station load and often causes inconvenience and necessitates redesign of the feeder and distribution circuits. About thirty years ago, when the plant of the Binghamton (N. Y.) Light, Heat & Power Company was built, it was placed in the ideal condition near the river and a short distance from the business section of the town. It so happened, however, that with the development of the Endicott-Johnson Shoe Company to the west of the town many of the employees centered about this big industry. When the company decided to construct a new power house to take the place of the old one, it was built to the west of Johnson City.

In order to have capacity as soon as possible, the 2300-volt and 33,000-volt tie lines were built to transmit the energy developed by the 3500-kw. turbines immediately installed in the new plant. In the accompanying illustration an approximate outline shows how the system was redesigned. A substation was erected near the present center of load to be connected to both the old and the new plant. On account of the difficulty in getting material and the high cost of material and labor at the time of construction, plans were abandoned for building a permanent substation until a later date. The temporary substation, which is a corrugated building 16 ft. by 22 ft. (4.8 m. by 6.7 m.), contains the 33,000/2300-volt transformer as shown above.



PLANTS UTILIZING DISTRIBUTION CIRCUIT AS TIE LINE

Originally three generators at the old station supplied twelve distribution circuits radiating from this station. By extending two of these circuits, marked *A* and *B*, to the new station, the two plants were tied together on the 2300-volt buses. Energy coming from the 2300-volt bus at the new plant was stepped up by means of transformers to 33,000 volts, run through a 33,000-volt transmission line, and stepped down to 2300 volts again at the new substation. Two distribution circuits run directly from the 2300-volt buses at this substation.

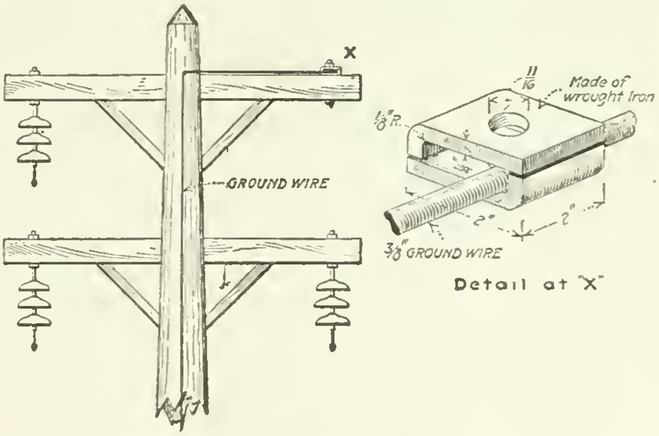
Radiating from the old station there were four distributing feeders marked *K*, *L*, *M* and *N* which happened to pass close by the new substation. The services fed by these circuits are now supplied by *O* and *T* from the substation, so the distribution circuits are no longer needed. These circuits were utilized by a little extra wiring as tie feeders between the old plant and the new substation. These feeders at present carry about 1500 kva. from the new plant to the old plant, but can also be used in feeding back from the old plant to the new plant in case of an emergency.

The two distribution feeders *A* and *B* can be fed from either the old plant or the new plant. A simple signaling device has been evolved which indicates which station is serving these feeders. In this way it eliminates any possibility of the two stations being tied together without being synchronized. All the circuits are connected separately at the old station, and therefore interconnection of the two stations is not considered necessary. The circuits can be rearranged to take care of the surplus of load at either station and provide for operating the machine a minimum number of hours.

SIMPLE SKY WIRE CLAMP FOR HIGH-TENSION LINES

Device Used to Bolt Ground Wire to Upper Cross-Arm Affords a Simple and Inexpensive Arrangement

A simple type of wrought-iron wire clamp is an interesting feature of the 66,000-volt transmission line recently completed by the Kansas Gas & Electric Company of Wichita, Kan. This clamp consists of two pieces of wrought iron arranged with bolt holes and curved edges so that the $\frac{3}{8}$-in. (9-mm.) ground wires can be clamped between them by a bolt which runs through both sections of the clamp and through the cross-arm on a two-arm lead. The clamp itself is 2 in. (5 cm.) square and 0.25 in. (6 mm.) thick. It is considered especially well adapted for a line on which there are a number of turns or on a line which traverses uneven country, because the sky wire is securely held against strains in all directions. On the lines of the Kansas Gas & Electric Company employing this device the sky wire is grounded at every pole.



POSITION OF SKY-LINE CLAMP ON POLE, AND DETAIL

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

SELECTION AND PROMOTION OF UTILITY EMPLOYEES

Details of a Plan of Personal Record of Employees Which Has Been in Use Many Years as a Guide to Promotions and Transfers

BY ARTHUR WILLIAMS
General Commercial Manager New York Edison Company

Many utilities have come to realize during the past three years the necessity for having a systematic policy with regard to selecting, training and promoting employees. In this period of reconstruction there will undoubtedly come an opportunity for making a definite plan for properly handling labor so that employee fitness may be a known quantity rather than a shrewd guess.

As a result of years of effort on the part of the New York Edison Company given to the development of a plan of employment and promotion, three of the most important conclusions which have been arrived at are that it is absolutely essential that the employment and promotion of the employee should not be haphazard, that promotion should not be acquired through pull, and that there should be equality of opportunity for the development of every employee and equality of reward according to the development of every employee.

One of the biggest problems confronting industry today is "men," namely, all workers who make up the organization, from the office boy and the stenographer to the president. Employment and promotional plans should all have for their ultimate aim the proper selection, training and advancement of the employee, for promotion and growth are the very life of a business institution.

In the New York Edison Company vacancies are filled from the ranks. Making promotions or transfers involves a big question. If we have an employee in our plant capable of filling a better job, we give him his chance, regardless of how well he may be performing a particular task. For the happy and satisfied worker is an asset to the company, whose interests are best served when the individual is allowed to grow and develop. The returns will be mutual.

To solve the question of promotion and transfers the New York Edison Company has devised a plan of keeping a personal record of each employee. The records are kept by an assistant to the manager of our bureau of education, who has charge of employment for his division of our company, which includes sales and handling of all matters pertaining to our relations with the public. The record shows the employee's age, education, time in the service of the company, history of such service, history of work done before entering the present employ and condition of his health. It records his accomplishments in educational courses, tardiness, absences, attitude of individual toward his duties; whether prompt, accurate and the amount of supervision he requires; whether he works well with other employees; whether ambitious, willing or adaptable; whether he possesses executive ability; whether sufficiently adapted to his work and sufficiently trained to render acceptable service. Often the record may indicate the fitness of the employee for a better position. To a large extent it registers his native ability.

We have had our system of records in use for five or six years and have found that, when conscientiously compiled, the record will reflect a fair picture of the individual employee's characteristics and general worth. Our managers must be exceedingly liberal, fair and unselfish regarding the question of transfers and promotion, for upon it depends the personality and spirit of our organization.

FLAT-RATE ADJUSTMENTS FOR LIGHTLESS NIGHTS

Iowa Property Charges 50 per Cent as Readiness-to-Serve Charge and Prorates Balance According to Hours of Use

The Citizens' Gas & Electric Company of Waterloo, Iowa, has developed an interesting method of handling flat-rate contract business on lightless nights which applies to sign and show-window lighting as well as to street lighting. To arrive at the selling price the company takes first 50 per cent of the contract price, to which is added the balance of the contract price prorated for the actual time in operation.

As an illustration, if the contract price is $4 per month per lamp and the actual operating time was twenty-five hours for the month compared with a total schedule of 100 hours for the month, the company would bill:

First:	50 per cent of $4	$2.00
Second:	25 per cent of $2	0.50
Total		$2.50

While the 50 per cent of the contract price used in the first instance as the basis of the charge is purely an estimate, it is based on what the officers of the company believe is sound reasoning. Careful consideration will show easily that a certain part of the flat-rate price is made up of fixed charges which do not vary materially as long as the contract price is in force, whether the electricity is actually furnished or not. These charges are made up of the usual readiness-to-serve expenses.

Austin Burt, manager of the Waterloo company, states that the Citizens' Gas & Electric Company has experienced no trouble in securing payment of accounts on this basis.

EFFECT OF VARIOUS ORDERS CONCERNING FUEL ECONOMY

Conservation Measures Decreased Revenue of Large Station 10 per Cent—Daylight-Saving Law Decreased Revenue of Another Company

A Middle Western company which operates a 15,000-kw. station in a city of 50,000 population reports that its income was affected to the extent of about 10 per cent by various fuel-economy orders and that the saving in coal was approximately 2000 tons. These figures are largely a matter of estimate, however, being based upon the differences between the last week of the daylight saving and the first week of the old system. It is the belief of the manager, nevertheless, that the figures are approximately true.

Another and smaller Middle Western company, which serves hydroelectric energy to a population of about 15,000, reports that the lightless nights have not affected its income to any extent because it is solely a water-power property. The daylight-saving law, however, did reduce its receipts from lighting about 15 per cent.

PROTECTION AGAINST THIEVING CUSTOMERS

Investigation Brings Out that Meter Protection Will Result in Decrease in Waste of Energy Besides Increase in Revenue

BY C. W. WARD

Formerly Superintendent of Laboratory Duquesne Light Company

With the view of determining how to protect itself against the theft of electrical energy, the Duquesne Light Company of Pittsburgh, Pa., recently conducted an investigation into the cost of, and returns from, the installation of meter-testing and protective devices on both new and existing services. The conclusions reached were that not only would there be a decrease in the loss of energy, but a substantial increase in revenue would be effected.

One of the first decisions reached, even before the total investigations were completed, was that in all cases where intentional irregularities were found to exist one of the terms of the settlement was the installation at the customer's expense of iron-clad service and a protective device.

Records of the contract department of the company during the period from Aug. 1 to Nov. 1, 1917, show that seventy-nine irregularities were detected, of which sixty-seven were reported by meter testers, ten by district meter men and two from other sources. Because the meter installers do not make any special effort to detect cases of irregular wiring, these figures represent only the most apparent cases, or those in which no particular effort at concealment had been made.

During these three months there were 3884 meters tested, and of that number there were 1095 meters which in the opinion of the investigating committee were not liable to irregularities, being mostly power meters. The remaining 2789 meters were liable to tampering and of these, as shown above, sixty-seven, or 2.4 per cent, were found irregular. The committee was convinced that there were enough thieving customers sufficiently clever to conceal their irregularities to justify the assumption that 5 per cent of the customers were indulging in this practice. Five per cent of the existing customers means that 3000 are regularly stealing energy. Statistics from the contract department show that the average annual revenue per lighting customer is $20. Therefore, if these 3000 customers were not stealing energy, their total returns to the company would be $60,000. Because they are stealing, their revenue drops off to their minimum of $6 each annually, or a total of $18,000.

In addition to this loss is the one represented by the difference betwen the consumption when the energy is being properly metered to such customers and the actual registration which such customers generously permit to occur. In other words, it was estimated that a deliberately thieving customer uses an average of 600 kw.-hr. per year, of which only 240 kw.-hr. is metered. This represents a loss of 360 kw.-hr. annually per thieving customer, which amount would be saved by the proposed new type of installation.

At an estimated cost of 2 cents per kilowatt-hour for delivery, this loss of 360 kw.-hr. would, if prevented, result in a saving of $7.20 annually per irregular customer, or a total of $21,000 for 3000 customers. Therefore the actual total saving effected is represented by an increased revenue of $42,000, which is the difference between $60,000 and $18,000 shown above plus the saving of $21,000, or a total of $63,000.

Estimates were made of the cost of equipping with iron-clad service and protective devices the various classes of customers served, and this was found to be $8 each, or for the 62,500 customers a total of $500,000. It was calculated that it would require thirty-five men a period of three years to do this work, entailing an annual expenditure of $166,000. Such an outlay would represent a capital account and would cost a total of 13 per cent divided as follows: Interest, 7 per cent; depreceiation, 5 per cent; maintenance, 1 per cent. The annual investment of $166,000 would then at 13 per cent cost annually $21,500. As theft of energy would be practically eliminated at the end of three years, the total annual saving effected from then on would be the $63,000 shown above, while the cost of the money for the installations for the three years would be $64,500. This would, of course, represent an excellent investment.

Owing to the great scarcity of labor, it was decided that the installation of such devices on the premises of existing customers could not be undertaken at the time, but that all new wiring jobs must be so equipped. Instructions were issued to all wiring contractors to that effect, and a system of issuing the devices, as well as locating the point of service entrance, was instituted. It was estimated that 4000 "safety switches" would be required annually for the new wiring jobs, all to be installed by the contractors. The only expense to the company would be the first cost of the box plus handling and delivery, or a total of $3 each, representing an annual investment of $12,000. This plan has been in successful operation for some time.

Each "safety switch" is equipped with wiring diagrams for both two-wire and three-wire installations. Reference copies of the diagrams were sent to every wiring contractor. The two diagrams are on the same sheet.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

An A. E. G. 55,000-Kw. Turbo-Generator.—Leading particulars are given concerning a turbo-generator of 60,000 kva. now being built by the A. E. G. for the large power station of the Rhenish-Westphalian Electricity Company. This station follows B. Goldenberg's designs and is situated in the brown-coal area near Cologne; a second similar 60,000-kva. machine will be added, so that, including six 15,000-kw. sets, the total plant capacity will be 200,000 kw. The new machine yields 55,000 kw., 7000 volts, three-phase, at 1000 r.p.m. with 220-volt excitation. The turbine is supplied with steam at 12 atmospheres gage pressure, superheated to 325 deg. C. and condensing water at 27 deg. C. The generator and turbine are each within a single housing. The turbine weighs 250 tons (rotor 49 tons), and the generator 225 tons (rotor 106 tons); total, 475 tons.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Elekt. Zeits.*, 39, May 9, 1918.)

New Graphical Representation of a Winding Scheme.—The principle of this representation consists in showing the winding scheme by a continuous undulating line, the conductors being represented by vertical lines, the lateral connections by horizontal lines, and in assigning to each conductor a number corresponding to its position in the coil without taking account of its position in regard to the poles. For instance, if in an undulating winding the step is 11, two neighboring conductors will carry the numbers 1 and 12, the following one 23, etc. The author gives finally examples of the application of the scheme to a series-parallel winding and to a three-phase winding.—*Revue Générale de l'Electricité*, Sept. 7, 1918. (Abstracted from *Elektrot. Zeits.*, Feb. 14, 1918.)

Lamps and Lighting

New Arc for Electric Searchlights.—V. Bellini.—To avoid the flaming of the Beck and Sperry arcs, the author proposes to cool the positive carbon, instead of the arc, by an air jet. Another important result is obtained in this way, namely, that the arc pressure is reduced to 50 volts, the voltage of the Beck and Sperry arcs being 70 volts. The new searchlight comprises three electric motors. One is used for slowly rotating the positive carbon, another for the centrifugal pump producing the air jet, and a third one energizes an aspirator for extracting the smoke produced by the combustion of the carbons. The air jet discharges itself under positive carbon through a rectangular slit. As actually constructed, the apparatus absorbs 120 amp. The Italian military authorities have adopted this device for transforming the ordinary searchlights. Special care is required in choosing the carbons. The copper sheath must not be thicker than 6/100 mm., as otherwise the drops of molten copper damage the mirror. The core of the positive carbon must not have too low a melting point and must be formed chiefly of cerium salts.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Elettrotecnica*, 5, July 25, 1918.)

Notes on Illumination in Stores and Factories.—Frederick J. Pearson.—An absolutely uniform lighting system in an establishment is inferior to a fairly uniform general lighting system reinforced by special lighting where necessary. Artificial lighting is used only for a small portion of the twenty-four hours and should be intensified to stimulate production. Efficiency, while important, should not always receive consideration to the exclusion of other factors which may result in greater satisfaction, increased sales in a store, etc. Local conditions must govern design. Light conditions in most factories are poor. Good lighting increases production just as it increases sales in a store. Increases of illumination intensity from 6 to 10 ft.-candles have increased the cost of lighting by only 1 per cent and have been found to promote sales by 6 or 7 per cent. Increase of lighting cost of 2 per cent in one installation was reflected in an increased factory production of 10 per cent.—*Transactions I. E. S.*, Oct. 10, 1918.

Incandescent Lighting in War Time.—G. H. Stickney and T. W. Moore.—The authors call attention to the fact that practice in illumination is not only affected by the fuel-conservation measures but also by the necessary manufacturing, transportation and other activities which must be conducted as speedily, efficiently and safely as possible. Luxuries must be restricted so that effort and material can be diverted toward more necessary enterprises and all unnecessary waste must be eliminated. In view of the effectiveness of good lighting, attention is called to some data furnished by the Commonwealth Edison Company showing that when illumination at 4 ft.-candles was tripled a record of production on eight different processes showed an average increase of 15 per cent. The writers then review the trend of the times regarding industrial lighting codes, protective lighting, lighting curtailment and the elimination of waste.—*General Electric Review*, October, 1918.

Generation, Transmission and Distribution

Electrical Mining Machines.—G. Rouet.—A comparison between the direct three-phase system and the Leonard system for the electrical control of mining machinery. The author holds that while at first sight the three-phase system is by reason of its simplicity the more attractive, the advantage with the machines in use none the less remains with the Leonard system, from the point of view alike of the precision of operation and the reliability of performance, of the repercussive effect on the central station, and of the economic results of exploitation.—*Revue Générale de l'Electricité*, Sept. 28, 1918.

Losses by Foucault Currents in Massive Armored Conductors During Transmission.—The importance of these losses is dwelt upon, and the error that lies in calculating output without adding to the losses by short circuit the losses in transmission due to the distortion of flux in the armor is pointed out.—*Revue Générale de l'Electricité*, Sept. 7, 1918. (Abstracted from *Archiv. f. Elektrot.* in *Elekt. Zeits.*, June 18, 1918.)

Development of Steam-Boiler Baffles.—Albert A. Straub.—Power-plant engineers are frequently required to develop modifications and changes in the standard method of baffling boilers in order to meet smoke-ordinance requirements of cities and also to increase the economy and flexibility of units operating under their direction. In developing the different types of baffles described, the ultimate purpose in each case was to obtain maximum economy and capacity consistent with the primary feature for which the baffle was designed. An extensive table giving tests of eighteen-tube wide, thirteen-tube high Babcock & Wilcox double-deck water-tube boilers equipped with Roney stokers of 80.8 sq.ft. (7.5 sq.m.) grate area are presented.—*Power*, Nov. 5, 1918.

Traction

Swiss Report on Corrosion by the Earth Currents of Electric Railways.—The corrosion of gas and water pipes and of the sheaths of cables has given cause for considerable complaint in Switzerland, particularly in two towns, and on this account the above-mentioned joint committee was formed. Trouble on a large scale has been experienced only in the larger towns with concentrated direct-current tramway services. The committee has drawn up a program of work consisting of five different parts as follows: (1) General report on the question of corrosion and methods of protection; (2) collection and utilization of the results of experience; (3) results of measurements on typical tramway systems; (4) regulations for the construction and maintenance of installations; (5) organization of a permanent controlling body. The present report refers to the first section only. It is divided into two parts: the first is theoretical and discusses the production of corroding currents and their laws of flow; the second part reports on the magnitude and nature of corrosive effects and their causes.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Schweiz. Elektrot. Verein*, July, 1918.)

Electric Traction and Hydraulic Power in Italy.—The author of this article considers that the three-phase system for electric railways has an unfavorable influence upon the national economy of Italy, as the peculiar frequency, separate apparatus, losses in the line, etc., influence detrimentally the cost of the energy both for railways and for private consumers and are inconvenient for a rational and economic utilization of the hydraulic forces. An example shows that if the three-phase railway were replaced by a direct-current one, the cost of the installation would be diminished by 15 per cent and the cost of the energy for traction by 52 per cent. The relatively high cost of production of three-phase energy for traction leaves a very moderate profit for the energy seller, who consequently is obliged to charge more to the private consumer in order to balance matters: this constitutes an unfavorable condition for the general national economy.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Elettrotecnica*, 5, June 25, July 15, 1918.)

Installations, Systems and Appliances

Automatic Fire Extinguisher for Transformer and Oil-Switch Chambers.—K. Perlewitz.—In conjunction with the Salzkotten Works for explosion-proof containers, the firm of Siemens & Halske has developed an automatic fire-extinguishing equipment for use with transformer or oil-switch chambers. A thermally sensitive device in the chamber to be protected closes a relay circuit when the temperature in the chamber exceeds a predetermined limit. The effect of this is that a tank of sulphuric acid is emptied into a potassium carbonate solution and the CO_2 liberated is carried by a pipe line to the chamber where fire has broken out. The chamber is filled quickly with CO_2 and the fire is stifled. At the same time one or more alarm bells are rung, the ventilating chimney in the roof and the oil outlet in the floor of the chamber are closed, and valves in the CO_2 pipes leading to the chamber affected are opened. Description of an actual installation is given with dimensions of apparatus.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Elekt. Zeits.*, May 23, 1918.)

Telegraphy, Telephony and Signals

Determination of the Characteristics of Three-Electrode Vacuum Tubes.—J. M. Miller.—This paper described a new method for determining the amplification constant and internal resistance of such tubes directly and rapidly. The method is based upon Vallauri's equation, $i_p = av_g + bv_p + c$, giving the relations between the grid voltage v_g, the plate voltage v_p and the plate current i_p. In this equation a is the slope of the (plate current) — (grid voltage) characteristic, and b is the slope of the (plate current) — (plate voltage) characteristic.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Inst. Radio Eng. Proceedings*, 6, pp. 141-148, June, 1918.)

An Electric World Girdle.—Edward Raymond-Barker.—The writer discusses the feasibility of telegraph lines completely encircling the globe. Secondary considerations, such as the total cost of such a project and the possibility of making it a paying proposition, are considered.—London *Electrical Review*, Oct. 25, 1918.

Miscellaneous

Economical Use of Coal in Railway Locomotives.—In addition to the discussion of problems peculiar to the burning of coal in locomotives, the subjects of selection, purchase and storage of coal are also considered.—*University of Illinois Bulletin*, Sept. 9, 1918.

Seeking Defects in Castings Made from Magnetic Metals.—Two small magnets are applied together on the metal casting. They comprise two windings, the primary one connected with a transformer. Both windings are connected with a buzzer. The two buzzers have the same tone. A flaw, in modifying the circuits, causes a difference of tone between the two buzzers which indicates its location and the importance of the defect.—*Revue Générale de l'Electricité*, Sept. 7, 1918. (Abstracted from *Schweiz. Bauzeitung*, March 16, 1918.)

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

UNLIMITED STORAGE ON BITUMINOUS COAL

All Restrictions Removed by the United States Fuel Administration in Conformity with Action of War Industries Board

All storage restrictions on bituminous coal were removed on Nov. 22 by the United States Fuel Administration in conformity with the action of the War Industries Board in canceling its preferential industries list. Anthracite coal is not affected, however, by the ruling of the Fuel Administration.

Every industry and every householder in the country now may store as much bituminous coal as desired or obtainable, as the action of the War Industries Board removes the necessity for the Fuel Administration to distinguish longer among different classes of industrial plants.

The restrictions just raised provided for the accumulation by the consumers in the preference classes defined by the War Industries Board of reserve stocks of bituminous coal in accordance with their location in relation to various mine fields and their classification on the preference schedule.

All industries located farthest from distribution points, particularly those in New England and in the Northwest, are found not only to be well stocked, in accordance with Fuel Administration specifications, but in many cases have surpluses above those amounts.

THE "LIGHTLESS NIGHT" ORDER IS SET ASIDE

Text of Dr. Garfield's Regulation, Effective on Nov. 23—State Administrators May Continue Rules in Whole or Part

The order of Dr. H. A. Garfield, United States Fuel Administrator, setting aside the "lightless night" order follows:

The United States Fuel Administrator, acting under authority of an executive order of the President of the United States, dated Aug. 23, 1917, appointing said administrator, and of subsequent executive orders, and in furtherance of the purpose of said orders and of the act of Congress therein referred to and approved Aug. 10, 1917, hereby orders and directs that the order of said administrator dated Nov. 7, 1918, establishing a regulation entitled "Regulation restricting the use in cities, villages and towns of light generated or produced by the use or consumption of fuel," and the regulation established by said order, be, and the same hereby are, vacated and set aside as of the effective date of this order; provided, however, that if the federal fuel administrator for any state shall, by an order in writing signed by him, provide for the continuance of said regulation or of any of the restrictions thereby imposed on the use of light, then such regulation, or the restrictions specified in the order of such federal fuel administrator, shall remain in full force and effect within such state until other or further order in the premises of such federal fuel administrator or of the United States Fuel Administrator.

This order shall be effective Nov. 23, 1918.

APPROVES THE LAMP CONSERVATION PLAN

Fuel Administration Indorses the Production Program of the Lamp Manufacturers' Committee and Recommends Conformity to It

G. T. Allen, acting director of conservation of the United States Fuel Administration, has written to J. W. Lieb, chairman of the lamp manufacturers' committee, that the administration approves the plan of lamp conservation which has been adopted.

Mr. Allen, acknowledging the receipt of transcripts of the proceedings at the meetings held on Oct. 16 and 23 by the committee of which Mr. Lieb is chairman, appointed July 15 to consider a plan for the conservation of fuel by limitations on the production and distribution of inefficient incandescent electric lamps, adds:

"After careful consideration of the production program for manufacturers of incandescent lamps which was considered and adopted at the meetings above referred to, the Fuel Administration is of the opinion that its execution will effect a substantial saving of fuel.

"The Fuel Administration therefore desires to record its approval of this program and its recommendation that the several manufacturers affected shall conform to it in the interest of fuel conservation."

A memorandum of meetings of the manufacturers of carbon and "gem" lamps on the two dates mentioned follows:

"At these meetings the manufacturers agreed to accord their hearty coöperation in carrying out the program approved by the Fuel Administration affecting the conservation of fuel by limiting the use of inefficient incandescent lamps, confining their use to conditions where the application of high-efficiency lamps is impracticable owing to excessive vibration or rough service handling.

"In order to carry out the general program already accepted by the users and distributers of incandescent lamps the manufacturers voluntarily offered to limit their production of the inefficient types and discourage their use as far as practicable in their advertisements and sales literature.

"The manufacturers represented at the meetings, those not directly represented having formally signified their coöperation by letter, unanimously offered to support the production program, each manufacturer voluntarily offering to adjust his production to the quota he presented as his individual proposal, as a war measure and in the interest of fuel conservation."

TORONTO WELCOMES AMERICAN ELECTRICAL ENGINEERS

Features of Ontario's Hydroelectric Power System Outlined and St. Lawrence River Crossing Near Three Rivers Described

The three hundred and forty-fourth meeting of the American Institute of Electrical Engineers was held in Toronto, Ont., on Friday and Saturday of last week. The sessions were held under the auspices of the Toronto Section, which has shown remarkable growth and renewed activity under its chairman, Arthur H. Hull. Two papers were presented at the Friday afternoon session in the Engineers' Club, one on the power developments in Ontario by Arthur H. Hull, assistant engineer of the Hydro-Electric Power Commission of Ontario, and the other on the equipment of the Canadian Northern tunnel under Mount Royal, Montreal, by W. G. Gordon, transportation engineer of the Canadian General Electric Company.

At the Friday evening session, held at the University of Toronto, S. Svenningson, designing engineer of the Shawinigan Water & Power Company of Montreal, described the overhead transmission line crossing the St. Lawrence River. An informal dinner was given earlier in the evening at the Engineers' Club, at which time Sir Robert Falconer, president of the University of Toronto, spoke most interestingly of his observations on the battlefields of France.

Technical excursions were made on Saturday to the Leaside munition plant, the electric-steel plant of the British Forgings Company and the Hydro-Electric Power Commission's laboratories and 110,000-volt substation. Every attentior was shown the American engineers by their Canadian hosts, whose bounteous hospitality was acknowledged by Secretary F. L. Hutchinson for the Institute and the American visitors.

The immense system of the Hydro-Electric Power Commission of Ontario, covering the Province of Ontario, was given in outline by Mr. Hull, who also included some data on the commission's latest development at Niagara Falls. Between Lakes Erie and Ontario there is a difference in elevation of 330 ft. (100 m.). The greatest head now utilized on the Canadian side at Niagara Falls is about 160 ft. (54 m.). To obtain the greatest amount of power from the water available, after careful surveys and studies, it was decided to locate the generating station just above Queenston, and to take water from the Niagara River, through the Welland River (reversing the flow) and canals encircling the city of Niagara Falls to Queenston. The first canal is now under construction.

The total length of waterway from the Niagara River to the generating station site is about 12½ miles (20 km.), 4¼ miles (6.8 km.) of this distance being in the Welland River and the rest in an excavated canal. The net effective head will be about 305 ft. (93 m.), and the first canal is normally designed for 10,000 cu.ft. (283 cu.m.) per second at minimum low water.

The generating station will be about one mile up stream from Queenston, in the gorge just at the end of the last rapids in the river. At this point the banks are steep and short penstocks only will be required. Provision is being made for extensions, and right-of-way for two more canals has been purchased. To show the effect of utilizing the greatest possible head of water, it was pointed out that about 30 hp. will be developed for each cubic foot per second in this development, whereas about 14 hp. is all that is obtained in existing plants at Niagara Falls.

The development now under construction is designed, as regards canal, forebay, gatehouse substructure and power-house substructure, for a capacity of 300,000 hp. It is proposed to construct the gatehouse and powerhouse superstructure for an initial installation of 200,000 hp. in four units. The designs are made so that extensions of power house and gatehouse can be made to almost any extent. Future plans contemplate the use of 100,000-hp. units.

The turbine speed has been fixed at 187.5 r.p.m., and specifications for the generators are now being issued calling for 45,000-kva., 85 per cent power factor, 12,000-volt, three-phase maximum-rated generators of vertical type equipped with thrust bearings to take the weight of the rotating part of the generator plus the downward thrust of the turbines.

Mr. Svenningson's paper dealt with some remarkable construction recently completed by the Shawinigan Water & Power Company near Three Rivers, Quebec. The St. Lawrence River is crossed by transmission-line wires on a span of 4800 ft. (1463 m.), this being the longest span in the world. Owing to necessities of navigation clearance, the towers are 350 ft. (106.6 m.) high.

Three lines of cable 50 ft. (15.2 m.) apart span the river between the two towers. The cables are 1⅜ in. (34.9 mm.) in diameter, made of galvanized plow steel. They are composed of six strands of nineteen wires each and a stranded core of thirty wires. It was originally intended to use the main cables as conductors and to insulate them from the tower by specially designed insulators. Unfortunately these insulators were not completed in time for erection, and for the present the main cables are used as messengers from which No. 1/0 stranded copper conductors are suspended. These suspended lines are supported every 250 ft. (76.2 m.) by suspension insulators of eight units to a string. The insulators which will be used eventually when the steel lines act as conductors consist of a large ring girder and two spiders.

The ring girder is 8 ft. (2.4 m.) in diameter and made up of two 9-in. (22.8-cm.) channels 12 in. (30 cm.) apart, with ⅜-in. (9.5-mm.) cover plates The upper spider is connected to the ring girder by means of three 2½-in. (6.2-cm.) bolts 10 ft. (3 m.) long, one at the end of each spider arm. The center spider is supported on the ring girder by six porcelain insulators of eight skirts each, two insulators at the end of each spider arm. The clear distance between the spiders is about 36 in. (91 cm.).

The porcelain insulators used are special compression insulators having a tested breaking strength of 60 tons each. This is about four times the estimated maximum load. Electrical tests showed a dry flashover of 302,000 volts and a wet flashover of 262,000 volts. The completed insulator has a net weight of approximately 6 tons.

The crossing has been in uninterrupted service now for about nine months. The provisions for protecting the towers from ice flows were described.

RAPID READJUSTMENT IN POWER APPARATUS

Bulletin of the Electrical and Power Equipment Section of the War Industries Board Shows Quick Progress

In Bulletin No. 2 on "Readjustment Plans," dated Nov. 21, the electrical and power equipment section (of which Walter Robbins is chief) of the War Industries Board says in part:

"*Priorities and Preference List.*—The Priorities Division has prepared for printing Circular No. 58, which may be briefly summarized as follows.

"Preference list and all supplements thereto are canceled as of Nov. 22. All specific and automatic priorities are canceled as of Nov. 22, save those in favor of the navy, the emergency fleet, the United States Railroad Administration, telegraph and telephone companies. The circular also provides that where exceptional necessity is shown, after careful investigation, specific priorities other than those mentioned above may be issued.

"You are, therefore, permitted to accept orders and make deliveries of all classes of apparatus and for any purpose where such deliveries are not in interference with priority orders on your books for the agencies mentioned above, and to readjust your schedules according to your own best interests.

"Section 2 of Circular 58 calls attention to the fact that the cancellation of priorities does not cancel the order.

"*Pledges.*—By virtue of the fact that the preference list has been abolished, you are hereby entirely released as to pledges addressed to the priorities committee.

"*Restricted Industries.*—A number of industries coming under the direct supervision of this section have been working under various degrees of curtailment by virtue of circulars issued by the Priorities Division. These are as follows: the vacuum-cleaner industry, washing-machine industry, electric heating appliance industry, fan-motor industry. You are hereby advised that all restrictions are now lifted and that your pledges filed in accordance with the provisions of such circulars are canceled.

"*Circular No. 23, Jobbers and Dealers.*—This circular is hereby canceled and withdrawn.

"*Monthly Reports.*—We suggest that you prepare your P. C. Form No. 21 for November, and, as stated in Bulletin No. 1, maintain your own machinery for preparation for similar report for December, if wanted. We cannot now see that the information for November will be useful to us; therefore suggest that you do not mail it unless we find a necessity later on. This is in line with our desire to refrain from seeking unnecessary information, and, of course, applies only to those industries under your jurisdiction which were under that system.

"*Our Future Duties.*—We are proceeding with all possible speed to review our files, put them in shape for future reference, to make explanations in connection therewith where it seems necessary, and in writing the history of our activities. We shall still probably be called upon for some service in connection with the various government agencies in connection with cancellations or tapering-off programs. So far as we can see, when this work is finished we are finished. In the meantime, if we can perform any service for you, please call on us.

"*Conservation.*—Positions with reference to general conservation and standardization are now quite as expressed in Bulletin No. 1; that is, schedules will not be promulgated from here except upon specific request from each war service committee having the schedule in charge. In the absence of request, we will understand that the schedule is not to be promulgated.

"The War Industries Board, however, fully recognizes the desirable nature of many features of the programs of conservation and standardization which have been prepared, believing that a thoroughgoing standardization of our industries will have a far-reaching effect on international competition through providing a basis for organization of such industries on a national scale. In this connection it will be of interest to quote the following paragraphs from a recent statement by Mr. Baruch:

"(a) Discussing the matter of conservation and standardization, Mr. Baruch called attention to the opportunity which exists for the country to make of a matter of necessity a matter of advantage. The various measures undertaken, he observed, had been projected and carried through under the stress of the war program—each measure taken up with the individual industry involved, and no attempt made to establish a general policy. The results achieved even in that way, he declared, justified, in his belief, a suggestion that the whole subject should be transferred to one of the permanent agencies of the government. Properly conceived, he declared, a policy of industrial conservation and standardization in time of peace would make for a saving in materials, money and labor, and a consequent increase in productive capacities. Standardization of types and styles in various classes of commodities, he said, would make for cheaper costs of production, and, resulting therefrom, lower prices to the consuming public. The possibilities from such economies, he remarked, constituted one of the great lessons learned from the war.

"(b) At this point the chairman took occasion to pay a warm tribute to the 'spirit of service,' which, he said, possessed to an unvarying degree by American industry in the period of the war, had made the war industries organization of America greater than that of any other country. Each industry, he said, considered itself to be fighting Germany. He relied on a similar spirit to see the country safely through the period of transition.

"Mr. Baruch announced that George N. Peek, commissioner of finished products of the War Industries, Board, had been delegated to represent the War Industries Board in its dealings with Herbert Hoover in the latter's demands for materials needed for the reconstruction work in Belgium. Mr. Peek's headquarters will continue to be in Washington.

"*Steam Condensers—Surface Type.*—On Sept. 9, 1918, all manufacturers of surface-type steam condensers were notified that the manufacture and distribution of this apparatus was to be controlled and regulated by the War Industries Board. The reasons which made such action necessary no longer exist, and the restrictions set forth in our letter of Sept. 9 are hereby removed.

"*Power Equipment—Shipping Schedules.*—The manufacturers of boilers, heaters, condensers, stokers and other power-plant apparatus may discontinue mailing shipping schedules and corrections thereto to this section of the War Industries Board; but it is suggested that the manufacturers themselves continue to make up these records for their own use, and for ready reference in case this board needs the information contained therein to carry out whatever program of cancellation or redistribution may be determined upon.

"*Maximum Prices.*—It has been decided that all maximum prices promulgated by the price-fixing committee will remain in force for the periods originally contemplated. At expiration each case will be considered individually, and, where justified by conditions then existing, price control may be retained on the present or on a modified basis, or may be withdrawn completely.

"*Restrictions on Buildings.*—All restrictions as to buildings and construction work of any nature have been withdrawn to-day.

"*Steam Turbines.*—On May 31, 1918, all manufacturers of steam turbines of 500 kw. or larger were notified that the manufacture and distribution of this apparatus was to be controlled and regulated by the War Industries Board. The reasons which made such action necessary no longer exist, and the restrictions set forth in our letter of May 31 are hereby withdrawn. As stated above, under the caption 'Priorities,' manufacturers will proceed to readjust their production schedules according to their own understanding of the relative importance of their various orders, keeping in mind only priority for the four agencies named."

THE PASSING OF WAR PRIORITIES ANNOUNCED

All Ratings Canceled Except for the Navy, Emergency Fleet Corporation, Railroads, Telegraph and Telephone Companes

B. M. Baruch, chairman of the War Industries Board, authorizes the following:

The Priorities Division of the War Industries Board announces the formal cancellation of all outstanding priority ratings, whether by certificate or automatic rating, excepting those for the navy, the Emergency Fleet Corporation, railroads, telegraph and telephone companies.

The order becomes effective as of Nov. 22, 1918. It in no wise implies cancellation of orders, priority directions and requests, whatever their form, having been entirely disconnected from the placing of orders, their sole purpose and function being to define the relative importance of orders when placed. Furthermore, the full force and effect of the directions prior to that date are retained and preserved for the protection and benefit of those manufacturers who have respected and observed them.

The effect of the cancellation will be to divert to civilian needs on an equitable basis vast quantities of materials in the obtaining of which the military program of the nation had prior claim.

Applications for priority certificates may still be made, but will be granted only when the need is urgent and where it is clearly in the public interest. Nevertheless the Priorities Division, under the new order, not only recognizes the paramount needs of the navy, Emergency Fleet Corporation, railroads, telegraph and telephone companies, but urges the industries of the country without resort to priority assistance to speed up the production and delivery of orders for the repairing of public utilities, manufacture of farm implements, and of equipment for the production and distribution of food, petroleum and natural-gas pipe lines and other facilities, and the operation, repair, maintenance or expansion of mines, coke-oven plants, ore-reduction plants, smelters and furnaces employed in the production of fuels, metals and metal products.

The order further eliminates completely Preference List No. 2 issued by the Priorities Division for the guidance of all governmental agencies and others interested in the production and supply of fuel and electric energy, the supply of labor and the supply of transportation. From time to time however the Priorities Division will promulgate such rulings and make such suggestions and requests in connection with priorities in the production and supply of fuel, electric energy, labor and transportation as changing conditions may require.

The order expresses strong appreciation of the wholehearted support accorded the priority regulations by the industries of the country during the period of active hostilities. Public interest, it goes on to say, demands that the flow of materials, equipment, supplies, fuel, transportation and labor shall now as promptly as possible, but without unnecessary disturbance, be turned back to normal channels.

TERMINATION OF SIGNAL ORDERS AND CONTRACTS

Letter from the War Department Asks for Information "in Order that Prompt and Mutually Satisfactory Action May Be Had"

A copy of a letter from the office of the chief signal officer of the War Department, sent to those interested in the termination of orders and contracts, has been received by the ELECTRICAL WORLD. It follows:

1. As a result of changed war conditions, it will be necessary in many cases in the interest both of the government and of the contractor to effect a termination of existing orders and contracts. The term "termination" does not necessarily mean an abrupt or complete cancellation, but rather such an adjustment as will best safeguard the interests of both parties under the conditions existing in each individual case.

2. In cases where the contractor is willing to so terminate an order or contract and is prepared to state in writing that such termination will not be accompanied by a disturbance of labor in the contractor's plant it undoubtedly will be possible for this office to agree with the contractor upon the terms of such termination and to effect it without referring the matter to other or higher authorities. It is evident that it is desirable in the interest of both parties that this course be followed wherever possible and all unnecessary technicalities and delay in effecting the adjustment thus eliminated.

3. In accordance with the foregoing it is requested that you advise this office immediately upon receipt of this letter: (1) What orders and contracts you are willing to terminate as above; (2) whether such termination would disturb labor conditions at your plant; (3) upon which of such orders you are willing to effect an immediate and complete termination.

4. This information is requested as a preliminary step only and in order that prompt and mutually satisfactory action may be had when those orders and contracts are taken up for consideration, and it must not be construed as a notice of termination.

5. Pending negotiations of this character, it will be to the interest of the government that no additions to or replacements of existing labor be made by you for Signal Corps production.

6. Your reply should be marked for the attention of the undersigned.

By direction of the chief signal officer.

L. J. DE MILHAU, Captain, Signal Corps.

MANUFACTURERS THANKED FOR THEIR WAR SERVICE

Appreciation for Their Hearty Co-operation and Efficient Effort—Would Be Criminal Waste to Set Conservation Programs Aside

A letter addressed to all war service group committees of the electrical manufacturing industry, signed by F. B. Eaves of the electrical and power equipment section of the War Industries Board, expresses appreciation for the coöperation given in the war effort. It is in full as follows:

"1. The work of the War Industries Board of assisting government agencies in building up production having ended, and its functions now being devoted to tapering off programs, we take this opportunity of expressing our appreciation and thanks for the hearty coöperation and efficient effort you have displayed throughout the strenuous campaign, which we realize has been done at great sacrifice to the normal commercial interests of your respective industries as well as to your personal interests.

"2. We feel that the time is just beginning when full advantage should be taken of what has been accomplished on various conservation programs and that it would have the aspect of criminal waste to set them aside and simply revert to pre-war methods and lines, waiting for the pressure of world-wide competition to compel similar conservation, which no doubt would ensue only after many markets had been irretrievably lost to American manufacturers.

"3. It is now a matter for each group to work out of its own volition and in a manner best fitted to the interests of its members, as the authority of the War Industries Board will be automatically canceled upon declaration of peace.

"4. In view of the fact that the army standardization committee will complete its present work on standards and will immediately proceed to draw up a set of standardized specifications for use of various departments of the army, it is hoped that each group war-service committee will hold itself in readiness to assist whenever called upon for information which may be required in the preparation of these specifications."

RESTRICTIONS REMOVED ON ALL NON-WAR CONSTRUCTION

No Further Permits Required—The Action Taken Follows a Careful Canvass of Conditions in Each State

B. M. Baruch, chairman of the War Industries Board, authorizes the announcement that all remaining restrictions of non-war construction throughout the United States were officially removed as of Nov. 21.

The action taken permits all building operations of whatever character held up in the interest of the war program to proceed. No further permits will be required from the War Industries Board or the state councils. A careful canvass has been made to determine whether the conditions obtaining in each state with respect to building materials, transportation and the supply of fuel and labor would warrant a removal of the remaining restrictions.

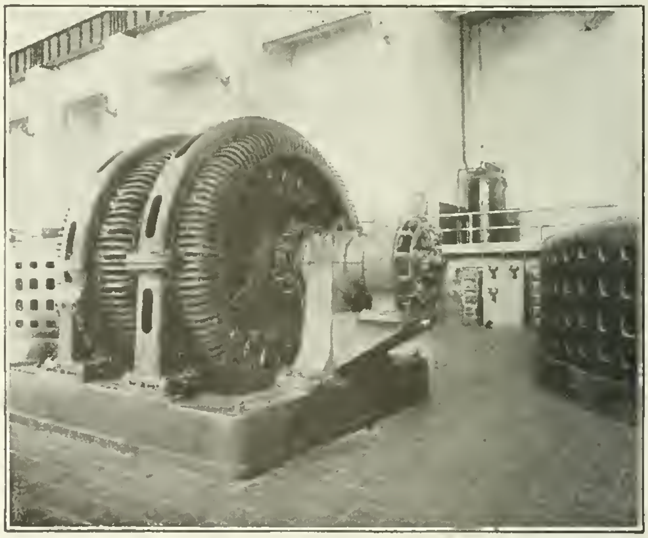
HEAT, LIGHT AND POWER RECONSTRUCTION MEETING

John W. Lieb Will Preside Over Major Group Conference Embracing the Electrical Industry at Atlantic City

John W. Lieb, chairman of the National Committee on Gas and Electric Service, has been asked to serve as chairman of major group No. 2 at the United States Chamber of Commerce reconstruction conference at Atlantic City on Dec. 4, 5 and 6. Mr. Lieb will do so. This group is the "heat, light and power" group, and, according to the plan of organization announced by the Chamber of Commerce, it includes several of the "related groups," which are divided among the "major groups." The related groups classified as associated with major group No. 2 are: Related group No. 4, coal and coke; No. 5, public utilities; No. 11, machinery, tools and power equipment.

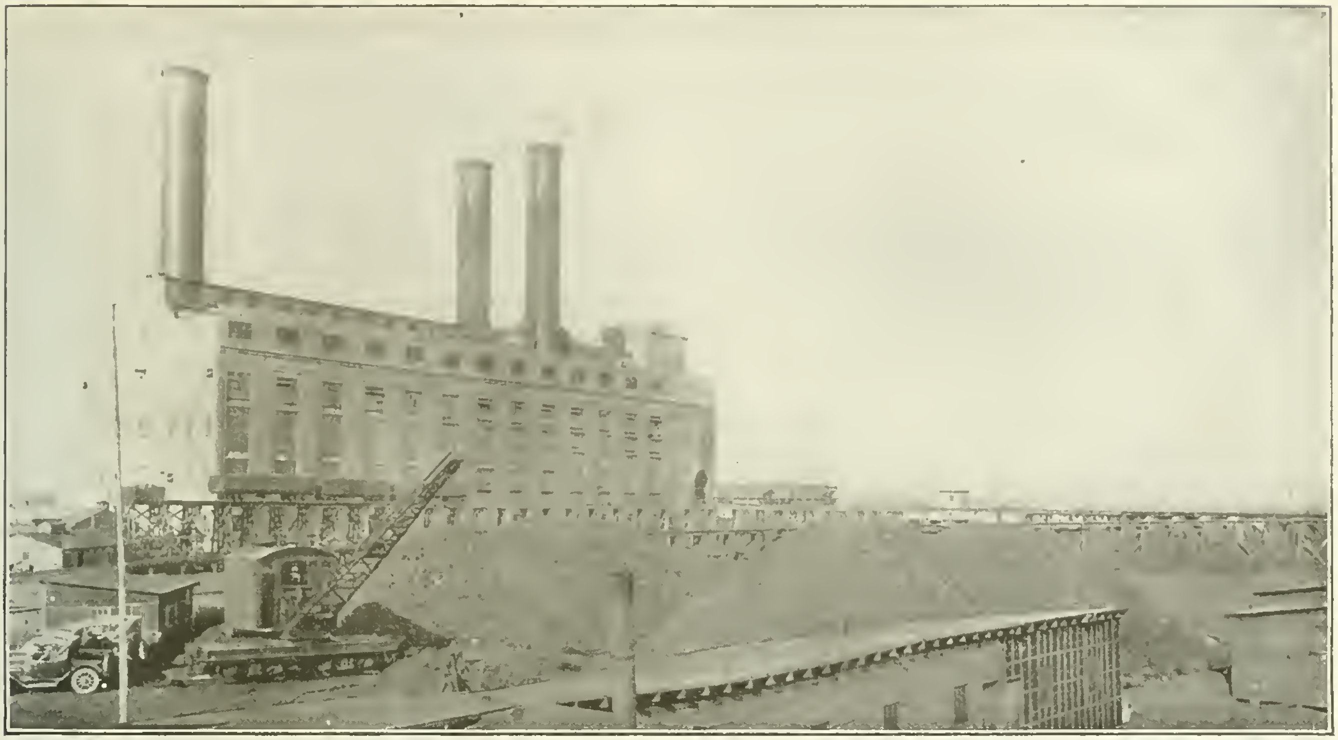
A meeting of the National Committee on Gas and Electric Service will be held at the Marlborough-Blenheim Hotel, Atlantic City, on the evening of Dec. 3.

Central Illinois to Get Energy from Keokuk



The Central Illinois Public Service Company has installed a 2500-kw. frequency changer in the power house of the Mississippi River Power Company at Keokuk, Iowa. Through this unit energy from the hydroelectric plant will be supplied to a transmission system which stretches across the central portion of Illinois. The frequency changer receives energy from the water-driven generators at Keokuk and converts this from 25-cycle energy to 60-cycle energy at 11,000 volts. Lines run through conduit in the dam to carry this 60-cycle, 11,000-volt energy to the Illinois side of the river, where it is stepped up to 33,000 volts in a substation at Hamilton. The line constructed from Hamilton to Colchester is the second connecting link between the Mississippi River Power Company's system and that of the Central Illinois Public Service Company. The line is 32 miles (51 kw.) long. It is expected that its completion will release for the Central Illinois Public Service Company 2000 tons of coal per month, which it can use in producing energy in other plants. It is stated that the building of the line does not reduce the operating expense but gives an additional capacity and reliability to the system and at the same time effects a conservation of coal in the national interests. The energy is purchased as prime power, the rate being on a cents-per-kilowatt-hour basis with a guaranteed maximum load factor.

Coal Stored at the River Station of the Buffalo General Electric Company as a Guarantee of Service This Winter.



Part of the power of Niagara goes to waste while coal is burned at this steam station to increase the supply of energy. The industries in the district were absolutely vital to the nation at war; they are also of great relative importance under peace conditions.

INTERCONNECTION IN EASTERN NEW YORK

Six Companies in Albany and Nearby Cities Effect Substantial Coal Saving in Short Interconnection Test

The following is made public by the United States Fuel Administration:

Coal saving at the rate of 5000 tons a month has been effected by six power companies of eastern New York through the operation of a plan of joint operation and the use of water power heretofore wasted, undertaken at the suggestion of the Fuel Administration. This record in coal conservation was effected without a change in existing equipment or additional cost to the power companies, and the success of the plan has been so marked that the companies interested are anxious to continue it.

The companies which combined and carried out the plan through a joint committee made up of their regular organizations serve what is known as the "Capital District," including the cities and towns of Albany, Troy, Schenectady, Amsterdam, Mechanicsville, Cohoes, Saratoga, Glens Falls and adjacent territory.

Putting the operation of the scheme in the hands of the joint operating committee and using the available resources of the six power companies, a two weeks' test was begun on Oct. 23. In that period electric energy equal to that generated by the burning of 2450 tons of coal was developed from existing equipment and the natural river flow which otherwise would have gone to waste. The generating companies were thus able to market heretofore unused power, and the coal-burning companies were able to get power at a saving over their own costs.

Following are the companies coöperating in the joint operation plan: Adirondack Electric Power Corporation, Glens Falls; N. Y.; General Electric Company, Schenectady, N. Y.; Municipal Gas Company, Albany, N. Y.; Cohoes Power Company, Cohoes, N. Y.; Hudson Valley Railroad Company, Mechanicsville, N. Y., and Schenectady Power Company, Schaghticoke, N. Y.

Some time ago the Fuel Administration, with the coöperation of the power companies, made a thorough investigation of power conditions in eastern New York. As a result of this investigation the power companies were asked to combine in a program of joint operation, a plan made possible by connecting transmission lines already in existence and the substitution of water for steam power. This was promptly agreed to; the available resources of the companies were placed in the hands of the joint committee, and an operating department was appointed to carry out the distribution of water power.

Using the existing equipment and organizations, and without additional labor cost, a two weeks' trial was commenced. At the end of that period, "there was such unanimity of thought," says the report to the Fuel Administration, "that the question of continuing did not enter into the discussion of the joint committee, but simply the endeavor to secure the success of the scheme by agreeing on the cost of power sold by the hydroelectric companies to the coal-burning companies in place of burning coal."

CONTRACTING ENGINEERS ON TRADE AND LABOR POLICIES

Conference Club, Meeting at Pittsburgh, Discusses the Relations That Exist Between the Constructing Engineer and the Industry

The constructing engineers' fundamental relation to the industry and to labor was the keynote of the ninth meeting of the Conference Club at Pittsburgh Nov. 21 and 22.

Sullivan Jones presented an opening discussion of the so-called "Conference Club plan." This plan broadly seeks to functionalize the relation between manufacturer, constructing engineer, consulting engineer and the buyers of equipment.

Discussion by manufacturers present, including Mr. Gibson and Mr. Curtin of the Westinghouse company and Mr. Bobson and Mr. Miller of the General Electric Company, indicated the manufacturer's willingness to consider definite cases in which the constructing engineer showed that he had performed engineering and selling service for the manufacturer for which the latter would be justified in compensating him. The manufacturer broadly puts his position as having specialized engineering service and sales promotion departments which he relies on to get his volume of sales. The constructing engineer urges that when he develops business and becomes responsible for the detailed application of the work his service should be recognized in his discounts as a buyer. The consulting engineer urges that if the customer receives engineering service that really helps him, he (the customer) should pay for it, and the manufacturer and constructing engineer who give such service and do not charge for it as such are not functioning properly.

The suggestion was made that if the classes of business were analyzed and divided into groups, certain very large industrials would stand by themselves, having their own engineering and construction departments and buying direct from the manufacturer; certain others would fall into a second group employing consulting engineers, and certain others in a third group where the contracting engineers would design, sell and install the equipment.

The drift of general discussion indicated the desire of the contracting or constructing engineers to add engineering departments and to design and lay out their work. A paper by E. D. Sickels of the Lord Electric Company provoked an interesting discussion upon "Group or Coöperative Advertising." Mr. Lord offered a prize of $100 to the best advertising suggestion. Discussion by W. L. Goodwin and others indicated the need of selling the idea of the conference plan to the electrical industry before attempting to capitalize the plan in advertising it to the public. A committee was empowered to consider the whole subject.

John R. Cole, vice-president of the Lord Electric Company, submitted for the definite consideration of the conference the so-called national agreement on dealing with labor. Mr. Cole said in part:

> It is not necessary to expatiate on the advantages of coöperating with organizezd labor, as results have spoken for themselves wherever coöperation has been tried. There is no question which can arise between employer and employee which cannot be successfully settled at the conference table by the application of common sense and honest intentions. Another way of expressing this idea is that successful coöperation must come from the heart, and if both parties really wish to coöperate the result is always assured.
>
> As a result of considerable study and consultation with men thoroughly conversant with economic questions, I have come to the conclusion that the most practical and satisfactory way to bring about sincere coöperation in the electrical industry would be to have the Conference Club lend its support and encouragement to a national agreement entered into with the International Brotherhood of Electrical Workers.
>
> There are several industries that now work under a national agreement, and as far as I am able to ascertain such agreements have given general satisfaction and have eliminated unnecessary stoppage of work, as they provide a method of settling all differences without resorting to the strike or lockout. It is superfluous for me to attempt to go into the details of such an agreement, which necessarily would have to be decided in a conference where both sides were equally represented, and drawn up to fit our specific problems. A permanent joint committee composed of three members of the Conference Club and three members of the International Brotherhood of Electrical Workers should be formed whose first duty should be to block out a set of fundamental principles that would form the basis of the national agreement.

Mr. Cole added several suggestions to this general plan, pointing out the necessity of absolute confidence on the part of each party to such an agreement in the other and suggesting that to this end the Conference Club include in its membership representatives of organized labor.

The Conference Club voted to appoint a committee to look into the feasibility of devising a national agreement. Among those taking prominent part in the discussion was J. P. McNulty, representing the International Brotherhood of Electrical Workers.

The meetings closed with a dinner given by the Westinghouse Electric & Manufacturing Company.

CLEVELAND MAXIMUM RATE IS UPHELD BY COMMISSION

Three-Cent Maximum Rate Ordinance Is Adjudged Unjust and Unreasonable—Finding Based on Production Cost in Last Four Years

The Ohio Public Utilities Commission recently announced its decision in the case of the Cleveland Electric Illuminating Company's appeal from the city of Cleveland's 3-cent ordinance to the effect that the company may retain its maximum rate of 10 cents per kilowatt-hour. This maximum, the commission said, is just and reasonable, while a 3-cent rate would be unjust and unreasonable. It does not follow, however, that any considerable part of the charge for service should be based upon the maximum, according to the commission, and in fact it is expected that the greater part will be much below this.

The rate allowed was based upon the cost of production for the past four years, with a determined valuation of the properties fixed at $26,222,216. City officials object to this, on the ground that the cost of operation for two years or more of the four has been abnormal and should not be considered in fixing a rate for the future.

Mayor Harry L. Davis and other city officials declare that the Ohio Supreme Court will be asked to review this decision.

POWER PLANT DEDICATED TO THE LATE HENRY FLOY

New Generating Station of the Yosemite National Park Is Dedicated to the New York Engineer

The ceremony at which the new power plant of the Yosemite National Park was dedicated to the late Henry Floy was held at the plant in the Yosemite Valley, about a mile below the Pohono Bridge, at 10 a.m. on Sept. 7, Stephen T. Mather, director of the National Park Service, presided. The speakers, besides Mr. Mather, were W. B. Lewis, superintendent of the Yosemite National Park; A. J. Robertson of the Mount Whitney Power & Electric Company; M. M. O'Shaughnessy, city engineer of San Francisco; A. B. C. Dohrmann of the Nathan-Dohrmann Company, and Howard H. Hays, manager of the Bureau of Service, National Parks and Monuments, of the United States Railroad Administration.

The plant was dedicated to the late Mr. Floy, the New York electrical engineer whose preliminary study of the situation, whose report and whose argument before the appropriations committee of the House were chiefly instrumental in securing the appropriation. Mr. Floy died shortly after finishing his report and before the appropriations committee acted favorably upon it. The plant, as completed, cost $213,500.

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THE LATE HENRY FLOY

A plaque upon the power house reads as follows:

YOSEMITE POWER PLANT.
Dedicated September 7, 1918, to the late HENRY FLOY,
Electrical Engineer of New York City,
whose personal interest and professional assistance were contributing factors in securing favorable legislation for its construction.

The new plant consists of a diversion dam 160 ft. (48.7 m.) long across the Merced River a mile below the Pohono Bridge, which delivers water through a wood-stave pipe 6000 ft. (1828 m.) long into a steel pressure pipe nearly 800 ft. (243 m.) long, which falls 330 vertical feet (100 m.) to drive the two Pelton water turbines, to each of which a 1000-kw. generator is connected.

In his address Superintendent Lewis, sketching the history of the project from the great increase of travel to Yosemite in 1915 which made it necessary, said:

> It is unfortunate that in government projects of this kind there are often not sufficient funds available to make the extensive studies and surveys upon which to base an accurate, intelligent estimate, and it is therefore necessary to resort to considerable guesswork. This was true in our case. With the meager information at hand, Mr. Floy's report on the situation was comprehensive and reasonable, and his estimate of $150,000 would have sufficed under ordinary conditions.
>
> On the strength of Mr. Floy's report to the Park Service and his testimony before the House appropriations committee during the winter of 1915-16, Congress appropriated the sum of $150,000 for the work. In August, 1916, Galloway & Markwart, consulting engineers of San Francisco, were engaged to design the plant and supervise, from the engineering standpoint, its construction.

The story of the construction of the work as told by Mr. Lewis is one of a struggle against unforeseen difficulties, including the labor shortage resultant from the draft.

Director Mather said in part:

> I want to say a word in regard to the great help that Henry Floy, to whom this plant is to be dedicated, was to me during my early connection with the national park work. Mr. Floy was a very busy engineer in New York, an electrical engineer, whose duties carried him all around the country; a man of very high standing in his profession, who had very little time to give outside of that work, but who, when I asked him with the consent of Secretary Lane to assume a position as temporary inspector and to study the work in connection with the parks, consented to do it for merely the nominal salary of such a position, notwithstanding that he was obliged to drop much work for which he was receiving good pay.
>
> He came out to California in 1915 as one of the party who went with me through the high Sierra country. He made a study of the Mount Whitney Power & Electric Company's holdings in the Sequoia National Park. He carried on negotiations with John Hays Hammond, then president of the company, and made an agreement with him by which the revenues from the company for the development of power were increased from a few hundred dollars a year to approximately ten or twelve thousand dollars per year, and the park revenues benefited accordingly.
>
> After making this preliminary study, Mr. Floy prepared a report, but before preparing that report he testified before the appropriations committee in connection with our request for $150,000 for the proposed new power plant. It had looked as if we were not going to get this money at all. Congressman Fitzgerald, then chairman of the appropriations committee, has always been the watchdog of the Treasury, and you had to prove absolutely the worth of any proposition before you could get him to consent to it. The testimony brought out at that hearing was practically the means of our getting that appropriation. I might state that Mr. Floy just within a month of his death made an exhaustive report to the committee in writing, with complete estimates of the power possibilities of the Merced River. The actual appropriation was not made, however, until two months after his death. The splendid work of Galloway & Markwart brought this project to a successful conclusion, but to Henry Floy belongs the credit of laying the foundation.

A. J. Roberston said:

> I do not think there could be a greater honor bestowed on a man, or a greater eulogy of his work, than to have dedicated to his memory a power plant like this. Its very permanence represents the permanence of the works a man leaves behind him, and Mr. Floy's work on the public utilities of New York and Brooklyn will live forever, as well as other works which are in every-day use by engineers. I am glad to be here this day and to see the dedication to Mr. Floy of this plant, which represents in concrete and iron the product of a master mind.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Electrical League of Cleveland.—On Nov. 14 Prof. R. M. Reering, Western Reserve University, addressed the Electrical League of Cleveland on the subject "Germany's Government."

Electrical Supply Jobbers' Association.—The semi-annual meeting of the Electrical Supply Jobbers' Association will be held at the Hotel Statler, Cleveland, Ohio, on Dec. 9, 10 and 11.

Cleveland Engineering Society.—On Dec. 3 G. Douglas Wardrop, editor *Aerial Age Weekly*, will address the Cleveland Engineering Society on "The War in the Air," illustrated by motion pictures.

A. I. E. E., Panama Section.—An inspection trip to the extension of the Gatun hydroelectric plant and substation occupied the Panama Section of the A. I. E. E. at a meeting held recently. Messrs. Hersh, Grier and O'Connell conducted the trip and explained the project.

A. I. E. E., Schenectady Section.—On Nov. 15 Dr. Sidney L. Gulick addressed the Schenectady Section, American Institute of Electrical Engineers, on the subject "Immigration After the War." Dr. Gulick is particularly familiar with some aspects of the problem on account of long residence in Japan.

A. S. M. E., Chicago Section.—The Chicago Section of the American Society of Mechanical Engineers will hold its annual dinner at the Hotel La Salle on Dec. 13. D. L. Derron will speak on the manufacture of shells. It is expected that a motion-picture film will be used to illustrate manufacturing processes.

Electrical Supply Jobbers' Association, Pacific Division.—The regular quarterly meeting of the Pacific Division of the Electrical Supply Jobbers' Association will be held at Del Monte, Cal., Dec. 5, 6 and 7. The purpose of the meeting, as announced, is to "peaceably assemble to discuss our past, survey our present and prepare for our future."

Western Society of Engineers.—The Western Society of Engineers of Chicago on Nov. 12 organized a gas engineering section. The society now has sections devoted to electrical, mechanical, civil and gas engineering. The following have been nominated as officers for the mechanical and the electrical sections of the society: Mechanical section, chairman, F. J. Postal; vice-chairman, B. A. Gayman; electrical section, chairman, J. R. Cravath; vice-chairman, Harold Almert.

Chicago Electric Club-Jovian League.—A resolution has been presented before the Electric Club-Jovian League of Chicago to change the name of that organization to the Electric Club of Chicago in the interest of simplification.

A. I. E. E., Chicago Section.—On Dec. 19 M. Luckiesh of the National Lamp Works of the General Electric Company, Cleveland, will speak to the Chicago Section of the American Institute of Electrical Engineers and the Chicago Section of the Illuminating Engineering Society on the "Principles of Camouflage." Mr. Luckiesh has an interesting collection of photographs to exhibit.

Oklahoma Utilities Association.—The Oklahoma Gas, Electric and Steel Railway Association and the Oklahoma Public Utilities Bureau were recently merged into the Oklahoma Utilities Association. The new officers are J. J. Owens, general manager Oklahoma City Gas & Electric Company, president, and H. A. Lane, 611 State National Bank Building, Oklahoma City, secretary. The first annual meeting of the new organization will be held in Oklahoma City on Feb. 13, 14 and 15.

Electrical Credit Association.—The Electrical Credit Association of Chicago. meeting at the Hotel La Salle Nov. 21, discussed the following topics: "Post-War Orders and Credits," "Readjustment of Financial Statements Due to Decline of Values After the War," "Changing Industrial Conditions," "Analyzing Public Utility Statements," "Looking Ahead," "How to Handle Railways and Large Industrials," "Trade Acceptance—Use and Procedure," "Interdepartmental Relations," "Approved Methods of Handling Unjust Deductions," and general credit conditions.

Ohio Electric Light Association.—The following subjects have been selected for discussion by the new-business coöperations committee of the Ohio Electric Light Association at its five meetings in the coming winter: "Industrial Electric Heating to Replace War Contracts," "Evils of Low Power Factor and the Improvement of Load Factor," "Basis for Differentiation Between Rates for Primary and Secondary Service Voltages," "Electrolytic Purification of Sewage," "War-time Public Attitude Toward Utilities," "Electric Heat Treating" and "Domestic Electric Heating."

A. I. E. E., I. E. S. and Western Society of Engineers.—On Nov. 18 the Western Society of Engineers, Chicago, met in joint session with the Chicago Section of the American Institute of Electrical Engineers and the Chicago Section of the Illuminating Engineering Society. This evening had been set apart as ladies' night, and S. J. Duncan-Clark of the Chicago *Evening Post*, who recently returned from France, was the principal speaker of the evening. On Nov. 25, at another joint meeting, fuel conservation was discussed by Preston S. Millar of New York and Harold Almert of Chicago.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Commission Orders Duplication Avoidance.—The Spring Valley (Ill.) Utilities Company recently filed an application with the Illinois Public Utilities Commission to build an 11-mile transmission line from Magnolia to Wenona, Ill., to furnish energy to farm customers along the line and to supply the Wenona Light & Power Company with energy. An objection was filed by the Public Service Company of Northern Illinois contending that it had a transmission line through Wenona and could furnish all energy necessary to permit the Wenona Light & Power Company to shut down its isolated steam plant. The record in the case showed, however, that during past years the Wenona company had repeatedly requested the Public Service company to give it a connection and supply power for the operation of its service at Wenona, but that such applications had been consistently refused on the ground that a load of this character amounting to 75 kw. would burden the circuits of the Public Service company and presumably jeopardize the service to the other utilities served from its circuits. Under the present conditions, however, the Public Service company expressed not only its willingness to take this load, but its desire to do so, "rather than have the territory invaded by other investments." The commission in rendering its decision says: "It appears from the record that the securing of transmission line service in Wenona will be a benefit both to the consumers in Wenona and to the utility. It will likewise result in a large conservation of coal aggregating in total amount about 1500 tons annually. As to the desirability of a connection of this kind there can be no doubt. The issue at present pending before the commission is as to whether the Spring Valley Utilities Company should be authorized to extend its line and take this load or whether the Public Service Company of Northern Illinois should be depended upon for furnishing it. It appears that the construction of this line from Magnolia would require material and capital expenditure, which the country is being urged at the present time to conserve. Proof is not made in the record of the necessity of an interconnection between the circuits of the Spring Valley Utilities Company and the Public Service Company of Northern Illinois. . . . A utility furnishing service in a territory which has consistently refused to take load obviously for the benefit of the community and the public at large can have no objection if this territory is invaded by another utility willing to furnish such service, and it is not the policy of the commission to offer protection to the original utility under such conditions. However, under the present circumstances the good of the public and the necessities of the nation must receive first consideration. It appears that the rates which will be charged for service to the Wenona Light & Power Company by the petitioner and by the objector are not far different. The commission finds that a connection should be constructed for the rendering of service by the Public Service Company of Northern Illinois to the Wenona Light & Power Company, and that such construction should be completed and ready for operation within forty-five days."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Load for Vaccine Incubation.—A 7-kw. load was taken on by the Colorado Springs Light, Heat & Power Company recently for operating a new and unique industry which has recently been established in Colorado Springs by the National Vaccine Company. This company will manufacture vaccine for the cure and control of various diseases by the process of inoculating large numbers of animals and the generation of the proper serums through their blood. The company is providing a 7-kw. load which will be used for incubation purposes.

Illinois Classification of Accounts Effective Jan. 1.—A uniform system of accounts for electric utilities has been prescribed by the Public Utilities Commission of the State of Illinois and is effective Jan. 1, 1919. The pamphlet giving instructions on these accounts covers 141 printed pages. It includes general instructions, schedule of accounts, balance-sheet accounts, plant and equipment accounts, income accounts and form of statements, surplus or deficit accounts, operating-revenue accounts and operating-expense accounts.

Coal Conservation Propaganda Film.—Good and bad methods of coal-mining transportation, good and bad methods of firing, losses from leaky steam pipes and uncovered steam pipes, losses from leaky steam traps, the use of CO_2 records, and in fact everything pertaining to boiler-room practice in its relation to coal conservation, have been featured in a film entitled "Coal Is King." The scenario for this film was written by Robert June, mechanical engineer of the Diamond Power Specialty Company, Detroit, and the picture was produced by the Ford Motor Company. Such points as the necessity for keeping the boiler surfaces clean are also cleverly brought out. Distribution of the picture is being superintended by Mr. June.

Vehicle Users Prefer Garage to General Maintenance Service.—The experience of the Commonwealth Edison Company in operating its electric truck garage at Jackson Boulevard and Morgan Street, Chicago, has been that the electric truck user prefers to contract with the company for electric garage service alone rather than for the complete garaging and maintenance service which the company has been offering. While the company has not withdrawn its complete-maintenance plan offer, it is now promoting the garaging service with vigor.

Empire Companies Plan Boiler Conservation Plant.—For the conservation of worn-out boilers the Empire Gas & Fuel Company will start the erection of a complete boiler plant at Oil Hill, Kan. It will be another measure of conservation. It is planned to rebuild every boiler at a minimum cost, and it is anticipated that not a single new one will have to be bought for several months. The shop building itself will be 30 ft. by 94 ft. and will be directly south of the larger, modern machine shop. It will have every modern mechanical device that is used in any of the large shops of the country.

Navy Needs Engineers.—Men are needed now by the navy for services essential to the reëstablishment of normal conditions. The Bureau of Navigation has issued a call for several hundred men who can qualify for posts which require specialized ability. Only those men who are registrants of Sept. 12, 1918, or registrants of deferred classifications of previous registrations are eligible. Applications will now be received for training in the Engineer Officer School. Applicants must be high-school graduates and graduates of an engineering course at a recognized technical school, or of equivalent training. The age limit is twenty-one years to forty years inclusive. Further information will be furnished upon application at the United States Navy mobilization station, in the Transportation Building, Chicago, of which Lieut. H. D. Childs is commanding officer.

Farm Plant Manufacturers' Organization.—In order to obtain a priority rating from the War Industries Board, manufacturers of farm power and light plants organized recently a temporary association known as the Farm Power & Light Manufacturers' Association. The first meeting was held in Chicago, Sept. 19, 1918. The association comprises about 80 per cent of the farm-plant industry based on capital invested. Its first work was to collect data from the manufacturers themselves on the amount of material and the amount of labor used in the manufacturing operations. At the same time the manufacturers collected through their distributers information from the users of their equipment as to the amount of labor saved through the use of different appliances operated by the farm power and lighting plants, such as motor-driven pumps, electric irons, vacuum cleaners, lamps, etc. It is considered likely that the association will be continued as a permanent organization. The secretary of the permanent association is G. W. Hafner of Ernst & Ernst, certified public accountants, 1040 Continental and Commercial National Bank, Chicago.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Regulation of Rates.—The act of May 18, 1905, entitled "An act to confer upon the city of Chicago the power and authority to sell surplus electricity and to fix the rates and charges for the supply of gas and electricity for power, heating and lighting furnished by any individual, company or corporation to said city of Chicago and the inhabitants thereof," is in violation of the State Constitution, Article IV, Section 13, providing that no act shall embrace more than one subject, which shall be embraced in its title, according to the Supreme Court of Illinois (120 E. E. 562). A city charter authorizing the city to regulate the rate of a gas company, but providing that company should not be compelled to charge less than $3 per 1000 cu.ft., did not authorize an ordinance fixing rates at 75 cents per 1000 cu.ft., the power given being limited.

Scope of Court's Review of Commission's Acts.—Under the public utilities act, which authorizes the Supreme Court to review orders or decisions of the Railroad Commission by a writ of certiorari or review and provides that the review shall not extend further than to determine whether the commission has legally pursued its authority, including a determination of whether the order or decision violates any constitutional right of the petitioner, and which provides further that the findings and conclusions of the commission on questions of fact shall be final and not subject to review, the findings and conclusions which are not subject to review are those on questions of fact within the jurisdiction of the commission, and the question of mixed law and fact, as to whether or not a corporation is a public utility, so as to give the commission jurisdiction over it, is reviewable, according to the Supreme Court of California (175 P. 466). The Supreme Court may restrain the Railroad Commission from exercising powers which it does not possess, or annul its decree when such unwarranted powers have been exercised.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

L. A. Keene, new-business agent of the Baton Rouge (La.) Electric Company, has been transferred by Stone & Webster to the Connecticut Power Company as manager of the Middleton division.

John D. Ryan has resigned as Second Assistant Secretary of War and director of air-craft production to return to his business interests. Mr. Ryan is president of the Anaconda Copper Mining Company and the Montana Power Company.

F. W. Bedard, gas engineer from the general offices of the Urbana & Champaign Railway, Gas & Electric Company at Peoria, Ill., has been chosen to succeed temporarily the late Harry J. Pepper as general superintendent of the company at Champaign, Ill.

Henry I. Harriman, president of the New England Power Company and the first president of the Boston (Mass.) Chamber of Commerce to serve a second term in that office, has been in the public utility field only eleven years. In this short period he has been identified with the initiation and development of one of the largest hydroelectric systems in the country, serving every New England state but Maine and interconnected with virtually all the important central stations in its district. Beginning with the construction of the 20,000-kw. hydroelectric station on the Connecticut River at Vernon, Vt., the system now embraces an extensive chain of plants on the Deerfield River with a large storage reservoir at Somerset, Vt., and an important layout of 66,000-volt and 110,000-volt transmission lines reaching practically every industrial center in middle New England. The upbuilding of this system at first met strong opposition from established central stations, which had with few exceptions been developed along the lines of retail energy supply rather than those of wholesale energy over statewide areas. Mr. Harriman was born in New York City in 1873 and was educated at Wesleyan University and at New York University Law School. His active business career began in 1899 with the American Loom Company, and he later became manager of the Stafford Company, manufacturer of cotton-weaving machinery, holding this position until 1907. He then became vice-president of Chace & Harriman, Inc., Boston and Providence, the organization which has developed the New England Power Company's system. Mr. Harriman is a member of the War Efficiency Board of Massachusetts and the Massachusetts Committee on Public Safety and is chairman of the New England Transportation Conference. He is an officer and director of the Bellows Falls Canal Company and Fall Mountain Electric Company and a director of the Worcester Suburban Electric Company, Gardner Electric Light Company, Central Massachusetts Electric Company, Connecticut River Power Company and Rhode Island Power Transmission Company.

E. E. Harrington has been appointed superintendent of the Hortonia Power Company at Brandon, Vt.

F. L. Good has resigned as superintendent of the Electric Light & Water Works of Winamac, Ind., to become manager of the Logansport (Ind.) Heat & Power Company.

Frank A. Ketcham, who for many years has been the central district manager of the Western Electric Company, has been appointed general sales manager of the company, succeeding in this work Gerard Swope, who, as previously announced, is at present serving as assistant to General G. W. Goethals in the Division of Purchase, Storage and Traffic of the War Department. On his return from his war service Mr. Swope will resume active charge of the export and foreign business of the company. Mr. Ketcham was born in Saginaw, Mich., in 1875 and was educated at the University of Michigan. He joined the Western Electric Company in 1900, starting at the Clinton Street office in Chicago. Most of his early work was done in the telephone supply end of the business and in 1905 he became telephone storekeeper. A year later he was promoted to the position of chief clerk, and on Jan. 1, 1907, to that of assistant manager. In April, 1911, he was made manager. Two months later he received the additional title of central district manager, with supervision over the Cincinnati, Omaha, Indianapolis and Minneapolis houses. Subsequently the Cleveland, Detroit and Milwaukee offices were opened under his jurisdiction.

F. A. KETCHAM

L. P. Chaney has been appointed chief engineer of the power plant of the Pensacola (Fla.) Electric Company, succeeding J. M. Anderson.

R. A. Sara, sales manager for many years of the city of Winnipeg (Man.) light and power department, has resigned to become connected with the American Cellulose & Chemical Manufacturing Company of New York.

R. V. Slavin has been appointed sales manager of the city of Winnipeg (Man.) light and power department, succeeding R. A. Sara. Mr. Slavin was graduated from McGill University in 1910 and has been connected with the Winnipeg municipal plant for many years.

Howard C. Foss, manager of the Savannah (Ga.) Electric Company, has been appointed acting district manager for Stone & Webster for the Southeastern district. Prior to going to Savannah in 1912 as general superintendent Mr. Foss was manager for the Cape Breton Electric Company, Ltd., Sydney, N. S., another Stone & Webster property.

Obituary

Major John Trumbull, formerly chief engineer of the Connecticut Public Utilities Commission, died recently in France following a surgical operation.

Martin W. Kern, for the past ten years mechanical engineer of the Narragansett Electric Lighting Company, Providence, R. I., died recently. Mr. Kern was a native of Providence and was educated at Brown University. His former professional connections were with the Rhode Island Company at Providence and with Stone & Webster at Boston for several years.

Bertram M. Downs, one of the pioneers in the sales branch of the electrical manufacturing industry, died on Oct. 29 from apoplexy. Mr. Downs at the time of his death was about fifty-five years old and had been connected with the industry for the past thirty-two years. He started as a young man with what is now the Brookfield Glass Company and rapidly worked his way up, taking complete charge of sales. He became secretary of the company at the time of its incorporation in 1898 and in 1894 was elected a vice-president. At the time of his resignation in the spring of 1912 he was also a director in the company. A few weeks later he became associated with the Hemingray Glass Company of Covington, Ky., of which he was general sales manager at the time of his death. "Bert" Downs, as he was familiarly known throughout the entire industry, was one of the charter members of the Electrical Manufacturers' Club and was very active in building the club up. For two years he was secretary of the club, and later he was president for two years. Mr. Downs had a host of friends among the manufacturers, jobbers and contractors, and his genial personality will be genuinely missed.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

COMPETING ELECTRICAL GOODS IN FOREIGN TRADE

Data on Specimen Articles of European, Chinese and Japanese Manufacture Used in Australia and the Far East

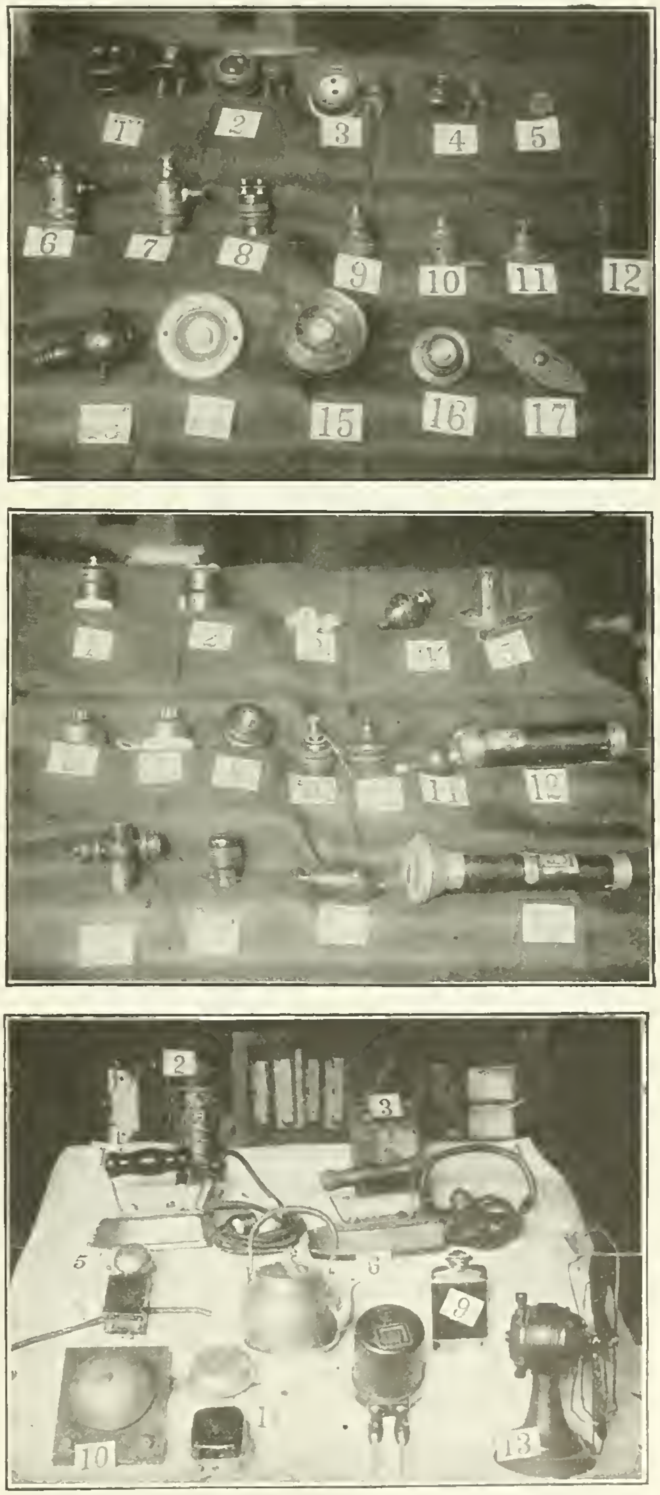
American electrical manufacturers entering foreign markets will have to meet a competition of European, Chinese and Japanese-made goods, generally cheap in price and to which the foreign markets have become accustomed. Some electrical goods have been developed in the United States to meet this competition, but only a start has been made. An idea of what these foreign-made goods are can be had from the accompanying illustrations and the following data. These specimens were collected in Australia and the Far East by R. A. Lundquist, special agent of the Bureau of Foreign and Domestic Commerce. Each article is numbered, and following are given the place of use, where made, price and other details of each according to its number.

GROUP A.—All items in this group are of English manufacture and were for sale in New Zealand. The collection was made in November, 1916.

1. Wall plug, 10 amp., wholesale price, 62 cents; retail, $1.12.
2. Litholite plug, 5 amp.; wholesale price, 36 cents; retail, 75 cents.
3. Wall plug, china, crocus top, 5 amp.; wholesale price, 21 cents; retail, 37 cents.
4. Wall plug, crocus, 5 amp.; wholesale price, 25 cents; retail, 62 cents.
5. Adapter (black); wholesale price, 11 cents; retail, 31 cents.
6. Key lamp holder 3½-in.; wholesale price, 29 cents; retail, 75 cents.
7. Shade carrier, cord grip, key lamp holder; wholesale, 29 cents; retail, 75 cents.
8. Twin-grip lamp holder (socket); wholesale price, 19 cents each; retail, 37 cents each.
9. Shade carrier, cord grip, keyless lamp holder; wholesale price, 19 cents; retail, 37 cents.
10. Lamp holder, ⅝-in.; wholesale price, 12 cents; retail, 25 cents.
11. Batten holder; wholesale price, 10 cents; retail, 25 cents.
12. Crocus adapter; wholesale price, 15 cents; retail, 31 cents.
13. Pear switch, 5 amp.; wholesale price, 37 cents each; retail, 75 cents each.
14. Bell push; wholesale price, 50 cents; retail, $1.12.
15. Bell push; wholesale price, 50 cents; retail, $1.12.
16. Bell push; wholesale price, 29 cents, retail, 62 cents.
17. Bell push; wholesale price, 31 cents; retail, 75 cents.

GROUP B.

1. Keyless socket-medium Edison; made in Germany; imported through the port of Vladivostok; manufactured by Allgemeine Elektricitäts Gesellschaft, Berlin; cost before the war about 7 cents each f.o.b. factory at Berlin; illustrates quality of sockets sold in Siberian market by German manufacturers.
2. Wall switch-snap type; used for house wiring; made in Germany; imported through the port of Vladivostok; retail price in Vladivostok in September, 1917, about 25 cents each; illustrates the popular switch in this market. It is of war-time construction.
3. Cartridge-type plug fuse; made in Denmark; imported through the port of Vladivostok.
4. Pendent switch, brass; used for house wiring; made in Germany; imported through the port of Vladivostok; typical of German goods used in this market in normal times.
5. Shade holder; used for drop-cord lights; made in Germany; imported through the port of Vladivostok; wholesale price to jobbers at Harbin, about 5 cents each in normal times. This is typical of the German fittings used in this market.
6. Snap-switch composition; used for house-wiring service; made in Japan; sold in New Zealand and Australia; price f.o.b. Kobe, Japan, 21 sen (10.5 cents) each; illustrating what Japanese manufacturers are making for competition with American goods abroad, as well as for sale in Japan home market. Many switches of this type were seen in China and Japan.



THREE GROUPS (A, B AND C) OF EUROPEAN, JAPANESE AND CHINESE ELECTRICAL GOODS ON SALE IN AUSTRALIA AND THE ORIENT

7. Snap switch, metal-covered; used for house wiring; made in Japan; sold in New Zealand and Australia; price f.o.b. Kobe 20 sen (10 cents) each; illustrating what Japanese manufacturers are making for competition with American goods abroad, as well as for sale in Japan's home market. Many snap switches of Japanese manufacture operate badly even when new.

8. Bell push; used for house and office electric bell work; made in a small shop in Japan; retail price at Kobe, 25 sen (12.5 cents) apiece; selected to show what Japanese are making in the line of electrical goods. This bell push is made up similar to British types seen in New Zealand and Australia and is being sold in those markets to an increasing extent.

9 and 10. Lamp holders with bayonet sockets; oxidized-copper finish; made in Osaka, Japan; sold in New Zealand and Australia; cost f.o.b Kobe, 9 cents each.

11. Bell push, pendent type; used for house and office bell systems; made in a small shop in Osaka, Japan; retail price in Kobe, 40 sen (20 cents) each. This is typical of electrical goods of foreign origin as to design that are now being made in Japan.

12. Round-head electric torch, made in Japan and sold in China; price for torch complete (wholesale), c.i.f. Hongkong, 55 cents each (Mexican); retail price in Hongkong, $1.25 each.

13. Three-way plug; sold in Hongkong; made in small shop in Canton; cost $1.25 Mexican in Hongkong; illustrates what is being made in a very small way in small towns of China.

14. Attachment plug; used for extension lamps, etc.; made in a small shop in Canton, China; retails in Hongkong for 25 cents each (Mexican); illustrates what small shops in China are beginning to turn out in a small way.

15. Pendent switch; used for individual ceiling lamp control; made in a small shop in Canton, China; retail price in Hongkong, $1.25 each (Mexican); sample of switch made in small native Chinese shop; copy of British switch much in use. Shell is made of horn; work mostly done with primitive hand tools.

16. One large-head electric torch; made in Japan and sold in China; retail price in Hongkong, $1.25 each (Mexican) for torch complete; typical class of electrical supplies which Japan is now furnishing the market. Battery for this lamp (Japanese-made) costs 16 cents (Mexican) and retails at 25 cents.

GROUP C.

1. Iron-clad cut-out, 6 amp., sold in New Zealand; wholesale price, 62 cents; retail, $1.12.

2. Dry cell; used for house bells, telephones, etc.; manufactured in Japan; retail price at Kobe in November, 1917, 65 sen (32.5 cents) each. This is the average grade of Japanese cells such as are being exported to China.

3. Dry battery; used for house bells, telephones, etc.; made in Tokyo, Japan; retail price in Kobe, 1.30 yen (65 cents) each. This is a Japanese cell that is being exported to China, New Zealand and Australia. It is recognized as being the best cell made in Japan.

4. Iron-clad switch, 12 amp.; manufactured in England; sold in New Zealand; wholesale price in November, 1916, $1.75; retail price, $4.25.

5. Electric iron; manufactured in a small shop in Kyoto, Japan; wholesale price at Kobe, Japan, in November, 1917, 4.5 yen ($2.25); retail price, 7 yen ($3.50); packed for local sale in a cheap box made of corrugated paper; typical of the Japanese-made heating appliances.

6. Electric flatiron; made in Germany and sold through the port of Vladivostok; price f.o.b. Berlin factory, 16 marks each with 45 per cent discount. This is the iron which seems to have the largest sale in Vladivostok.

7. Electric bell, midget size; claimed to be of Japanese make, but it is believed to have been made in Germany; retail pre-war price at Vladivostok, 35 cents each. This is typical of this class of goods used in Vladivostok.

8. Electric teapot, made in a small shop in Kyoto, Japan; local retail price, 5 yen ($2.50) each, complete with cord. This teapot is of typical Japanese manufacture. The Japanese are beginning to make heating appliances in a small way. These appear to be made mainly by small shops and sold through a selling agent, the manufacturer often never appearing in the transaction. Appliances are cheap and have poor lasting qualities.

9. Flat electric torch, medium size; made in Japan; retail price in Hongkong, $1 each (Mexican); to illustrate a popular electric flashlight of Japanese manufacture, sold in this market. Battery renewals cost 19 cents (Mexican) c.i.f. Hongkong and retail there at 25 cents each.

10. Electric bell; manufactured in England; sold in New Zealand; wholesale price, 75 cents each; retail, $1.62.

11. Electric bell; claimed to be of Japanese manufacture, but it is much better made than the average product; retail price in Kobe, Japan, 1.30 yen (65 cents)

12. Ampere-hour meter; used for residence work; made in Germany. This was the only German meter obtainable and was obtained mainly to illustrate German meter work in the Siberian market, rather than to illustrate a piece of equipment in demand.

13. Electric fan, 8-in. standard; made in Germany; wholesale price in Vladivostok, $9 each (pre-war)

TREND IN DIRECTION OF VOLTAGE STANDARDIZATION CONTINUES

Advance of 12 per Cent in Number of Stations Operating at 110 Volts, 115 Volts or 120 Volts Has Been Made in Three Years

Data collected by the National Lamp Works of the General Electric Company, Cleveland, show that while only 60 per cent of the central stations in the United States were operating at standard voltages in 1916, at the present time 72.4 per cent are serving energy at standard potentials. The voltages considered standard are 110, 115 and 120. The change is due in a large measure to the efforts of lamp manufacturers, who now find it possible to produce lamps the voltage of which can be determined in advance of completion, whereas such procedure was impossible before the advent of the tungsten-filament lamp.

Data on the increases by states are given in the accompanying table. The figures for 1918 represent replies from 11,000 "stations." The term "stations" in this instance means not only generating stations but also communities served by transmission lines. The figures given in the columns headed "Population" give the percentage of population reached by electric service which is served at a standard voltage. In the figures for the whole United States the trend, both as regards percentage of stations and percentage of population, has been continually upward. There are a few instances in which certain states appear to be backsliding. So many factors enter into these cases that they are difficult to analyze accurately. Nevertheless, it is interesting to point out that a change to standard voltage by a large number of small stations may produce a marked increase in the percentage of stations on standard potentials without materially affecting the percentage of population receiving standard voltages. The reverse is, of course, true in the case of a large station.

	Percentage of Stations			Percentage of Population Served by Them		
State	1916	1917	1918	1916	1917	1918
Alabama	73	70.8	83.6	42	81.1	63.2
Arizona	67	96.3	93.2	75	94.1	91.6
Arkansas	77	70.1	77.5	76	68.5	79.5
California	69	59.8	72.1	73	59.7	65.5
Colorado	53	47.8	57.4	85	51.6	62.7
Connecticut	58	53.4	57.7	66	55.3	56.6
Delaware	80	83.3	92.9	97	97.6	97.7
District of Columbia	100	100.0	100.0	100	100.0	100.0
Florida	67	67.7	75.0	34	39.6	65.0
Georgia	50	56.8	70.3	58	66.7	70.4
Idaho	90	57.6	60.6	84	42.4	42.5
Illinois	83	82.4	88.4	91	84.6	92.9
Indiana	62	42.2	77.5	36	64.9	63.0
Iowa	69	65.4	87.1	73	85.2	86.5
Kansas	75	74.5	68.5	84	68.8	72.8
Kentucky	59	62.0	58.6	26	66.0	69.0
Louisiana	50	58.3	65.3	15	21.3	28.3
Maine	61	71.8	78.0	59	74.8	81.0
Maryland	39	51.5	56.0	2	9.4	12.0
Massachusetts	48	68.6	53.5	42	41.3	65.0
Michigan	52	60.0	83.4	55	72.3	86.0
Minnesota	59	59.6	80.0	43	79.9	91.0
Mississippi	56	55.3	65.7	56	62.9	69.0
Missouri	64	65.0	81.5	20	67.8	70.5
Montana	61	56.8	62.8	54	60.9	52.1
Nebraska	62	76.6	82.1	38	89.6	85.8
Nevada	83	67.8	64.7	78	93.6	93.0
New Hampshire	47	44.7	55.1	27	23.8	48.0
New Jersey	42	51.9	48.6	44	56.4	55.9
New Mexico	62	45.0	69.6	49	41.0	59.2
New York	54	51.9	69.0	50	65.9	61.7
North Carolina	63	59.5	68.0	34	65.4	76.2
North Dakota	69	66.2	69.3	73	76.6	64.8
Ohio	57	77.6	81.8	65	73.3	75.6
Oklahoma	66	74.3	80.3	42	80.0	79.2
Oregon	54	62.0	61.3	20	52.4	51.7
Pennsylvania	58	51.6	52.2	61	40.4	45.6
Rhode Island	14	56.2	52.8	10	10.0	29.3
South Carolina	71	71.5	72.8	66	80.4	87.7
South Dakota	70	72.0	74.5	69	67.5	76.5
Tennessee	63	71.8	74.3	41	55.1	57.6
Texas	77	74.7	72.1	59	77.3	96.0
Utah	30	76.3	80.6	24	45.1	48.1
Vermont	53	74.2	64.0	65	69.9	67.8
Virginia	74	65.2	65.5	76	71.3	66.3
Washington	45	45.4	65.4	17	53.8	73.1
West Virginia	77	56.2	66.3	52	66.2	79.8
Wisconsin	54	63.0	77.5	29	64.3	57.2
Wyoming	58	67.9	50.0	51	54.8	53.1
United States	60.6	69.3	72.4	53.4	62.0	67.0

EXPERIENCE SHOWS TRADE ACCEPTANCES SUCCESSFUL

Jobbers Apply Them with Resultant Reduction in Average Time Customers Take in Payment of Bills

Among the credit men of electrical jobbers and manufacturers who met the Electrical Credit Association in Chicago on Nov. 21 a definite opinion, based on experience with trade acceptances, was handed down. Those who have adopted acceptances have, of course, experienced some difficulty in details, but it seems to be the general impression that the use of the trade acceptance in the case of the slow-paying customer is an excellent proposition. Those who formerly paid in 90 and 120 days have been brought into line, so that now the average time of payment taken by customers who do not take cash discounts has been reduced about thirty days. Fifty-five to sixty days was the average time mentioned for accounts, excluding those which take cash discount. Some of the delegates who have instituted the trade-acceptance idea with slow-pay customers are planning to apply it to all classes of customers as soon as they have succeeded in educating the more troublesome among their clientele.

If acceptances are to be used to any great extent in the future, the opportunity of the present time must be grasped. It is very much easier to put such policies into effect in a sellers' market than it is in a buyers' market. Besides, it is just possible that some manufacturers and jobbers might remember any difficulties they had last year in getting cash to pay taxes.

METAL MARKET SITUATION

Market Continues to Be Dull—Stocks of Copper and Tin Are Developing

The dullness in metals that followed the signing of the armistice still continues. Prices that were not controlled are holding up remarkably well. Copper producers are pledged to continue at maximum production. Already there is a large supply of raw copper, and more is accumulating, although there is very little refined copper available. Considerable quantities of the refined metal, however, can be expected shortly.

Large quantities of tin have been found to exist in this country, which is very surprising in view of earlier reports. It is announced that the provisions of the international tin agreement will continue in effect until the 80,000 tons of tin allocated to the United States has been liquidated. The agreement, as between the contracting nations, will terminate with the signing of the treaty of peace.

Old metals continue weak. Prices are gradually lowering, and there appears to be no consumer buying to speak of.

NEW YORK METAL MARKET PRICES

	Nov. 19	Nov. 25
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26.00
Casting	Govt. price 26.00	Govt. price 26.00
Wire base	28.75	28.75
Lead, trust price	7.75	8.05
Antimony	7.75	8.75
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	15.00	15.00
Spelter, spot	8.50	8.70 to 8.80
Tin	No quotations	71.00
Aluminum, 98 to 99 per cent	Govt. price 33.10	Govt. price 33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	22.00 to 22.50	21.00 to 21.50
Brass, heavy	12.00 to 12.50	11.50 to 12.00
Brass, light	10.00 to 10.50	9.00 to 9.50
Lead, heavy	6.75 to 7.00	6.00 to 6.50
Zinc, old scrap	5.75 to 6.00	5.75 to 6.00

THE WEEK IN TRADE

NEW business in the electrical line is, generally speaking, at a standstill. There is a good demand for socket devices and lamps, and jobbers are cautiously rounding out their stocks by filling the low bins. There is also some purchasing for maintenance. A number of large cancellations are reported for the week, but there seems to be a disposition not to cancel operations where raw material is actually in the process of manufacture.

There seems some reason to believe this week that cancellations will not flood the second-hand market with used equipment. It looks rather as though the manufacturers would reclaim the equipment, rebuild it and release it in such a way as not to upset the market.

Labor appears to be a bit restless, and it would not be surprising to see more or less Mooney sympathy disturbance. The socialists are making attempts, so far ineffectual, to upset things. In fact, labor presents the most serious problem of reconstruction, and those looking for lower wages very soon, according to present indications, are likely to be disappointed.

Prices of equipment are keeping very steady. Large stocks, ordered long before the armistice was signed, are on the way, however, and it consequently would not be surprising to see the market give way a little here and there as competitive conditions arise.

NEW YORK

With the exception of socket devices, the local market has been rather quiet the past week. There have been some inquiries, but no orders of any consequence are reported. Government contracts are still being canceled, and manufacturers are beginning to put their plants in order for peace business. The general practice seems to be to permit the manufacturers to finish those goods in the process of fabrication.

Industrial labor is getting more plentiful, but there are still reports of shortage.

Prices are holding very strong with no indications of any break. Local stocks are in good condition and are rounding out in those places where they were spotty. Orders, however, are not being placed so far in advance. The jobbers are marking time and will shortly be in a position to take care of any building that might arise.

Large quantities of projected building are reported, and architects appear to be getting very busy. There are grave doubts, however, that this will reach any considerable volume while prices of material and money remain so high. At any rate, it is very doubtful if the electrical interests will feel the effects in any volume of a large building program much before the first of May or June

CONDUIT.—Large shipments are on the way, and local stock will shortly be in a very excellent position

WIRE.—Manufacturers may finish all outpost wire that has been stranded according to the latest reports. Good stocks of code wire are reported.

LAMPS.—Demand is good and getting better, and stocks are in good condition.

MOTORS.—There seem to be a few motors available, although an inquiry for a 200-kw. motor showed that six months was the best delivery date.

APPLIANCES.—There are a few flatirons in stock. Radiator stocks are short with increasing demand. A limited stock of copper washing machines is reported. Demand generally is getting better and better with the approaching holiday season.

CHICAGO

The past week showed very little change over the one just preceding. The jobbers report that there are many orders but they are small. Cancellations which have been received all come from concerns which have not yet started production, and no cancellations have been received from firms which are operating on contracts already started. There have been no changes in prices.

The news concerning construction activities ready for starting is not quite so favorable this week as it was last. While several specific instances in which projects are ready for launching have been mentioned in the papers, there was also mention of cancellation of construction at some of the government camps. On the whole, however, the building outlook appears to be bright.

In thinking about reconstruction, manufacturers are also arriving at the conclusion that the small manufacturer who has correct designs—that is, designs in which no excess material is used—and who knows his cost and operates on a definite policy will find opportunities for considerable development. The subject of export trade also occupies a prominent position in the minds of the manufacturers.

Credits and collections are reported to be in an excellent condition. The belief is expressed, however, that the credit of the electrical contractors should be watched carefully during the coming building boom.

COPPER WIRE.—There was no change in the copper-wire market during the last week. Not enough wire is in the country at the present time to permit the market to sag, even though the demand should drop to practically nothing.

TRANSFORMERS.—Some of the manufacturers see the possibility that the central stations will attempt to get out from under some of their financial burden by requiring customers to purchase all utilization apparatus, including transformers. Even if this is true it seems unlikely that the change will mean much to the trade, since the central stations will in all probability devise some method of retaining supervisory control over the purchase of transformers in order that inferior apparatus may be kept off their lines.

DIESEL ENGINES.—During the war practically all manufacturers of Diesel and oil engines have been occupied in constructing submarine equipment. These manufacturers are now getting ready to launch a selling campaign among the central stations and among the industrial plants and mines that use prime movers of moderate size.

METERS.—There is considerable activity in the export field among the meter manufacturers.

FIXTURES.—Fixture manufacturers see a period of eight or nine months for them between the cessation of government work and the beginning of private building. Some of the naturally optimistic thinkers, however, have pointed out that the fixture business is to a large extent a replacement proposition and that the shelves of the contractor-dealers in the country have been practically cleaned of fixtures during the war period. This replacement business can be secured now since the ban has been lifted from the sales of metal goods. Moreover, the contractor-dealers will welcome an opportunity to replenish their stocks, since during the past few months they have been limited in their sales efforts, through lack of stock, to such an extent that they have been repairing and refinishing old fixtures already owned by customers.

MOTORS.—Concerns already in the business are thinking seriously of the export trade and of adding more sizes to the lines which they are already producing.

METAL CONDUIT.—The suggestion has been made in the trade that prices of steel tubing may go up when the government's price regulation of steel is discontinued. The statement to this effect is based on the fact that previous to the armistice date there was not enough steel tubing being produced for the government's own use, yet even with that condition prevailing, production was ordered reduced 40 per cent. There is a considerable shortage in butt-welded pipe, which leads some observers to believe that conduit prices may rise.

BOSTON

Jobbers are extremely busy despite a cautious policy now apparent in many branches of commerce and industry. Optimism regarding the future was expressed by a large number of jobbers, contractor-dealers and central-station men interviewed toward the end of last week. Stocks are low along the line of industrial supplies, but the removal of priority restrictions has put a better face on deliveries, and jobbers are already ordering supplies for receipt early in the new year. So far prices are holding firmly.

The labor situation presents the most serious problem at this time. Cancellations of war orders are being received here and there, and overtime work has been largely eliminated. War orders upon which work has not been done have been canceled in many localities; in others the government has notified the manufacturers to suspend production as soon as goods in process are completed. At this writing there has been no wholesale cutting of war orders sufficiently large to flood the market with unemployed labor, although the employment agencies and factory and central-station superintendents report an increasing number of applicants for steady work.

Architects are beginning to receive requests from clients to prepare plans and specifications for new building work, despite the fact that high prices of labor and material and the high cost of money are retarding immediate expansion in this field on a large scale. It is expected that a large amount of new construction will be under way within a few months and that the exhausted shelves of retail dealers in many branches of trade will soon be the cause of great activity in manufacturing circles.

Central stations report little reduction in load as yet, though the doing away with night work and overtime is unquestionably cutting into the twenty-four-hour output somewhat, perhaps 10 per cent at the outside. There is a general feeling among the more conservative jobbers that if stocks are maintained and customers served without resorting to price-cutting through fear of future price declines, conditions will be better in the next few months than if attempts are made to obtain speculative profits in the present transition period.

CONDUIT.—Delivery promises are encouraging, though as yet shipments of pipe are slow to materialize. By the time the building trade gets on its feet, however, stocks should be greatly enlarged in comparison with the present general scarcity.

WASHING MACHINES.—A most promising market is reported, supported by excellent sales. One of the smaller jobbers sold seventeen machines in a fortnight.

LAMPS.—A big trade in lamps is in sight, following the removal of lighting restrictions by the Fuel Administration. Retailers report increased sales of portable lamps within the past two weeks. Free renewals have been resumed in some central stations in the larger units.

FIRE-ALARM EQUIPMENT.—Conditions are quiet in municipal circles, but industrial plant improvements are likely to call for new equipment soon. Plans are afoot for a more competitive development of the municipal field by manufacturing interests hitherto specializing in interior apparatus.

MOTORS.—The supply of motors is still spotty. A large amount of betterment work in electric drives is in sight. Underloaded machines are to be taken in hand, with much benefit to the motor and controller market.

FARM-LIGHTING EQUIPMENT.—Sales have been held back by the difficulties of battery delivery, but the prospects are good for next spring.

RADIATORS.—An improvement in supply is noted. The demand is excellent, one moderately small dealer disposing of fifty units in one day recently. Mild weather has helped in the accumulation, but stocks would soon be seriously depleted if a prolonged cold snap should come.

FIXTURES.—Business is still very dull, but the improved outlook in the building trade reflects encouragement. Some contractor-dealers are going out of the fixture business on account of the high overhead entailed. Specialty houses, however, are well stocked.

ATLANTA

A spirit of optimism pervades the electrical field in the Southeast. Opinions vary regarding the outlook for the following six months, but every one is of the same mind relative to business for 1919, namely, that trade in all lines is going to be active. It is reported that some large distributers are laying plans now to order reasonable stocks of rubber-covered wire and standard material so that they will be in good shape to take care of the much-needed replacements, and also anticipating a heavy demand from commercial channels which will open up in the early spring from work that will be started around the first of the year. Architects have had stacks of plans laid away that are now being brought out and revised to meet the present conditions of readjustment. Although there is no surface indication of a building rush at this time, there is an undercurrent of activity pointing to the fact that this section is rapidly absorbing the peace news and getting ready for the large volume of ordinary commercial business that is bound to be transacted. The news from Washington that the ban on all building is off, together with the appeal to municipalities from the War Industries Board to go ahead with construction will certainly be gladly received here. Construction of this nature has been stagnant so long that a reaction is sure to follow. The lifting of the cotton embargo is reflected in the more cheerful expressions of contractors and dealers at outlying points.

Uncertainty still exists regarding the future of Southeastern cantonments, but information reported to have been given out by a personage high in Washington military circles indicates that all camps will be abandoned with the exception of Camp Gordon, Atlanta, Ga., Fort Oglethorpe, Ga., and Camp Jackson, Columbia, S. C. These possess excellent facilities of distribution as well as strategic value. It is reported that barracks at Camp Benning, Columbus, Ga., are to be constructed of tile instead of wood, which indicates that this will be a permanent camp.

APPARATUS.—Manufacturers are notifying their customers that the lid is off and no priority affidavits are necessary to secure turbines, generators, motors, etc. The last two weeks have shown a decline in inquiries and orders for large equipment.

CONDUIT.—Restrictions have been modified on rigid conduit, and this class of material can be purchased without accompanying priority classifications. Government orders are to receive preference, as usual. The government is curtailing purchases, and if a wholesale cancellation of outstanding orders takes place, shipments of conduit will be somewhat improved. While the demand for conduit is comparatively quiet at this time, it is expected that commercial activity will offset the lack of government orders.

SEATTLE—PORTLAND

To a large extent the industrial field seems to be marking time and drifting into the reconstruction period in a very gradual manner. There have, however, been a few important changes within the past week or ten days. All work being conducted by the spruce division has been held up and all contracts for equipment not already on the way canceled. This has affected in a marked manner a number of industries, particularly in the Portland district, where one large manufacturing company laid off its entire night shift of approximately 1200 men, owing to canceled orders. The various shipyards, however, both steel and wooden, have work contracted for a long time to come. The reported noticeable slowing down in orders received from shipyards applies strictly to the Portland field, as Seattle electrical jobbers report for the week that business was as good as or better than for the past several weeks.

Sales volumes, particularly in retail trade, are increasing rapidly at the approach of Christmas. Jobbers and contractors in Portland report little if any change, although there seems to be a general feeling that there is a tendency to slow down a bit.

Electrical manufacturers first cut their stock requirements from a six-month period to four months, and since in some lines to an even shorter period. Many Portland electrical contractors have released men during the last few days, and it is a noticeable fact that laborers are now obtained for electrical work with relatively no trouble, whereas a few weeks ago it was almost impossible to supply the demand. Portland jobbers report stocks in good shape in practically all lines. At the present time no special movement of any line is noticeable. In the appliance end there is undoubtedly a decided depression, due not to the probable period of peace but to the very material increase in price effective last week. This depression is felt also in Seattle.

The lifting of the embargo against shipments of northwest forests products into the territory east of the Mississippi and north of the Ohio River has been gratefully received by local lumbermen. In Seattle there is a noticeable increase in the announcements of new building projects. All important problems connected with large wooden-ship construction apparently have been solved, and nothing now stands in the way. However, the Northwest is faced with a labor shortage estimated at about 14,000 men, embracing all branches of labor. Steel shipyards of Seattle and Tacoma are confronted with a situation that threatens to curtail production materially. The release of men from Northwest spruce camps is expected to help somewhat as will the expected demobilization of men in nearby cantonments. Seattle jobbers as a whole report collections exceptionally good.

SAN FRANCISCO

The Pacific Coast electrical industry has not yet been affected by the signing of the peace armistice. Rather has it prepared itself for a triple load—the continuance, for the present at least, of special war work, the resumption of interrupted non-essential work, and preparations for what is supposed to be the heaviest electrical Christmas yet.

The forthcoming meeting of the northern California co-operative campaign, following hard on the heels of the southern California meeting, will coalesce the electrical contractors for the enormous private construction and the business to come.

Early rains have encouraged the power companies, although the mountains have not been drenched so heavily as has the coast. In the San Francisco Bay district the present rainfall is about 300 per cent greater than the average rainfall at this time of the year. This will at least relieve the irrigation problem and will release energy for other needed work.

The Sierra & San Francisco Power Company has been granted permission to raise its rates by about 15 per cent.

The labor situation is again threatening, the past week having been marked by sporadic strikes in the shipyards.

HEATING DEVICES.—Some deliveries of electrical radiators are now being made. As to percolators and other special heating devices of Christmas nature, some fortunate firms have received their advance orders already, while others are afraid that their stocks will reach them too late.

SCHEDULE MATERIAL.—The first indication of peace and its effect upon shipyard business was the cancellation of several orders for marine schedule material, principally composed of door switches to cut off light instantaneously on the opening of outside doors on the ships. These switches prevented any disclosure of a ship's position to submarines. Most of the orders had already been shipped, so that this cancellation did not affect many items.

FARM PLANTS.—The farm-plant business has shown great increases during the past month, probably due to a circulation of crop money and the result of the summer campaign by representatives of several of the factories. This business is rather surprising in its extent in a state so well covered by power lines as is California. Deliveries, which have been hampered for some time by inability to get storage batteries, are now much better. Several wide-awake dealers are carrying stocks at certain districts and not depending upon factory or San Francisco or Los Angeles shipments.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61 00
No. 12 solid	71 00
No. 10 solid	90 00
No. 8 solid	106.00
No. 6 solid	145 00
No. 10 stranded	95 00
No. 8 stranded	115 00
No. 6 stranded	160 00
No. 4 stranded	205 00
No. 2 stranded	266 00
No. 1 stranded	315 00

Twin-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	104 00
No. 12 solid	135.00
No. 10 solid	185 00
No. 8 stranded	235 00
No. 6 stranded	370 00
No. 4 stranded	575 00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+30% to $73 20
Coil to 1000 ft	List

	No. 12 Solid
Less than coil	+30% to $85 20
Coil to 1000 ft	List

Twin-Conductor

	No. 14 Solid
Less than coil	$115.00
Coil to 1000 ft	100.00

	No. 12 Solid
Less than coil	+20% to $162 00
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0 22 to $0.30 each.
Standard packages from 100 to 250

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to 12%
1/5 to std. pkg	+5% to 20%
Std. pkg	18% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular		No. 6 Ignitor	
Less than 12	$0 45—$0 46		$0 45—$0.47	
2 to 50		40	40—	41
50 to barrel	35-	36	36—	37
Barrel lots	32	329	33	339

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 40 to $0 45	$0 40 to $0.45
12 to 50	.35 to .39	.35 to .39
50 to barrel	.319 to 362	.329 to .382
Barrel lots	289 to 332	299 to .342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5 00
3/8	250	7 50
1/2	100	10 00
3/4	50	13 00
1	50	21.00
1¼	50	26.00
1½	25–50	35 00
2	25–50	45 00
2½	25–50	52 00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75.00	$63.75— 69 75
3/8-in. double strip	75 00— 82 50	72.00— 75 00
1/2-in. single strip	100 00	85 00— 93 00
1/2-in. double strip	100.00—110 00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75 00	$63 25 to $63 75
3/8-in. double strip	78 25 to $90 00	71 25 to 75 00
1/2-in. single strip	100 00	75 00 to 85 00
1/2-in. double strip	105.00 to 120 00	93 00 to 100.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0 05½	1	$0 25
1/4	06	1¼	33
3/8	09	1½	40
1/2	12	1¾	47
5/8	.15	2	.55
3/4	18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$25.00–51 70	$24 00–35 20	$23.00–30 25
1/4-in.—	30.00–56.40	28.00–38 40	26 00–33.00

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$44 00–60.00	$30 00–33 00	$26 50–29 15
1/4-in.—	48.00–65 00	33 50–36 00	29 00–31.80

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
1/4	$0 08½
3/8	08½
1/2	.08½
3/4	.11½
1	.17
1¼	.23
1½	27½
2	.37½
2½	58½
3	76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
1/4	$0 05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	10	.25
1	13	.37
1¼	17	.45
1½	21	.50
2	28	1.10
2½	40	1.80
3	60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	7% to 7 1%	9% to 9 1%
2500 to 5000 lb.	10% to 10 1%	12% to 12 1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 to 1/2 In.	3/4 to 3 In.
Less than 2500 lb.	+5.5% to 3.5%	+3.5% to +1.5%
2500 to 5000 lb.	+2.5% to +0.5%	+5% to 1.5%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$6.00 to $7.00
Discount	20% to 30%

CHICAGO

List price	$6 00 to $7.00
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	Lis
3-amp. to 30-amp	100	$0.25
35-amp. to 60-amp	100	.35
65-amp. to 100-amp	50	.90
110-amp. to 200-amp	25	2.00
225-amp. to 400-amp	25	3.60
450-amp. to 600-amp	10	5.50
600-Volt		
3-amp. to 30-amp	100	$0.40
35-amp. to 60-amp	100	.60
65-amp. to 100-amp	50	1.50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5 50
450-amp. to 600-amp	10	8 00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41% to 45%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6.00 to $9 37
1/5 to std. pkg	5.25 to 7 00

Standard packages, 500. List, each, $0 07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8 00
1/5 to std. pkg	7 00

Standard packages, 500. List, each, $0.07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0 35
60-watt—B	100	40
100-watt—B	24	85
75-watt—C	50	70
100-watt—C	24	1 10
200-watt—C	24	2.20
300-watt—C	24	3 25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.6
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4⅜-in., Frosted:		
100-watt—G 35	24	1 15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.47—$40 77
Coil to 1000 ft	27 42— 30 22

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$38 00
Coil to 1000 ft	28 00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24.00

CHICAGO

Net per 100	$23 93 to $30 00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S	30 00
103—C.A., 9, 4R, B 1½	25 00
106—F.A., 7, C.S., 1½, 3 R	20 00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%	20%
$10.00 to $50.00 list	36%	31%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20%	10%
$10.00 to $50.00 list	30%	20%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	5%
1/5 to std. pkg	15%
Std. pkg	25%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$21.00 to $34 00
1/5 to std. pkg	17 85 to 28 90

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$21.00–24 15
1/5 to std. pkg	17 85–21 00

Standard package, 2200. List per 1000, $20.00–21.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.—Solid Nail-it	Std. Pkg. 4000 —N.C.
Less than 1/5 std. pkg	$16.00 to $22.00	$32.00
1/5 to std. pkg	13.60 to 18.70	27.20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.—Solid Nail-it	Std. Pkg. 4000 —N.C.
Less than 1/5 std. pkg	$13 00–$18.40	$32 00–$36 80
1/5 to std. pkg	11 50– 16.00	27 20– 32 00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push sockets	500	$0 33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List
1/5 std. pkg	10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0.80
60-amp. S. P. S. T	1 20
100-amp. S. P. S. T	2 25
200-amp. S. P. S. T	3 48
300-amp. S. P. S. T	5.34
30-amp. D. P. S. T	1 20
60-amp. D. P. S. T	1 78
100-amp. D. P. S. T	3 38
200-amp. D. P. S. T	5 20
300-amp. D. P. S. T	8 00
30-amp. 3 P. S. T	1.80
60-amp. 3 P. S. T	2 68
100-amp. 3 P. S. T	5 08
200-amp. 3 P. S. T	7.80
300-amp. 3 P. S. T	12 00
Low Grade:	
30-amp. S. P. S. T	$0 42
60-amp. S. P. S. T	.74
100-amp. S. P. S. T	1.50
200-amp. S. P. S. T	2.70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T	1.22
100-amp. D. P. S. T	2.50
200-amp. D. P. S. T	4 50
30-amp. 3 P. S. T	1.02
60-amp. 3 P. S. T	1.84
100-amp. 3 P. S. T	3.76
200-amp. 3 P. S. T	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15% to +10%
$10 to $25 list	+10% to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5% to list
$10 to $25 list	List to 8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 15%
$10 to $25 list	List to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15% to 16%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Sna Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List to 10%
1/5 to std. pkg	10% to 16⅔%
Std. pkg	18% to 25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0 34
No. 160	60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 30%	Net
$2.00 to $10.00 list	10% to 35%	5%
$10.00 to $50.00 list	20% to 37%	10%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00 to 6 50
Discount	20% to 30%

CHICAGO

List price	$6 00 to $7.00
Discount	20% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0 54–$0.66
No. 18, full spools	.52– .56

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0 65 to $0 71
No. 18, full spools	.55 to .595

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$20.00–$25 00	$15.00–$17 00	$15.00–$15 75
12	23.58– 27 09	21.62– 29.09	17.68– 23 22
10	30 20– 37 80	27.45– 32.40	23.47– 32 40
8	42.74– 53.34	38.85– 45 72	33.21– 45.72
6	61.50– 84 42	55.35– 72.36	52.58– 55.48

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$25.00	$18 00–$25 00	$15.50
12	$29.46– 31 44	29 46– 31 44	$25 54– 31 44
10	41 10– 43 84	41.10– 43.84	34 62– 38.36
8	57.00– 61 76	57 00– 61 76	50 18– 54 04
6	85 31– 97 68	85 31– 85.47	77 21– 85 47

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$39 75 to $44 00
25 to 50 lb	39 75 to 42.00
50 to 100 lb	38.75 to 40 00

CHICAGO

	Per 100 Lb. Net
Less than 25 lb	$41.00 to $41 76
25 to 50 lb	39 75 to 40 76
50 to 100 lb	38.75 to 39.76

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Portable Twin-Arc Lamp

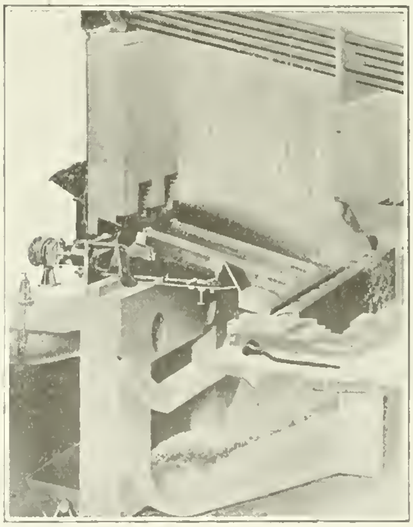
The Allison & Hadaway Corporation of 42 West Thirty-ninth Street, New York City, has just developed the "Panchroma" self-contained twin-arc lamp for motion-picture studios, photographers and photo-engravers. It is designed to give a powerfully actinic light. When the lamp is not in use the doors, which act as reflectors, may be folded together and the folding stand dismounted in this way, permitting the new model to be carried about, as it weighs but 18½ lb. (8 kg.). The manufacturers point out the feature that there are no projecting parts to break off or to catch the clothing and that mislaying parts is not possible since nothing but the stand need be detached.

MAY BE USED IN MOTION-PICTURE AND PHOTOGRAPHIC STUDIOS

The 12-in. (30-cm.) carbons in the lamp are said to require infrequent trimming, the lamp giving a good white light with little flickering. Prominent double shadows are obviated by a triangular shadow breaker that is placed between the arcs. Adjustment of the rays is facilitated by both the reflectors and the tilting mount, so that the light may be distributed in any range from one strong beam to an area of 120 deg.

Automatic-Cleaning Underfeed Stoker

An automatic-cleaning underfeed stoker has been developed by the Under-Feed Stoker Company of America and is similar in general design to the standard Jones underfeed stoker but in addition has the self-cleaning feature. Coal is fed into the hoppers in front, either by gravity from storage above or by hand. The steam cylinder below and in front of the hopper operates a pusher rod and ram which as it moves toward the fire pushes a charge of fresh coal from the hopper into the retort or coal magazine that supports the fuel bed. As this coal is pushed into the retort it moves the previous charge of coal slightly backward and upward. This intermittent process keeps fresh coal fed into the fuel bed from below. As this coal is gradually forced upward, the heat from the incandescent zone above drives the volatile gases from the fresh coal before the actual burning takes place. These gases mix with the air admitted through the tuyères, and the mixture passes upward through the hot fuel above. The gasless coal or coke which is left is forced to the upper part of the fuel bed (the incandescent zone) by the new fuel coming in, where it burns with the gas coming up from below. This process gives a coke and gas fire, not a coal fire.

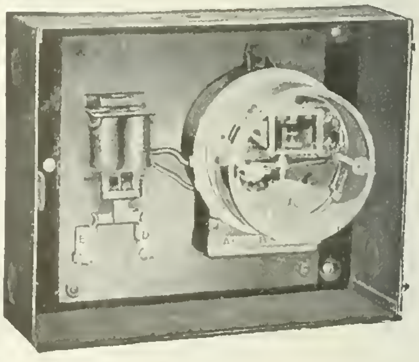

DESIGNED SO FUEL AT REAR IS COMPLETELY BURNED

As the coke burns, the intermittent movement of the fuel, caused by the feeding of fresh coal from below, moves the whole burning fuel bed with ash and refuse slowly toward the rear. This is not a gravity movement, as the slope of the retorts is not sufficient to cause the ash and refuse to slide or roll toward the dump plate. The movement is primarily caused by the intermittent upward and backward motion of the fuel resulting from the steam-ram action. This backward movement, assisted by the pusher rod and blocks, carries the whole fuel bed slowly toward the rear as though on a conveyor, so that when the fuel bed reaches the dump plate at the rear the coal is burned. This keeps the fire clean and prevents the "avalanching" of burning fuel onto the dump plate. As the refuse accumulates on the balanced dump plate at the rear of the furnace, the plate is dropped, which dumps the ashes into the ash pit below. This need be done only at infrequent intervals and is the only manual operation necessary as the cleaning is automatic. This automatic cleaning feature is said to effect a very important saving in labor.

Protection of Polyphase Motors

Protection of polyphase motors operating elevators or cranes against reversal of one phase or open circuit in one wire may be secured by the use of Palmer type TS reverse-phase relays, which, according to the maker, give full protection against reverse-direction elevator accidents or motor burn-outs due to attempted single-phase operation. This device is particularly applicable to elevator controllers in which a no-voltage opening-shunt-coil contactor, in the circuit between the reversing switch and the motor, forms a standard part of the elevator equipment. The action of the relay under reverse-phase or single-phase conditions opens the magnet circuit of this contactor so that it will not connect the motor to the line unless proper operating conditions prevail.

The device is selective, the manufacturers say, in its single-phase operation to the extent that if a fuse blows when the car is moving the motor carries the car to its next stop and prevents the motor from being again connected to the line until properly fused.


ECONOMICAL RELAY FOR ELEVATORS OR CRANES

This device is made by the Palmer

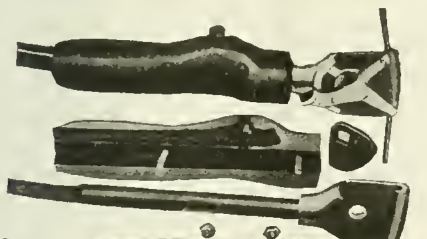
Electric Manufacturing Company, South Boston, Mass.

It is said that the relay is a simple device to install and connect, either in old or in new motor installations, but that the wiring connection must be exactly in accordance with diagrams and instructions furnished by the company. Elevator and crane motors equipped with this type of relay comply with the National Code regulations that call for the protection of this class of apparatus against possible operation under reverse or single-phase conditions. According to the manufacturers, the relay is very economical, requiring only 3.85 watts, and, as its moving parts stand on jewel bearings and are of standard watt-hour-meter construction, it can be depended upon for long service under normal conditions of use.

Strong Light-Weight Holder for Arc Welding

In electric arc welding it is not only desirable to have an electrode holder strong enough to hold the electrode during operation but also one which can pull the electrode away should it stick to the work. Again, with the increase of women as welding operators it is advisable to have a tool which is neither very heavy nor cumbersome. With these ends in view the Arc Welding Machine Company, Inc., of 220 West Forty-second Street, New York City, has developed a new type of electrode holder especially designed for a closed-circuit system but also applicable to other systems.

Welding current enters the holder through the rear end of an insulated composition shank and passes along to the head of the tool and from there directly into the electrode. Excessive heating due to contact resistance is said to be impossible, there being no joints in the holder save where the cable is soldered into the shank. Since there is a relatively large contact between the holding head and the electrode, undue heating at this point is also precluded. The actual holding device consists of a lever-controlled spiral segment of case-hardened steel which grips the electrode harder as it is pulled, so that the electrode will not come out should "freezing" to the work take place. Yet the electrode can be quickly and easily removed from the holder by the lever when changing is desired. For remote control with the closed-circuit system a trigger in the shank is used which is omitted on holders for other systems.



READY FOR USE AND ASSEMBLED TO SHOW VARIOUS PARTS

Economical 75-Watt Argon Lamp

A 75-watt argon-filled lamp which is said to be a real coal saver has been perfected by the Hygrade Lamp Company of Salem, Mass. This lamp, filled with argon instead of nitrogen, has an average life of 1000 hours, the same as other lamps, and the manufacturers claim excellent character of light and economy of operation.

Aside from its much more frequent use in offices, stores, store windows, mills, factories and other large spaces, this 75-watt argon-filled lamp will be especially useful in home lighting. It is said to have a spherical candlepower of 69 and can be used in place of any cluster of tungsten-vacuum lamps of approximately the same candlepower at a considerable saving of electrical energy. For instance, at a cost of 10 cents per kilowatt-hour a 75-watt argon-filled lamp will burn 1000 hours for $7.50. For the same length of time one 40-watt vacuum lamp, with a total spherical candlepower of 68 and a total consumption of 90 watts, will cost $9. A comparison with other combinations of vacuum lamps will give the same result in favor of the 75-watt argon-filled lamp, the makers say.

An advantage which is not shown by figures is that actually the 75-watt argon-filled lamp will give more useful light than any combination of 25-watt to 50-watt tungsten-vacuum lamps having the same rated candlepower if the light is diffused with suitable reflectors, the pear-shaped lamp with concentrated filament throwing the light where it is wanted better than the straight-sided group of filaments in the ordinary vacuum lamp.

Small-Capacity Light and Power Plants

Light and power plants of ten-light and twenty-light capacity with a belt-connected engine are being marketed by the Essandee Corporation of 39 South La Salle Street, Chicago. When not charging the batteries the engine may run pumps, corn shellers, cream separators and similar labor-saving devices.

The hard-rubber jars used in the sixteen-cell storage battery are said to be sealed so that the elctrolyte cannot readily leak out. The engine, of gasoline or kerosene type, develops $1\frac{1}{2}$ hp., has a speed of 500 to 600 r.p.m. and dispenses with batteries for ignition purposes, using a magneto instead. The commutators are extra large inasmuch as the generator has been designed for low-voltage service. Heavy slate is used in manufacturing the switchboard.

Switchboard Designed for Simplicity

Switchboards designed for farm-lighting, in standard sizes, measuring 18 in. by 24 in. (45 cm. by 60 cm.), and rated at 30 amp., 32 volts, are being made by the Knoeller Electric Company, De Pere, Wis. The details of these switchboards have been worked out with the special purpose of making it almost impossible to injure the apparatus which they control. They are made of 1-in. (2.5-cm.) purple slate, mounted on angle-iron supports. They are equipped with a voltmeter, ammeter, switches and an automatic cut-out.

FOR USE WITH SMALL ISOLATED PLANTS

Film Fire Prevention

If the film in a motion-picture projector clogs and stops running in front of the arc light, it usually ignites and flares up. The reflection of the burning film projected on the screen causes the audience to become restless and apprehensive and even to stampede for the exits. Should the flames reach the magazine reels a serious fire is possible. In order to remove these two hazards the Seligraph Company of 92 Lenox Avenue, New York City, is marketing the "magnetograph," a device for attachment to any make of projector. This is said to cut the strip of burning film, seal the entrances of the two film reels, turn off the arc light and stop the motor, drop the port shutters into the booth, turn on the auditorium lights and signal the orchestra to start playing.

When the film ignites the heat burns a trigger string, releases the trigger, which breaks a magnetic contact and causes knife blades to cut off the burning film at the two points of entrance to the magazines, sealing the apertures so that the flames are prevented from spreading and are forced to burn out in the lamp house, the makers say. A pin release shuts the port shutters, through which any smoke or reflection of fire on the screen would necessarily have to pass. An automatic control and booth-service breaker is used for turning on the auditorium lights and the orchestra signal lamp and to turn off the arc light and stop the film-winding motor.

Trade Notes

LABOR DISPUTES DURING SECOND QUARTER OF 1918.—The United States Bureau of Labor Statistics reports 997 strikes and 26 lockouts in the United States during the second quarter of 1918. In 528 strikes the number affected was 287,404, and the average duration of 551 strikes reported as ended during the quarter was fourteen days.

IMPORT RESTRICTIONS ON RUBBER MODIFIED.—The War Trade Board announces in a new ruling (W. T. B. R. 355) that W. T. B. R. 248, issued Oct. 3, 1918, under which the total importations of rubber to be licensed during October, November and December, 1918, were limited to 25,000 tons, has been amended to permit the licensing of 7500 tons additional prior to Jan. 1, 1919. The amount so licensed will be allocated by the War Trade Board.

STOKER MANUFACTURERS COMBINE SALES ORGANIZATIONS.—Beginning with Jan. 1, 1919, the Sanford Riley Stoker Company of Worcester, Mass., and the Murphy Iron Works of Detroit, Mich., will combine their sales policies in one large constructive organization, it is announced, so as to render the greatest possible service to all clients. Eleven centrally located offices will handle both sales and service for the Riley underfeed stoker and the Murphy automatic furnace. These offices will be established in the following cities: Worcester, Boston, Philadelphia, New York, Pittsburgh, Buffalo, Detroit, Cleveland, Cincinnati, Chicago and St. Paul.

ENGLISH ELECTRICAL MANUFACTURER SCORES EXCESSIVE COMPETITION.—H. I. Rogers in speaking before the Western Section of the British Institution of Electrical Engineers from the standpoint of the manufacturer stated recently that perhaps the most important cause of the failure or extremely unsatisfactory state of affairs of the British electrical industry has been the excessive and unnecessary competition between different manufacturers. Electrical apparatus, it was pointed out, is inherently cheap if manufactured under right conditions. All parts should be produced on a repetitive basis, and if so quality can be of the highest and conditions of the workers can be of the best. This, however, can only be done if the purchasing public will buy the resulting apparatus. The consumer, it is held, must standardize his requirements while the manufacturer must produce apparatus which will stand the acid test of service. The best designed appliances under proper conditions of manufacture cost no more than apparatus of poor design. Under these conditions the industry, it was pointed out, would be profitable to the worker and insure good wages; it would be profitable to the manufacturer and insure financial stability, and profitable to the consumer because it would insure him machinery of good quality at a reasonable cost.

SPECIAL EXPORT LICENSE FOR SAMPLES.—The War Trade Board announces that W. T. B. R. 280 is revoked and that a special export license, effective Nov. 25, 1918, No. RAC 55, has been granted to the Post Office Department and to the Customs Service, authorizing the exportation, without individual export license, of samples of any commodity and advertising matter to be used therewith, regardless of whether the same are shipped by mail (subject, however, to the postal regulations), by express, or by freight, in passenger's bagage or otherwise, when destined to any country except Norway, Sweden, Denmark proper, Iceland, the Faroe Islands, European Holland, Switzerland and Greece. Under this license the term "samples" is construed to mean articles or portions thereof intended for use in soliciting orders and is not construed to include any article or portion thereof which is itself intended to be sold as an article of commerce. Shippers should note that it is unnecessary to apply to the War Trade Board for permission to ship under special export license RAC 55, and no special document issued by the War Trade Board is necessary in connection with such shipments. It is only necessary to note on the package, if the shipment is made through the mails, or on the export declaration, if the shipment is made by express or freight, the following: (1) "Shipped under special export license RAC 55"; (2) the name and address of shipper; (3) the name and address of consignee; (4) a statement of contents. It should further be noted that special export license No RAC 55 is not a license to trade with the enemy and does not authorize any shipment in contravention of Section 3 of the trading with the enemy act.

CHANGES IN FAIRBANKS, MORSE & COMPANY STAFF.—Following a recent meeting of the directors of Fairbanks, Morse & Company of Chicago, with branch houses in principal cities all over the country, C. H. Morse, Jr., president, announces several new and important changes, covering the active management of the business. R. H. Morse has been elected vice-president in general charge of purchasing and traffic. Mr. Morse's connection with the firm covers many years of varied experience in both sales and manufacturing departments, and he continues his duties as a director of the company. C. W. Pank rises from general director of sales to vice-president in charge of sales of all factory products. Mr. Pank's growth with Fairbanks, Morse & Company has been unusually marked since his start with the firm some thirty-three years ago as a stenographer. His activities through these many years have included practically every branch of sales and affiliated effort. W. S. Hovey, formerly general manager of the large Fairbanks-Morse manufacturing plant at Beloit, Wis., has been elected vice-president in charge of general manufacturing at all factories. Mr. Hovey has been with this concern for a number of years, aiding in its development through the application of modern principles of design and manufacture to many of the Fairbanks-Morse products. W. E. Miller becomes vice-president and treasurer instead of first vice-president. F. M. Boughey retires from the position of treasurer to become secretary and comptroller.

C. W. PANK

RESALE PRICE FIXING.—Declaring it has reason to believe the concerns are forcing retailers to maintain standard fixed resale prices on their products, the Federal Trade Commission, "in the interest of the public," has just issued formal complaints against the Procter & Gamble Company and the Procter & Gamble Distributing Company, Cincinnati, makers and distributers of "Ivory" soap, and the Klaxon Company, Newark, N. J., maker of automobile horns. Both concerns are charged with refusing to sell to dealers who insist on reselling to the public at prices they deem adequate. The Procter & Gamble companies were also charged with refusing to sell mixed carload lots of their products unless purchasers also buy "Ivory" soap. The Klaxon Company is further charged with selling its Klaxon horns on the condition, agreement or understanding that dealers shall at all times carry a minimum stock of Klaxons to the value of $300 and is charged under the Clayton anti-trust act with fixing prices, rebates or discounts on the condition that dealers will not deal in the products of its competitors.

SWISS MARKET FOR ELECTRICAL GOODS.—A report by Consul Philip Holland from the Basle district of Switzerland on the condition of the market for electrical material during 1917 has just been released by the Bureau of Foreign and Domestic Commerce. It says, "The demand for electrical machinery and equipment was heavy throughout the year. As the use of gas was cut to less than half of the normal need and wood and coal were scarce and dear, efforts were made in privite homes and in industrial plants to replace heat and power with electricity. Raw materials, especially electrolytic copper, could not be had in sufficient quantities to meet the demand and prices rose to many times the normal. Large electrical machines could not be sold or delivered without government permits. Electrical insulations, especially high-tension insulations, were in demand. These were manufactured and sold profitably in the district and also exported to France and Italy. A new industry for manufacturing electric heaters was established and was able throughout the year to dispose of its product This heating apparatus is constructed of composite stone, with inside wiring, and heats during the night at a low rate for energy. The industrializing of small villages has created a heavy demand for small motors. In almost every village in this district there is some kind of factory which gives employment to the inhabitants between the crop seasons."

CONDUIT CONCERN'S AMERICANIZATION PLANS.—A system of free schools to educate adult foreigners employed by the Youngstown (Ohio) Sheet & Tube Company was started as early as January, 1917. The scope of the plan, as it was designated and as it has been carried out, opened these schools to the non-English-speaking women in the households of the company's employees. The classes were held originally in a building in the heart of the section inhabited by these employees. The course consists of reading, writing, spelling, grammar and arithmetic. At the beginning six teachers were employed, and the first term began on Jan. 8 and closed the first week in June. The first session, from 8:30 to 9:30 in the morning, was intended for men working from noon until midnight; the second session, from 3 to 4 p. m., for those employed on the night turn, and the third session, from 7:30 to 9 o'clock in the evening, for men employed on the day turn. Women were admitted to all these sessions and encouraged to attend those which were most convenient. In addition to the regular sessions, special classes for instruction in citizenship, civic and kindred branches were conducted on Thursday of each week. The success which attended the entire venture the first year resulted in increasing the number of teachers to fourteen during the 1917-1918 term. Additional schools were established, and the plan was enlarged accordingly. At various times during the terms special exercises were held, including addresses, music and the presentation of certificates to pupils who had earned them by the good quality of their work.

PROCEDURE FOR EXPORTS TO MEXICO.—In view of the increasing scarcity of many commodities of prime importance and necessity to the United States and which at the same time this government desires to share with Mexico, it has become necessary for the War Trade Board to allot such commodities for export to Mexico, in order to equalize the distribution throughout the neighboring republic in an equitable and orderly manner consistent with the maximum amount of such commodities as can be spared. Prospective importers in Mexico will facilitate the granting of licenses for export by the War Trade Board by presenting copies of their orders for supplies in triplicate to the nearest American consular officer, who will visé such orders and retain one copy for his file, returning the original and one copy to the applicant. The importer should forward both visé́d orders to the prospective exporter in the United States, with instructions to attach the original viséd order to his application to the War Trade Board for an export license covering the commodity specified in such order, or file the original viséd order with the War Trade Board at Washington, D. C., and thereafter, in filing applications for licenses to export the commodities specified on such order, refer to the order by the consulate stamp serial number which will be affixed to the order, and also the consular address, as "Mazatlan, Serial No. 4782." The official statement further says that in cases where American consular officers are not easily accessible to the prospective importer, a statement to that effect should be attached to the order, giving the name of the nearest place where an officer connected with the American consular body is stationed.

A. F. DAUM, manufacturer of refillable fuses, Pittsburgh, Pa., announces that the Oriental Electric Industrial Corporation of Nagoga, Japan, is closing a deal for a sole license under the Daum patents in Japan and China. Shigekaten Mori, chief engineer of the Oriental company, has been at the Daum plant getting details. Mr. Mori states that all renewable fuses used in Japan and China are imported and that the company he represents will be the first in the Far East to manufacture renewable fuses.

WILLIAM G. MEROWIT, Buffalo, N. Y., is now representing the following concerns in the western part of New York State and nearby Canada: Monitor Controller Company, Baltimore, automatic motor starters and controllers; Roller-Smith Company, New York, circuit breakers and instruments; Union Electric Manufacturing Company, Milwaukee, manual motor starters and controllers. He will make his headquarters at 716 Ellicott Square, Buffalo. Mr. Merowit has had a varied experience in the application of electrical power apparatus and will specialize along those lines.

THE HOBARTS MANUFACTURING COMPANY, Troy, Ohio, announce that its kitchen machines and mixers are now regular equipment in the United States Navy. Instead of having a separate machine for coffee grinding, dough mixing, vegetable cutting, potato mashing and other culinary operations, it is possible by the Hobart unit and attachment system to use only one motor, with which it is possible to perform these operations by using various attachments. This, the manufacturers say, is exceptionally welcome on shipboard, where space is at a premium.

THE MORAN & HASTINGS MANUFACTURING COMPANY, 16 West Washington Street Chicago, has equipped the Emergency Fleet Corporation offices with more than 2000 of its new "Raymo" adjustable lighting fixtures, which are also suitable for store lighting. These fixtures, which have but recently come on the market, have a shade supported from the holder, the bowl being suspended from the husk. Both light rays and lamp sizes may be varied to suit individual requirements since the lamp socket may be moved up and down. The glassware in these units is translucent, while the chain and canopy are finished in Roman gold.

CHAMPION & RYAN, a new concern, have opened an office at 299 Broadway, New York City, and will act as manufacturers' representatives for export trade, with connections in several countries. The company's lines for export will comprise automobile shoes and tires, nitrogen and tungsten lamps, time switches, etc. Mr. Champion was formerly manager of the engineering division of H. Boker & Company, 101 Duane Street, New York City, and Mr. Ryan was associated with him as assistant. Previous to this, Mr. Champion was president of the Kandem Electric Company, Inc., New York City, which company was later absorbed by the Menominee Electric Manufacturing Company. The firm will also act as manufacturers' representative for local trade, which will embrace the territory belonging to the cities of Boston, New York and Philadelphia.

Trade Publications

MOTOR GRINDER.—The F. & M. motor grinder is the topic of a folder issued by Forbes & Meyer of Worcester, Mass.

GRINDERS.—Portable radial grinders are described in a recent bulletin of the Mummert-Dixon Company, Hanover, Pa.

CHURN.—A folder about the "Reliable" electric churn has been prepared by the Piedmont Electric Company of Asheville, N. C.

MARINE FITTINGS.—H. S. Tuttle, 766 Folsom Street, San Francisco, Cal., has prepared leaflets on electrical marine fittings.

STONE POLISHER.—A folder of the Cavicchi Polishing Machinery Company of Quincy, Mass., describes its litho stone polishers.

FUEL OIL.—Much information useful in fuel problems is given in "Fuel Oil and Its Use," published by Tate, Jones & Company, Inc., of Pittsburgh, Pa.

SEWING LAMP.—The American Lamp Company, 506 South Wabash Avenue, Chicago, is distributing a broadside regarding its "Eye-Ease" sewing lamp.

BOWL HANGER.—The Standard Electric Company, Inc., Cedar Rapids, Iowa, is distributing a folder about its "Stelco" bowl hanger for lighting fixtures.

FITTINGS.—Catalog No. 2 from the Efficiency Electric Company of East Palestine, Ohio, describes electrical fittings for structural, mill and general use.

GLUE-POT WARMERS.—Advance-Toledo electric glue-pot warmers form the subject of bulletin 220 of the Advance Machinery Company, Van Wert, Ohio.

NAIL-PACKING MACHINE.—A folder about an electromagnetic nail-packing machine is being distributed by Otto Gamper, 366 West Fifty-seventh Street, New York City.

HOSPITAL SIGNAL SYSTEM.—Leaflets describing the Deveau signaling system for hospitals have been prepared by Stanley & Patterson, 23 Murray Street, New York City.

LIGHTNING ARRESTERS.—The Electrical Engineers' Equipment Company, 710 West Madison Street, Chicago, has distributed a leaflet on sphere-gap lightning arresters.

TURBO BLOWERS.—A new catalog containing figures and tables on forced-draft apparatus has been prepared by the Coppus Engineering & Equipment Company, Worcester, Mass.

FUSE LINKS.—The Economy Fuse & Manufacturing Company, Kinzie and Orleans Streets, Chicago, has prepared a mailing folder about the Economy "drop-out" renewable links.

TURBINE WATERWHEELS.—An illustrated circular on Trump turbines and turbine waterwheels is being distributed by the Trump Manufacturing Company, Springfield, Ohio.

TWIN RADIANT HEATER.—Information about the "American Beauty" twin radiant electric heater has been printed by the American Electrical Heater Company of Detroit, Mich.

MEDICAL APPARATUS.—"Telatherm" high-frequency medical apparatus is described in a folder of the Wappler Electric Company, Inc., 173 East Eighty-seventh Street, New York City.

LIGHT AND POWER PLANT.—The 1918 model "Warnerlite" standard-unit electric lighting and power plant is dealt with in a folder issued by the Warnerlite Company of Davenport, Iowa.

RECTIFIER.—A recent seven-page booklet of the Stahl Rectifier Company, 401 West Jackson Boulevard, Chicago, has for its subject the Stahl rectifier for charging starting and lighting batteries.

RHEOSTAT AND COMPENSATOR OPERATING MECHANISMS.—Bulletin No. 47,702 from the General Electric Company, Schenectady, N. Y., describes the rheostat and compensator operating mechanisms.

FEED WATER REGULATORS.—The Chaplin Fulton Manufacturing Company, Pittsburgh, Pa., has described its complete line of Vigilant feed-water regulators and steam specialties in the 1919 catalog.

BATTERY CHARGING SETS.—The fourth edition of bulletin No. 105, descriptive of its battery-charging equipment for public garages, has been recently issued by the Main Electric Manufacturing Company of Pittsburgh, Pa.

BOILER TUBE CLEANERS.—A general catalog, X-4, giving full descriptions of the company's tube cleaners, accessories and other boiler room specialties, will be furnished upon request to the Lagonda Manufacturing Company, at Springfield, Ohio.

DISCONNECTING SWITCH. — Bulletin No. 1250 of the Electrical Development & Machine Company describes and illustrates the new "Franklin" disconnecting switches with positive locks for sale by the supply department of the Philadelphia Electric Company, Philadelphia.

POWER AND LIGHT PLANTS.—The various types of Western Electric lighting and power plants for farms and isolated buildings are dealt with in a sixteen-page booklet recently prepared by the Western Electric Company, Inc., of 195 Broadway, New York City.

FEED-WATER FILTER AND GREASE EXTRACTOR.—A twelve-page catalog "R" from the Lagonda Manufacturing Company, Springfield, Ohio, speaks of that company's multiple-filtration feed-water filter and grease extractor and shows photos of various power-plant installations.

WASHING MACHINE.—The Syracuse Washer Corporation, Syracuse, N. Y., has issued a leaflet about the model "H" "Easy" vacuum electric washer.

MAGNET CHARGER.—The "Elco" magnet charger is the subject of a folder from the Electric Equipment Company, 1240 South Hope Street, Los Angeles, Cal.

STANDARD UNIT PANELS.—Loose-leaf bulletins 47,131, 47,133 and 47,135A have been prepared by the General Electric Company of Schenectady, N. Y. The first deals with small-plant alternating-current standard-unit panels, while the second and third describe alternating-current standard-unit panels for isolated and small plants.

MOTORS FOR KITCHEN DEVICES.—"Hobartize Your Kitchen" is the title of a sixteen-page booklet, catalog No. 4118, dealing with the motor-driven coffee grinders, kitchen aids, power units and attachments for chopping, mixing, cutting, etc., made by the Hobarts Manufacturing Company Troy, Ohio. A price list of these devices with revisions up to Oct. 21 has also been issued by the company.

BALL BEARINGS.—A very comprehensive discussion on the construction and application of Hess-Bright ball bearings is contained in a 108-page board-bound book published by the Hess-Bright Manufacturing Company of Philadelphia. It is entitled "Hess-Bright Ball Bearings." The uses of these bearings are well illustrated, and a number of valuable tables are given on the proper bearings for different loads and speeds.

YEAR BOOK.—The Western Electric Company, Inc., 195 Broadway, New York City, has just issued its "Electrical Supply Book for 1919," which follows similar lines to those of its four predecessors, although it is a little more compact, containing 1120 pages. Manufacturers' list prices are given, from which, with a few exceptions, a uniform discount is allowed. In addition to descriptions and illustrations of the thousands of products marketed by this company, there is included for the convenience of the dealer a catalog of the various Western Electric sales helps and also twenty-three pages of very useful electrical formulas, rules and tables.

New Incorporations

THE KENTUCKY LAMP COMPANY of Owensboro, Ky., has been incorporated with a capital stock of $100,000, by Roy Burlow, M. E. Pierson and H. F. Coombs.

THE HARDING ELECTRICAL COMPANY of Brooklyn, N. Y., has been incorporated with a capital stock of $5,000 by L. H. Harding, 241 Quincy Street, Brooklyn, and others.

THE CRAWFORD ELECTRICAL CONSTRUCTION COMPANY of New York, N. Y., has been incorporated, with a capital stock of $5,000, by S. Berliner, J. Wolf and J. L. Diamond, 1789 Broadway, New York, N. Y.

THE PLAINFIELD STORAGE BATTERY COMPANY has been incorporated with a capital stock of $50,000 to manufacture storage batteries, etc. The incorporators are: J. S. Rifley, Edward J. Way and A. C. MacIntosh of Plainfield.

THE GENERAL EQUIPMENT COMPANY of Hornell, N. Y., has been chartered by A. R. Palmer, F. R. Serles and H. G. Wenzel of Woodhaven. The company is capitalized at $50,000, and proposes to manufacture electric generating equipment.

THE WISCONSIN PEERLESS STARTER COMPANY of Milwaukee, Wis., has been incorporated by Henry Messmer, William O'Connor and E. Van Boo. The company is capitalized at $10,000 and proposes to manufacture gas-engine-starting devices and other accessories.

GEORGE DUBUCS, INC., of New York, N. Y., has been incorporated by G. B. Smith, G. H. Woods and W. M. Mulloch, 473 West 141st Street, New York City. The company is capitalized at $25,000, and proposes to manufacture and repair magnetos and parts.

THE S. D. HARTTOG MANUFACTURING COMPANY, 2638 Locust Street, St. Louis, Mo., has been chartered with a capital stock of $20,000, to manufacture piston rings, patented dies for electrical machines and specialties for the motor-truck trade. The incorporators are: S. D. Harttog, presiden; John E. Winter, secretary and treasurer, and Henry Till, vice-president.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

RUMFORD, ME.—Work is under way on the construction of a new dam for the Rumford Falls Power Company which will make available for manufacturing and other purposes 10,000 hp. in addition to the 20,000 hp. already developed. The cost of the dam is estimated at $2,000,000. Power will be supplied to the Maine Power Sales Company.

PORTSMOUTH, N. H.—The power plant of the Portsmouth, Dover & York Street Railway Company at South Berwick Junction was recently destroyed by fire, causing a loss of about $5,000.

EAST PEPPERILL, MASS.—The Nashua River Paper Company of East Pepperill is building a 3000-kw. electric generating plant just below its mill on the Nashua River. Three 1000-kw. vertical turbines with concrete penstocks will be installed. It is proposed to equip the mill, which is now operated by steam and mechanically used water power, for electrical operation.

FALL RIVER, MASS.—Plans have been filed by the Stevens Manufacturing Company for the erection of an electric building, 20 ft. by 45 ft., one story, at its plant.

LEOMINSTER, MASS.—The Leominster Electric Light & Power Company has been granted permission to erect transmission lines across Lancaster Street.

MILFORD, CONN.—The Laurel Beach Association has decided to substitute electricity for gas for street lighting. The service is furnished from Milford.

NEW LONDON, CONN.—The Connecticut Power Company has acquired nine building lots near Riverside Park on which it proposes to erect a high-t-ension transmission line to connect with the substation of the Shore Line Electric Railway Company in Williams Street. Viggo E. Bird is manager of the company.

PUTNAM, CONN.—Plans have been prepared by the Cochran Manufacturing Company, 56 Barrett Avenue, Malden, for the construction of a new power house, transmission system and dam at its local properties.

SALISBURY, CONN.—Plans have been filed by the Central New England Railroad Company, controlled by the New York, New Haven & Hartford Railroad Company, for the construction of a new engine plant, repair shop, etc., at Salisbury. Contract has been awarded to the H. Wales Lines Company, 134 State Street, Meriden.

Middle Atlantic States

BINGHAMTON, N. Y.—The Binghamton Railway Company has petitioned the Town Board of Fenton for a franchise to construct a line beginning at the northern line of the village of Port Dickinson through Fenton to the Hires plant at Hiresville.

BUFFALO, N. Y.—Plans are under consideration by the City Commission for the installation of a new interconnecting telephone system throughout the city departments.

BUFFALO, N. Y.—The new plant to be erected by the Mayer & Clarkson Company, Comet Avenue, for the manufacture of cold-rolled steel, drill rods, shafting, etc., will be equipped throughout with electrically operated machinery. Individual motor drive will be used for large machine tools.

DANSVILLE, N. Y.—Extensive additions are being made to the plant of the Power Specialty Company in Dansville.

DEPEW, N. Y.—The Buffalo & Depew Railway Company has applied to the Board of Trustees for permission to extend its line in Depew.

MORRIS, N. Y.—The village trustees have granted the Morris Light & Power Corporation permission to construct and operate an electric system in the village of Morris.

NIAGARA FALLS, N. Y.—Plans have been prepared by the Star Electrode Works of the National Carbon Company, Buffalo Avenue, Niagara Falls, for the erection of an addition, 80 ft. by 80 ft., to its works.

NIAGARA FALLS, N. Y.—The Niagara Falls Power Company has filed a petition with the Public Service Commission for an order authorizing an issue of $2,000,000 in bonds reserved under the refunding and improvement mortgage of the Hydraulic Power Company of Niagara Falls. Improvements under way and proposed, it is stated, will cost $4,000,000.

WATKINS, N. Y.—Plans are being prepared by the International Salt Company for an extension to the boiler house at its Glen works, to cost about $15,000.

ASBURY PARK, N. J.—The Atlantic Coast Electric Railway Company, it is understood, will install new electrical equipment at its power plant.

ATLANTIC CITY, N. J.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 12, for conduit and wiring, and lighting fixtures in the United States post office at Atlantic City. For details see Searchlight Section.

BLOOMFIELD, N. J.—Plans are being considered by the International Arms & Fuse Company, Grove Street, for an addition, 38 ft. by 40 ft., to its power house, to cost about $7500.

CLIFTON, N. J.—Extensions to the street-lighting system on Columbia, Getty and Chester Avenues have been approved by the Borough Council.

LAKE DENMARK, N. J.—Plans are under consideration by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the installation of a new lighting system at the local government station, to cost about $50,000.

MATAWAN, N. J.—Plans have been prepared for the installation of a new fire-alarm system in Matawan.

MORRISTOWN, N. J.—Work has begun by the Central New Jersey Power Company on the construction of a new dam across the Black River, near Chester, in connection with the proposed new hydro-electric plant to be erected by the company at this location. The company was recently incorporated with a capital stock of $125,000.

NEWARK, N. J.—Plans are being prepared by the board of managers of the Isolation Hospital at Soho for the installation of a new ash-conveying system.

NEWARK, N. J.—Arrangements have been completed by the Electrical Appliance Manufacturing Company for the purchase of the plant of the Diehl Manufacturing Company at 820-850 Frelinghuysen Avenue. The company will take possession at once and establish a factory for the manufacture of electrical specialties.

NEWTON, N. J.—Plans are under consideration by the Newton Electric & Gas Company for the installation of additional equipment at its plant.

POMPTON LAKES, N. J.—Plans have been approved by the Board of Utility Commissioners for the proposed extension of the municipal electric light, heat and power plant of the borough of Pompton Lakes, and also for the issue of $56,000 in bonds to pay for the proposed work.

VERONA, N. J.—Plans have been prepared for the erection of a group of one-story hospital buildings at the Essex County Tuberculosis Hospital. Considerable electrical equipment, it is understood, will be required.

BUTLER, PA.—Ground has been broken for the erection of the new power house to be erected for the Imbria Coal Company at Etnaria. The building will be about 40 ft. by 65 ft. and will cost about $10,000.

CONNELLSVILLE, PA. — Plans have been filed for the erection of a new boiler plant at the local properties of the Western Maryland Railway Company.

HARRISBURG, PA.—Plans are under consideration by the City Council for the installation of new boiler equipment at the city filtration plant.

HAUTO, PA.—Contract has been awarded by the Lehigh Navigation Electric Company, Lafayette Building, Philadelphia, to the Phoenix Construction Company, 81 Broadway, New York, N. Y., for extension to its local power plant, to cost about $1,250,000.

LANSDALE, PA.—In an opinion handed down by Judge Swartz at Norristown the court decides that the borough of Lansdale has no legal right to generate electricity to supply the towns of Hatfield and Chalfont, 2 and 7 miles distant respectively, claiming that it is unconstitutional.

LUCINDA, PA.—Work has begun on the construction of a new power house at the properties of the Lucinda Coal Company, to cost about $8000.

MILTON, PA.—The Milton Manufacturing Company has awarded contract to the Cleveland Construction Company, Citizens' Building, Cleveland, Ohio, for construction of power house, 80 ft. by 184 ft., and a one-story building, 50 ft. by 80 ft., at $100,000.

NANTICOKE, PA.—Plans have been prepared by the Liberty Throwing Company for the construction of a new boiler house at its local works, to cost about $8000.

NANTICOKE, PA.—Preparations are being made by the Delaware, Lackawanna & Western Railroad Company for the construction of an addition to the boiler plant, about 50 ft. by 80 ft., and also to remodel the present building. The cost is estimated at about $40,000.

NORTH EAST, PA.—The Electric Materials Company is erecting an addition, 40 ft. by 60 ft., to its plant. The cost is estimated at about $35,000.

SHAMOKIN, PA.—Work is nearly completed on the construction of the electric transmission line connecting the Mount Carmel electric plant with the local power house of the Shamokin-Mount Carmel Transit Company. The two companies were recently consolidated, and it was decided to increase the output of the Shamokin plant and supply energy in Mount Carmel and abandon the power house there. Contracts have been secured to furnish electricity to Natalie Colliery, Kulpmont and Marion Heights Boroughs and Mount Carmel Township. Preparations are being made by the company to install additional machinery at the power station in the western part of the town. When improvements are completed the company will also furnish energy to the Shamokin-Mount Carmel Transit Company, which will close down entirely its plant at Green Ridge.

SHARPSVILLE, PA.—Work has begun on the construction of an addition to the power plant of the Sharpsville Boiler Works, to cost about $80,000.

BALTIMORE, MD.—Contract has been awarded by the Baltimore Car & Foundry Company to the McAleer Construction Company, 15 East Fayette Street, Baltimore, for the erection of a transformer station at its plant at Curtis Bay, to cost about $8,000.

INDIAN HEAD, MD.—Plans have been prepared by the Navy Department for the installation of a new private telephone system at the local government works, to cost about $40,000.

AFFINITY, W. VA.—Plans have been prepared by the Pemberton Coal & Coke Company for the construction of a new power house at its local plant.

CHARLESTON, W. VA.—The Kanawha Collieries Company, National Bank Building, Charleston, it is reported is contemplating the purchase of power plant equipment.

FAIRMONT, W. VA.—The Oldbury Electro Chemical Company, Buffalo Avenue, Niagara Falls, N. Y., has made arrangements with the United States government for operating a new plant at Fairmont, to be used for production for the Chemical Welfare Department. The cost of the plant is estimated at $500,000.

LOGAN, W. VA.—The Guyan Machine Shops would like to receive prices on a 100-kw., 250-volt generator, with engine, switchboard and boiler.

MOOREFIELD, W. VA.—Bonds to the amount of $8,000 have been voted for the installation of an electric lighting system in Moorefield.

WHEELING, W. VA.—The City Council has approved the contract with the Wheeling Electric Company for furnishing electricity for operating the municipal electric system for a period of five years. The municipal generating plant will be closed down.

NEWTON (P. O. NORFOLK), VA.—Contract has been awarded by the Manganese Steel Casting Company to the General Contract Company, Citizens' Bank Building, Norfolk, for the construction of a steel casting plant on an eight-acre site on the Eastern Branch of Elizabeth River. The cost of the proposed plant is estimated at $300,000, and will include pattern and molding shops, furnace-houses, equipped with four electric furnaces, power house, grinding and machine shops, office buildings, shed and 30 cottages for employees, and also construction of wharf. Work on construction will begin about Feb. 1, 1919.

NORFOLK, VA.—The City Council has authorized an issue of $70,000 bonds for improvements to waterworks system, to include replacing wooden filters with concrete filters, installation of 15,000,000-gal. electrically driven pump, wash filter pump, three additional transformers and mechanical controllers for filters, etc. Walter H. Taylor, Jr., is city engineer.

PETERSBURG, VA.—The Petersburg, Hopewell & City Point Railway Company, it is reported, is contemplating building an extension of its railway to Prince George Courthouse.

PORTSMOUTH, VA.—Plans have been submitted by Barclay, Parsons & Klapp, engineers, 60 Wall Street, New York, N. Y., to the United States government for improvements to the ferry system, including slips in Portsmouth and Norfolk, 50-ft. addition to ferry house in Portsmouth, installation of electric lift float for operation of Berkley boats, etc. Contract for the work has been awarded to the George Leary Construction Company.

North Central States

ADRIAN, MICH.—Henry Ford & Son of Detroit, it is reported, will establish a tractor plant in Adrian. The proposed plant will be erected on the Red Mill site, and the White Mill site will be used for a power plant.

HAMTRAMCK, MICH.—Contracts have been awarded by the Michigan Smelting & Refining Company for an addition to its plant and for construction of power plant, to cost about $10,000. Work has begun on the erection of an addition, 110 ft. by 140 ft., two stories, to cost about $100,000.

ADA, OHIO.—The property of the Ada Water, Heat & Light Company has been sold to the Ada Natural Gas & Fuel Company. A number of improvements will be made to the plant by the new owners in order to furnish a better lighting and heating service.

AKRON, OHIO.—The Capital Issues Committee has approved a bond issue of $47,000 for extensions and improvements to the fire and police alarm signal systems. C. W. Baum is safety director.

CLEVELAND, OHIO.—Plans have been prepared for the construction of a new power house in connection with the proposed extensions to the Harvard Avenue plant of the Aluminum Castings Company. F. A. Parkhurst is architect.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, Room 216, City Hall, Cleveland, until Dec. 5 for furnishing, repairing, maintaining and furnishing current for electric lamps for street lighting in the city of Cleveland for the year beginning Jan. 1, 1919. Bids will also be received until Dec. 5 at Room 219, City Hall, for 14-in. boulevard glass globes for the street-lighting division. Bids will also be received on the same date at Room 218, City Hall, for ornamental glass globes for park and boulevard lamps for street-lighting division. Specifications may be obtained at the office of the superintendent of street lighting, Room 436, City Hall.

HAMILTON, OHIO.—Plans have been prepared by Fred G. Mueller of Hamilton for the proposed tractor plant for Henry Ford & Son, to be erected in this city. A hydroelectric plant, it is understood, will be built to supply power for the proposed plant.

SANDUSKY, OHIO.—The Farrell-Cheek Steel Foundry Company is planning to increase the output of its plant and will install an electric furnace.

MADISONVILLE, KY.—Work has begun on the construction of the new power plant of the St. Bernard Mining Company at Loch Mary, which will furnish power for nine of the company's mines, besides lighting a number of mining towns. The company will also supply electricity for lamps and motors in Earlington. Rights-of-way for its proposed transmission lines have been secured by the company.

INDIANAPOLIS, IND.—The Van Camp Packing Company, Shelby Street, is planning to erect a power house at its plant.

NORTH MANCHESTER, IND.—The capital stock of the Brown Mills Electric Company has been increased from $25,000 to $68,000.

SEYMOUR, IND.—A committee representing the Commercial Club and citizens of Seymour has applied to the Indiana Public Service Commission for permission to purchase the local power plant of the Interstate Public Service Company. The commission will be asked to make an appraisal of the property. The city contemplates purchasing the property and leasing it to an operating company financed by local capital.

WARSAW, IND.—New coal-handling devices are being installed in the main power station of the Winona Interurban Railway Company at Winona Lake.

CHICAGO HEIGHTS, ILL.—The Armour Fertilizer Works, it is reported, is planning to erect a plant, to cost about $500,000, in Chicago Heights.

DURAND, ILL.—The Citizens' Utilities Company has increased its capital stock from $5,000 to $40,000.

MILWAUKEE, WIS.—The Industrial Controller Company, 866 Greenbush Street, Milwaukee, has engaged Henry C. Hengels, architect, First National Bank, to prepare plans for addition to its plant, to cost about $15,000. The company manufactures electric controlling devices. Charles G. Welch is president.

OCONTO, WIS.—The Holt Hardwood Company has applied for permission to make improvements and extensions to its factory and steam generating plant. Considerable new equipment will be required.

SUPERIOR, WIS.—At an election held recently the proposal to purchase the plant of the Superior Water, Light & Power Company, to be owned and operated by the municipality, was carried. The franchise of the company expired several months ago, and an application for a renewal has been before the city officials for some time.

ST. PAUL, MINN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 19 for alterations in conduit and wiring and lighting fixtures in the United States Custom House, St. Paul, Minn. For details see Searchlight Section.

STOCKTON, MO. — The Humansville Electric Light Company is contemplating extending its electric transmission line from Caplinger Mills to Stockton, a distance of 8 miles. L. L. Mathis is secretary.

ASHLEY, N. D.—The Ashley Electric Company is planning to install a 200-hp. Corliss engine.' S. P. Waage is manager.

MADISON, S. D.—Bonds to the amount of $100,000 have been voted for rebuilding the municipal electric light plant.

LOUISVILLE, KAN.—The City Council has granted the Riverside Light, Power & Gas Company of Abilene a franchise to install and operate an electric lighting system in Louisville.

OSBORNE, KAN.—Arrangements have been made by the City Council whereby the municipal electric light plant will supply electricity to the towns of Portis, Harlan, Gaylord and Cedar. These towns will erect an electric transmission line to Osborne and provide funds for installing switchboard and other equipment at power plant.

Southern States

GREENSBORO, N. C.—The Southern Truck & Car Company, recently incorporated, is contemplating establishing a new plant in Greensboro for the manufacture of trucks and tractors, to cost about $200,000. J. A. Norfolk is president and manager.

PARIS ISLAND, S. C.—Plans have been prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for extension to power house and heating system at Paris Island, to cost about $97,000 (Specification 3666).

AUGUSTA, GA.—Plans are under consideration by the City Engineering Department for extensions to the municipal waterworks system, to cost about $350,000, including the installation of new pumping machinery and auxiliary equipment.

FORT BENNING, GA.—Contract has been awarded by the United States government for electrical work at Fort Benning, near Columbus, including the erection of an electric transmission line, 8 miles long, to T. H. McKinney of Atlanta, Ga. The cost is estimated at about $1,000,000.

ANNISTON, ALA.—Contract has been awarded by the War Department, Washington, D. C., to T. C. Thompson & Brothers, Charlotte, N. C., for the erection of additional wooden barracks at Camp McClellan, to cost $4,500,000.

BAY SPRINGS, MISS.—The Bay Springs Electric Company is planning to repair its plant, recently damaged by fire. New equipment, it is understood, will be required, including a generator. O. E. Ford is manager.

OIL CITY, LA.—The Oil City Electric Light & Power Company contemplates extensions to its plant to supply additional service in the towns of Oil City and Mooringsport.

JEFFERSON, OKLA.—Contract has been awarded to the Burrell Engineering Company of Chicago, Ill., for the construction of a flour and feed mill for the Morrison Brothers Mills, recently organized in Jefferson. The plans provide for an expenditure of about $150,000 and will include a six-story building, 66 ft. by 36 ft., and a power plant, 36 ft. by 36 ft. Machinery for the proposed plant, it is understood, has been purchaesd. C. J. Morrison is secretary and manager.

GALVESTON, TEX.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning to erect shop and industrial buildings at Galveston, to cost about $270,000 (Specification 3675).

RIO GRANDE, TEX.—Plans are under consideration by F. R. and E. D. Radcliffe for the installation of a pumping plant on the Rio Grande River for the purpose of irrigating a tract of about 514 acres.

Pacific and Mountain States

ANACORTES, WASH.—The Morrison Mill Company is installing a new power house in which it will install a new steam turbo-generator unit. The machinery is being installed by the Allis-Chalmers Company.

SEATTLE, WASH.—Plans have been completed by the Smelters Steel Company, White Building, Seattle, for the erection of a building 90 ft. by 100 ft. The equipment will include large electric furnaces.

SEATTLE, WASH. — Plans have been completed by the Puget Sound Traction, Light & Power Company for re-roofing its lighting station at 4237 Seventh Avenue, recently damaged by fire. The cost is estimated at about $10,000.

TACOMA, WASH.—Plans are being prepared by City Engineer Manley for double-tracking the municipal tideflats car line. The cost of the work is estimated at $250,000. Bids for the work will be asked for.

YAKIMA, WASH.—Extensions and improvements to the Yakima reservation drainage and distribution systems, involving an exepnditure of about $500,000, are under consideration by the United States Reclamation Service of Yakima. About 20,000 acres will be reclaimed; two pumping plants of 4500 gal. capacity will be installed and several concrete structures erected.

ASTORIA, ORE.—The Port of Astoria Commission has voted to engage an engineer to prepare a complete report on the available water power in the state, together with the probable cost of transmitting electricity to Astoria in quantities sufficient to meet the present needs of the industrial plants and also to provide for future needs of the city. The Port of Astoria plans to prepare a bill for presentation at the January session of the Legislature giving the port jurisdiction to expand its powers.

LOS ANGELES, CAL.—Steps have been taken by the Public Service Commission for the construction of power plant No. 2 in the San Francisquito Canyon. The new plant will add at least 28,000 hp. to the city's aqueduct power resources and will cost about $1,250,000. The commission has decided to start work at once on construction of pipe line and penstocks, which will lead the water from the outlet of the tunnel from power plant No. 1 to the power house at the foot of the 505-ft. drop. The cost of the pipe line and penstocks is estimated from $50,000 to $100,000. William Mulholland is chief engineer of the aqueduct, and E. F. Scattergood is chief engineer of the power bureau.

SAN FRANCISCO, CAL.—The War Industries Board has approved the application of the city of San Francisco to expend $17,000,000 on the power division of its Hetch-Hetchy domestic water project.

Canada

VANCOUVER, B. C.—A bylaw has been passed by the City Council providing for installing ornamental lamp standards in certain sections of Granville and Pender Streets. The cost is estimated at about $9000.

LEASIDE, ONT.—Work, it is reported, will soon start on the erection of an electric transmission line for the Leaside Munitions Company. The cost is estimated at about $30,000.

SAULT STE. MARIE, ONT.—The Algoma Steel Corporation of Sault Ste. Marie is contemplating the purchase of a centrifugal pump with a capacity of 1500 gal. per minute, directly connected to a 2200-volt, three-phase, 25-cycle motor.

TORONTO, ONT.—Plans are under consideration by the Campbell Flour Mills Company, Cawthra Avenue, for the erection of an elevator at Cawthra Avenue and Junction Road, to cost about $130,000.

Record of Electrical Patents

Notes on United States Patents

14,546 (reissue). Socket; Herman G. Pape, New York, N. Y. App. filed May 25, 1918. Will not injure person handling socket even if it is wet.

14,539 (reissue). System of Motor Control; Samuel H. Keefer, Plainfield, N. J. App. filed Oct. 19, 1916. For controlling electrically driven machine tools such as planers.

14,540 (reissue). Planer and System of Motor Control Therefor; Samuel H. Keefer, Plainfield, N. J. App. filed Oct. 19, 1916. For stopping motor at any time from any part of apparatus.

1,281,907. Current Tap; Frank V. Burton, Bridgeport, Conn. App. filed Nov. 27, 1915. May be applied to various fittings of standard type to afford detachable connection for branch circuit.

1,281,917. Seal; Earl E. Eby, Wilkinsburg, Pa. App. filed Dec. 29, 1915. For forming a hermetic joint between vitreous material and bodies of metal.

1,281,952. Process and Apparatus for Dehydrating Emulsions; Ford W. Harris, Los Angeles, Cal. App. filed April 4, 1917. Smaller particles of water are agglomerated to facilitate settlement.

1,281,955. Exciting System for Phase Converters; Rudolf E. Hellmund, Swissvale, Pa. App. filed Aug. 7, 1916. Relates to the T-connected, rotary type.

1,281,956. Phase-Balancing System; Rudolf E. Hellmund, Swissvale, Pa. App. filed Aug. 10, 1916. For alternating-current distribution wherein three-phase currents are derived from a single-phase source by means of a phase converter.

1,281,959. Regenerative Braking; George H. Hill, Schenectady, N. Y. App. filed Sept. 18, 1916. Direct-current motor may be retarded by causing it to act as a generator to return energy to the line.

1,281,962. Fuel Mixer; Glenn R. Holland Genesee, Ill. App. filed Nov. 8, 1917. For generating gas by electrical decomposition of water to form fuel for engine.

1,281,983. Process for Making Alkali Perborates; Otto Liebknecht, Frankfort-on-the-Main, Germany. App. filed Feb. 29, 1916. Relates to electrolytic production of alkali perborates in the presence of certain electrodes possessing properties favorable for such electrolysis.

1,282,010. Locking Device for Impulse Starters; Frederick W. Andrew, Brooklyn, N. Y. App. filed June 29, 1918. For enabling device to be used as a coupling in case of accidental breaking of spring, to start engine.

1,282,017. Motor-Control System; George E. Stack, Schenectady, N. Y. App. filed July 24, 1918. Involving use of electromagnetic switches or contactors of the "lock-out" type.

1,282,019. Spark Distributer for Internal-Combustion Engines; Ellis D. Allensworth, Waukegan, Ill. App. filed Oct. 27, 1917. Of dual construction, one method better adapted for starting and the other for normal operation.

1,282,027. Brush for Electrical Machinery; Oliver E. Becker, Oak Park, Ill. App. filed March 11, 1918. For preventing spreading or fraying of gauze brush without resilience, springiness or ventilation.

1,282,029. Process for Making Resister Plates; Arthur S. Bemis, Cleveland, Ohio. App. filed April 22, 1914. Method of applying coating of protective material.

1,282,038. Electric Iron; George Bullock and Arthur E. Templeman, Grand Junction, Col. App. filed Dec. 8, 1917. Device for supporting cord out of operator's way.

1,282,039. Electric Iron; George Bullock and Arthur E. Templeman, Grand Junction, Col. App. filed Dec. 8, 1917. Means for preventing displacement of support for cord.

1,282,057. Electric Battery; Raymond William, Fremont, Ohio. App. filed Nov. 30, 1915. A negative element consisting of copper oxide and sulphur in electric batteries containing an alkaline electrolyte and zinc electrode.

1,282,070. Comb; Edward D. Green and Emily M. Scott, Chicago, Ill. App. filed June 28, 1918. With heater to straighten out curls in wool or hair.

1,282,086. Stationary Induction Apparatus; Svend E. Johannesen, Pittsfield, Mass. App. filed May 2, 1917. To provide a better central-core construction for transformers, etc.

1,282,101. Brush Connection; Arthur R. Miller, Cleveland, Ohio. App. filed Dec. 14, 1916. Flexible conductor is secured directly to carbon block.

1,282,114. Combined V-Type Engine and Magneto; Richard A. Oglesby, South Bend, Ind. App. filed April 14, 1917. Every portion of its cycle of rotating to be absolutely asynchronous with movement of engine crank shaft.

1,282,122. Process for the Production of Ductile Tungsten; Carl A. Pfanstiehl, Waukegan, Ill. App. filed July 12, 1915. Single furnace used in welding treatment.

1,282,130. Electropneumatic Brake Mechanism; James R. Sloan, Howard E. Perry and Ira V. Goodman, Altoona, Pa. App. filed April 1, 1918. Requires use of only a single train wire without special connections between cars.

1,282,132. Automatic Electric Switch; Louis A. M. Phelan, Chicago, Ill. App. filed Sept. 27, 1915. For use in connection with intermittently flashing electric signs.

1,282,133. Electrode Holder for Searchlights; Elmer A. Sperry, Brooklyn, N. Y. App. filed April 16, 1915. Heavy current is handled within lamp without damage to electrodes.

1,282,159. Electric Storage Battery; James A. Wood, Philadelphia, Pa. App. filed Jan. 25, 1918. Construction of electrode grid and non-metallic acid-resistant insulating means to separate and insulate positive from negative plates.

1,282,178. Float-Controlled Circuit Closer; Wilfrid J. Bousquet, Woonsocket, R. I. App. filed April 11, 1917. Particularly for use in refrigerator alarms.

1,282,195. Electric Oven; Jay D. Crary, Aberdeen, Wash. App. filed Oct. 10, 1917. Heater connected independent of oven so that heater may be moved and used for other purposes.

1,282,208. Method of Manufacturing Electrical Cables; Henry W. Fisher, Huguenot Park, N. Y. App. filed June 18, 1917. Insulating compound having desired physical and dielectric properties incorporated in insulating material entering into cable structure.

1,282,219. Portable Signaling Searchlight; William Grether, Dayton, Ohio. App. filed Feb. 11, 1918. Tilting lamp housing may be revolved in complete circle for airplane signaling.

1,282,221. Regulator; William S. Hadaway, Jr., New Rochelle, N. Y. App. filed March 26, 1914. To govern electrically controlled devices in response to temperature variation.

1,282,238. Device for Operating X-Ray Apparatus; William Kleinberg, New York, N. Y. App. filed Aug. 10, 1916. Adapted to be employed with either alternating or direct current.

1,282,242. Electrical Heating Unit; Frank Kuhn and Jay A. Hand, Detroit, Mich. App. filed Feb. 21, 1918. Of the exposed resistor types.

1,282,243. Electric Air Heater; Frank Kuhn, Detroit, Mich. App. filed April 6, 1916. Detachable heating unit permits ready repair or renewal.

1,282,257. Telephone-Exchange System; Talbot G. Martin, Chicago, Ill. App. filed Jan. 12, 1906. Relates to automatic or semi-automatic telephone systems.

1,282,259. Method of Producing Metal-Surfaced Articles; Matthew M. Merritt, Danvers, Mass. App. filed Dec. 3, 1915. For electrolytically depositing metal on a core of other material.

1,282,261. Galvanoplastic Method and Apparatus; Matthew M. Merritt, Danvers, Mass. App. filed March 29, 1917. Copper deposited on a permanent metallic mandrel coated with mercury amalgam.

1,282,262. Electrolytic Process; Matthew M. Merritt, Danvers, Mass. App. filed June 27, 1917. Pertains particularly to manufacture of copper or other metallic sheets by electrodeposition on a rotating cathode.

1,282,263. Electrolytic Process; Matthew M. Merritt, Danvers, Mass. App. filed June 27, 1917. Pertains particularly to processes of depositing copper on rotating cylinders or mandrels wholly or partially immersed in electrolyte.

1,282,264. Electrolytic Process; Matthew M. Merritt, Danvers, Mass. App. filed June 27, 1917. Relates to separating deposited metallic sheets from mandrel to form continuous sheets.

1,282,268. Electrolytic Process and Product; Matthew M. Merritt, South Middleton, Mass. App. filed Nov. 2, 1917. Useful as applied to electrolytically coating with copper the surface of aëroplane propellers.

1,282,269. Galvanoplastic Process and Product; Matthew M. Merritt, South Middleton, Mass. App. filed Nov. 2, 1917. Pertains to manufacture of manifolds for internal-combustion engines such as aëroplane engines.

1,282,270. Electrolytic Process and Product; Matthew M. Merritt, South Middleton, Mass. App. filed Nov. 2, 1917. Pertain to manufacture of aëroplane propellers formed of non-conductive materials and coated with electrolytically deposited metal.

1,282,276. Electromagnet; Leonard D. Morris, Chicago, Ill. App. filed Sept. 17, 1917. Armature may be moved in substantial parallelism with adjacent face of magnet core and may be kept out of actual sliding contact with core.

1,282,317. Outlet Box; Irijah A. Terrell, New York, N. Y. App. filed March 12, 1913. May be used in walls, ceilings, floors and other places.

1,282,330. System of Electric Heating; Tycho Van Aller, Schenectady, N. Y. App. filed May 11, 1918. Variety of degrees of heat may be obtained without external resistance in one continuous heating element.

1,282,380. Method of Forming Secondary Windings of High-Tension Coils; F. W. Cotterman, Dayton, Ohio. App. filed Sept. 2, 1916. Wire and insulating material are applied to coil simultaneously and continuously until secondary winding is completed.

1,282,383. Electric Wire Clamp; Edson S. Damon, Council Bluffs, Iowa. App. filed Sept. 27, 1915. To obviate necessity of removing insulation.

1,282,388. Electromechanical Make-and-Break Movement for Electric Circuits; Francois de d'Hamale, Enfield, England. App. filed Dec. 27, 1917. Break is produced by inertia of a weight secured at end of a spring.

1,282,415. Process of Leaching Copper Ores; Albert W. Hahn, El Paso, Tex. App. filed Jan. 19, 1915. Method of recovering copper by electrolysis of copper solutions.

1,282,426. Relay; Lee P. Hynes, Chicago, Ill. App. filed Nov. 1, 1912. Designed to be durable and carry comparatively small currents.

1,282,430. Automobile Signal Device; Laurence E. Jones, Liberty, Mo. App. filed Feb. 11, 1916. Mounted on rear of car to indicate change of course.

1,282,439. System for Amplifying Variable Currents; Irving Langmuir, Schenectady, N. Y. App. filed Oct. 29, 1913. Includes means for securing selectivity in detecting signals.

1,282,445. Process of Producing Gas; Ben. F. McKee, Arma, Kan. App. filed Dec. 12, 1917. Electric are used to produce gas from coal or other carbonaceous materials.

1,282,475. Manufacture of Carbon Electrodes; Sven E. Sieurin, Hoganas, Sweden. App. filed Oct. 16, 1917. Carbonaceous raw material is also heated in an electric resistance furnace.

1,282,476. Electric Fluid Heater; Maurice Simon, St. Louis, Mo. App. filed July 14, 1917. Primarily adapted to be supported by wall in hot-water storage tank.

1,282,481. Multiple-Section Suspension Insulator; Sol. S. Sonneborn, Brooklyn, N. Y. App. filed Feb. 10, 1917. For high-potential transmission lines.

1,282,487. Bottle-Making Machine; Richard O. Stilwell, Tarentum, Pa. App. filed Aug. 4, 1914. Relates particularly to machines wherein a blank is formed in one part of the machine from a portion of glass and subsequently blown into a finished bottle by another part of the machine.

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Looking to the Peace Conference

FROM now on all eyes will be turned in hope and confidence to the Paris peace conference. It is not longer a question of what individuals shall or shall not represent this nation, it is a question of what just reparation shall be imposed upon the enemy, what guiding righteous principles shall be laid down for the future of all the nations so that any more wanton onslaughts upon civilization shall be sure of defeat. The possible economic results of the conference upon generations yet unborn are limitless. They open a vista of new service for this country of energetic workers and vast resources. They may involve great responsibilities for this nation. Parties or individuals may seek to use them for selfish or unworthy advantage. But whatever changes or opportunities may be developed, we are sure that the great forces operating in the world are in the last analysis constructive for good, corrective of evil. The representatives of the countries that overthrew the mighty, unscrupulous strength of Germany will see to it that tangible benefits for humanity are written large and deep in the final agreement. And the terms therein set forth will give us a better understanding of what our place in the family of nations is to mean. We shall have to wait with patience.

Now that the emergency is past, decentralization of control is in order. Our state public service commissions are maintained at great expense and the commissioners would like to give service for value received. Various forms of federal control have given rise to questions of jurisdiction which lead to uncertainty and unrest.

The Presidential Viewpoint

HE WHO reads the President's message to Congress is likely to look for a clear-cut statement on the things which are the most vital to his every-day life and interest, the things which in his judgment mean most to the country. The Executive of the nation has another viewpoint; it is a different viewpoint, and we may take his message, what it says and what it leaves unsaid, as the only conclusion which he is prepared at the time to put before the nation. We wish that it had said more about reconstruction, we should like to have had more definite recommendations on domestic matters, but it must be admitted in fairness that the occupant of the White House is not the only man who is in doubt as to the wisest policy to be followed, whether the turn to the right or to the left will lead to the safer highway for travel. So we shall take the message as it is for such constructive light as we can see in it.

The policy on "reconstruction," we gather, is to let industry work out its own salvation. President Wilson regards the problem, so far as domestic affairs are concerned, as one "of economic and industrial readjustment." His statement that it is less serious for us than for the nations which have suffered more in the war bears out the general impression given by his message that he considers the world peace conference issues the most important now demanding his attention. He is therefore apparently content to leave both business and labor here to make their own arrangements. In fact, he well characterizes our people as knowing their own business, "quick and resourceful at every readjustment, definite in purpose and self-reliant in action." But those faculties are entitled to, they must have, free play so far as they are not used against the public interest. The difficulty is that whereas we have been operating under a rigid control for war reasons, we still are without sufficient knowledge as to exactly how long and in what degree that control will be retained. The President says that the restraints "are being relaxed as much as possible, and more and more as the weeks go by." This evidently means that the intent is that the government shall gradually abandon its use of the extraordinary powers granted for the war needs. Through this part of the message the Executive is hopeful that, as he says in so many words, it will not be easy to direct the return to a peace footing "any better than it will direct itself." If he is willing to leave the process to the "quick initiative" of the American business man, certainly the business man is willing now to have it so, provided of course there is no necessity for allocation of raw materials and capital. It is too late to make the advance studies which the European nations have in hand concerning their reconstruction problems.

Railroad policy is what causes the President the greatest concern. He has no "confident judgment" of his own, no judgment of any kind which he is ready to express. It is a large, serious question, big in itself, far-reaching in its effect upon other industries, upon our entire social and governmental structure. We cannot feel otherwise than that, having taken the railroads as a war measure, having used them in prosecuting the war to victory, the government is now bound to return them to their owners. It cannot justly return them in helpless operating or financial condition; it would not in the public interest put them back merely to the old unsatisfactory conditions of mixed restrictive regulation; it will surely have sooner or later a reasonable program for making the carriers more effective agencies in economical upbuilding of our industries. There is here an opportunity to learn from the mistakes of both war and peace in railroad management and operation and to rehabilitate the carriers physically and financially and with sound economic results benefiting the nation.

It is right that President Wilson should pay tribute to the bravery of our armed forces, should emphasize the place they hold in our regard, should consider the need of providing places for them in industry when they return. These men will want, will be entitled to, work, and the plan of Secretary of the Interior Lane for land reclamation, with the resumption of public works of every sort, as recommended in the message, will help to meet this problem wisely. These processes of necessary construction and enlargement of production will aid in restoring the normal balance in industry which is essential for the payment of the heavy taxes of which the President gives warning. Congress may not have been told what it would like to have heard when the Executive stood before it, the members of the two houses may feel that they are asked to knead the dough while somebody else is eating the cake, but they can find in and outside of the Presidential document work to do which will measurably further the solution of some of our problems.

A report that one company showed the greatest output in its history on one day last week, due largely to the elimination of the daylight-saving hour, indicates that some results of this change are sure to be experienced in many properties during the present season. We are approaching the shortest day of the year, and the early twilight and winter conditions mean steady demand for energy for lighting.

Illumination and Industrial Efficiency

THE tests on industrial output as a function of illumination which are outlined in the paper by William A. Durgin presented at the recent convention of the Illuminating Engineering Society and abstracted in our columns this week are striking evidence of what good lighting really means. It is no easy matter to work out a series of practical tests of this character, and the Commonwealth Edison Company is greatly to be congratulated on its enterprise in going thoroughly into this exceedingly important subject. If all central stations were as keen on following up illuminating engineering matters, the average condition of artificial lighting would be immensely improved. When the tests outlined by Mr. Durgin are completed there will have been accumulated a mass of evidence so weighty as to leave no difference of opinion regarding the economic advantage of improved lighting.

A particularly useful part of the experiment is the comparison instituted between lighting at the minimum specified by the I. E. S. code and at the higher point that gives a maximum efficiency of production. There is no doubt in our minds that the code is altogether too lenient if it is to take into consideration at all the ultimate efficiency of the workman. Any one who will actually take the trouble to compare lighting at the code minimum with illumination pushed toward the upper limit of present good practice will quickly be convinced of the great gains which could be made. Of course, one may reasonably contend that a statutory code is intended merely to insure fair working conditions for the laborer, but does not the code fail of its duty to the laborer if it does not secure for him conditions of high industrial efficiency? It is not enough to be satisfied with the tolerable. The evidence secured in Chicago of increased output at a very small extra cost for illumination seems to be incontestable, and the facts should be closely studied by every progressive manufacturer who is on the watch to secure from his plant the biggest and best output of which it is capable.

Canada is not backward in making use of her resources. Vancouver, Calgary, Winnipeg, Toronto, Montreal, Quebec, every large city within her borders, is supplied with hydroelectric energy, because her government is keenly interested in water-power development. Will Washington please take notice?

Progress in Outdoor Substations

THE paper by M. M. Samuels which we present this week is of large practical value in summarizing the progress which has been made in the design and equipment of outdoor substations. This type of station has come to stay and has worked its way by its merits, beginning in places of fairly favorable climatic conditions and extending all over the country. The small outdoor substation presents a very easy problem, being merely an extension of pole-top equipment to a more substantial basis. The larger stations are only slowly coming to standard design, but very material progress has already been made. The outdoor transformers in particular have undergone material improvement, so that terminal troubles have been greatly reduced; self-cooled transformers have come into very general use, and all the accessory apparatus has been brought to more convenient and manageable form. With larger installations has come abandonment of the earlier elevated-platform type of construction, and recent designs carry the main weight on a concrete foundation and have a superstructure chiefly to carry conductors. Accessories like lightning arresters and choke coils are now designed for greater reliability and demand far less care and inspection than the earlier patterns.

The matter of switches and circuit breakers is still in a formative stage. Several types of air-break switches have come into successful use for plants of moderate capacity, but in Mr. Samuels' judgment still require considerable improvement. Oil switches and circuit breakers have long proved their reliability, but at the high voltages now in common use the cost and dimensions of these pieces of apparatus rapidly become extremely burdensome, especially at large outputs. It is perhaps not putting it too strongly to agree that there is considerable improvement still to be made both in switching apparatus and in the scheme of its application. At present in high-voltage stations and substations the switchboard is becoming an undesirably large factor of the total first cost and upkeep. Mr. Samuels calls especial attention to the matter of high-voltage conductors for outdoor substation work, and his judgment leans strongly toward the use of self-supporting conductors, preferably tubular, as against wires supported by strain insulators. Here as in many other cases the choice turns practically on the output and voltage involved. With self-supporting busbars the steel work or other carrying structure may be relatively light, while any considerable system of wires held by strain insulators puts so large a burden on the supports that much greater strength, and hence greater cost, is demanded. All these things are gradually working themselves out experimentally. The designing engineer will find Mr. Samuels' suggestions and sketches of typical outdoor substations extremely useful as a guide to good current practice and a hint for further improvements.

Transition periods test staying power and make heavy draft upon reserve optimism. Temporary circumstances cannot shake fundamental stability, and a fair profit must be received upon honest effort and legitimate investment in supplying the necessities of civilization. Net earnings rather than prices are the real index of prosperity.

Electric Power in Sugar Mills

AS ELECTRICAL distribution becomes more general, so do new applications come to light to increase demand. It is only within five years that electric drive has been applied to plantation sugar mills, and even now such installations are uncommon and depend on the local generation of power. Perhaps indeed this field may continue to be occupied by isolated plants by reason of the plentiful fuel at hand. It is historically worth noting that the very first genuine commercial application of the electric motor was for operating a hoist for unloading beets in a French beet-sugar factory, now forty years ago.

From the brief paper by Clarence G. Hadley which appeared in our columns last week it appears that electric drive is being standardized in various Cuban sugar mills with very excellent results. The machines operated are crushing mills, pumps and centrifugals. Of these only the first named require special equipment. It is no easy task to crush the sugar cane swiftly and thoroughly so as to squeeze out the now doubly precious juice, leaving only the nearly dry bagasse behind. The great heavily pressed rollers are worked in tandem, the masses of cane passing between them in turn, and it is found necessary to work at variable speed to keep all the sets uniformly at maximum working load. Hence for this part of the drive slip-ring induction motors are used, with resistors for varying the speed at the will of the operator. In the typical mill equipment described by Mr. Hadley each tandem of five sets of rollers requires three 250-hp. motors, while the total demanded by the two tandems and the accompanying conveyors, pumps and centrifugals rises to more than 3000 hp. in nearly 100 motors. All are three-phase, 60-cycle, at 480 volts, and the power supply is from a central steam plant with turbo-generators. Bagasse, with a modest supply of wood to help in driving out residual moisture, is used for fuel, burned in Dutch ovens under simple return tubular boilers. The exhaust steam from the turbines does the first heating of the cane juice and the evaporation of the syrup, live steam being used only for the last stages of the sugar-making process. The installations already made have proved so successful that they are likely rapidly to increase in numbers.

Setting the Time Right

IMAGINE a vast electrical power plant designed without skill or harmony, built up at haphazard and housed in antiquated and inflammable buildings. Something goes wrong, short circuit follows short circuit with lightning rapidity, flames break out, and when at last the course of destruction is halted many of the buildings are in ruins, much of the machinery is a tangled mass of metal, and the best and bravest of the operators lie dead at their posts of duty. Such a picture as this the civilized world calls to mind to-day, after more than four years in which its great creative machinery, instead of carrying light and power to the nations, has been involved in a frenzy of destruction. Around the wreckage stand the peoples, and amid the babel of contending voices the dominant note is inevitably that of restlessness and discontent.

This universal unrest—no new thing, of course, but accentuated tenfold by the war—is felt in every branch of life. Students debate whether or not to resume their interrupted courses, teachers turn to new subjects and new methods, editors wonder what they should advocate, clergymen how they should preach. Time-serving politicians are at a loss. Business men are perplexed. The great masses of the population, oppressed by high prices and in the first stage of reaction from long-continued excitement, are not easily persuaded, edified or led. Public dissatisfaction everywhere runs high. Even the theaters find that the old entertainments no longer attract, and the sporting page itself has partly lost its charm. The status quo ante has few friends, and there will be no tame acquiescence in a reversion to things as they were.

All this is no vindication of the pessimist. Human progress has been built on discontent, and widespread ambition rather than widespread apathy is the token of a nation's health. Let no one despair. The patriotic ardor that has flamed so high will subside, but it will not be quenched. Common sense will assert itself to the discomfiture of red revolutionists and red reactionaries alike, but to the salvation of the nations. And here America, the oldest of the great democracies, will set a steadying example to Europe.

In the evolution of the new order of things the engineering mind, which may be possessed by statesmen as well as by technicians, has a great part to play. The engineering mind does not pile heavy structures on frail foundations, does not cover up faulty work with showy ornamentation, does not leave uneradicated defects that will grow and eventually bring disaster, does not miscalculate stress or power, never forgets the safety factor or the escape valve. There are axioms in statesmanship as irrefutable as any in mathematics. May the world be guided by political engineers with the wisdom to grasp and the courage to apply them!

The thoroughness and promptness with which we apply ourselves to the problems of reconstruction will determine in a large measure our future greatness. Our earnestness and zeal brought us quick and effective results in war, and if we are to keep a true perspective throughout the long period of readjustment we shall have need of these selfsame virtues in the years immediately before us.

The Modern Outdoor Substation

Apparatus Has Been Developed Until It Is as Reliable as Indoor Equipment, but Station Design Has Not Improved So Much—Notes on Transformers, Oil Circuit Breakers, Lightning Arresters, Air-Break Switches and Bus Supports

BY M. M. SAMUELS

WHEN the outdoor substation first appeared as a new and distinct type of construction a great many objections were raised against it by engineers and operators. Some thought that outdoor apparatus would not work satisfactorily under conditions of cold weather and snow; others held that it was not advisable to expose apparatus to the sun, and again others objected for the reason that apparatus placed outdoors would not receive so much attention from operators as it does when housed. All these and other objections have now been practically overcome, and many of the objectors have been so convinced of the advantages of placing high-tension apparatus outdoors that they would now strongly object to housing it. Thus the outdoor station, although of very recent creation, has come to be generally accepted as a matter of course. Most high-tension apparatus, regardless of whether it is for indoor or outdoor service, is now being built to stand up under outdoor conditions. Outdoor transformers, outdoor oil circuit breakers, outdoor metering apparatus and outdoor lightning arresters are now standard with all manufacturers of high-tension equipment and are as reliable in operation as any indoor apparatus was, and perhaps even more so.

Transformers.—Many improvements in outdoor transformers have been made within the last year or two. Terminal troubles have practically been eliminated, all high-tension transformers now having their terminals on top of the case instead of on the side. Furthermore, no more difficulty is being experienced in laying out the proper connections to their terminals. The necessity of climbing ladders or mounting platforms for the purpose of reading transformer temperatures and the danger connected therewith have been done away with, since modern transformers are equipped with electrical temperature indicators, which can be mounted so that the reading can be done from the ground, or where a switchboard is available in a nearby building the temperature indicator can be placed on this switchboard. Some difficulty is still being experienced when it is necessary to read the oil gage, since no indirect method for this reading has yet been developed and the gage must be mounted at a considerable height near the top of the transformer tank.

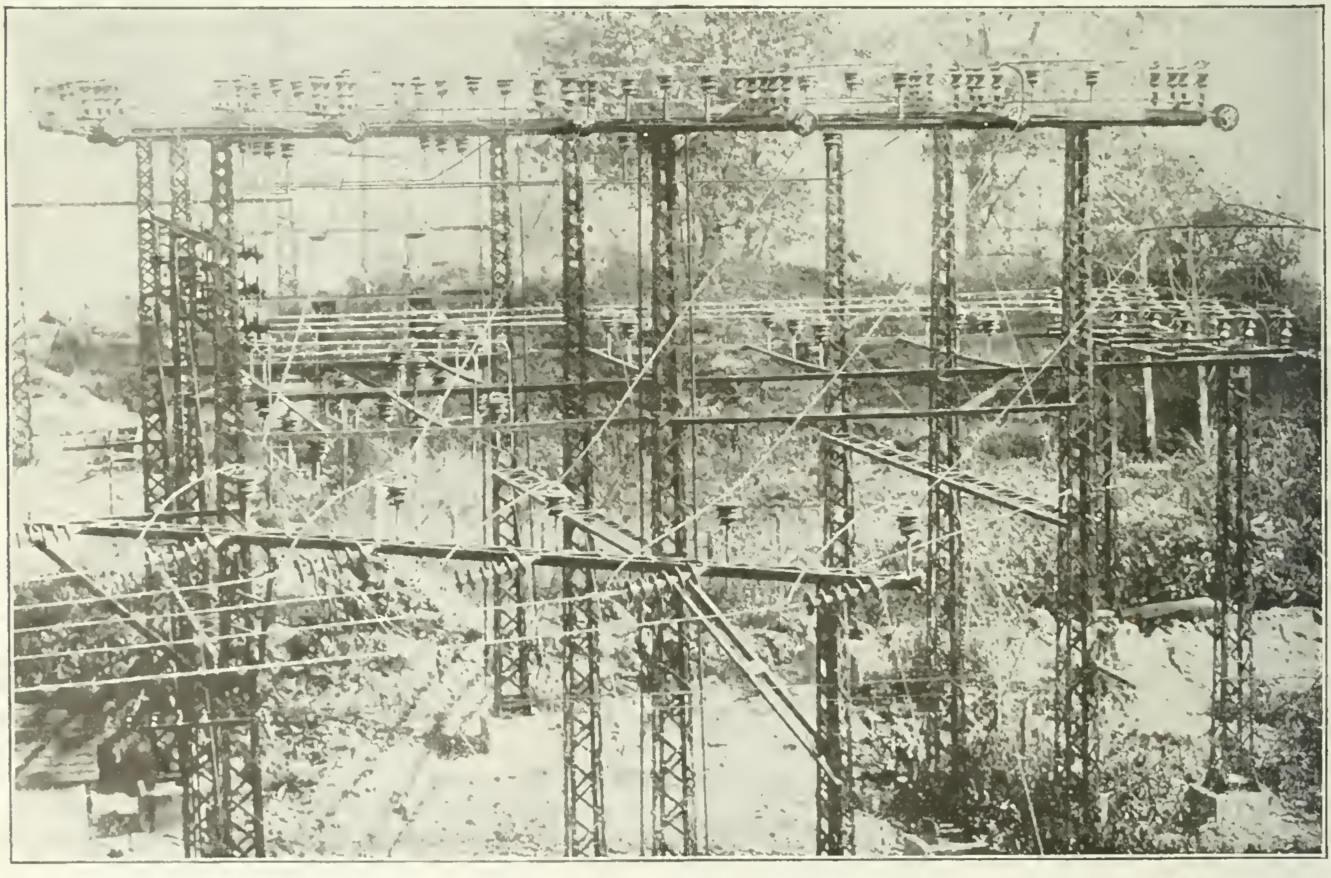
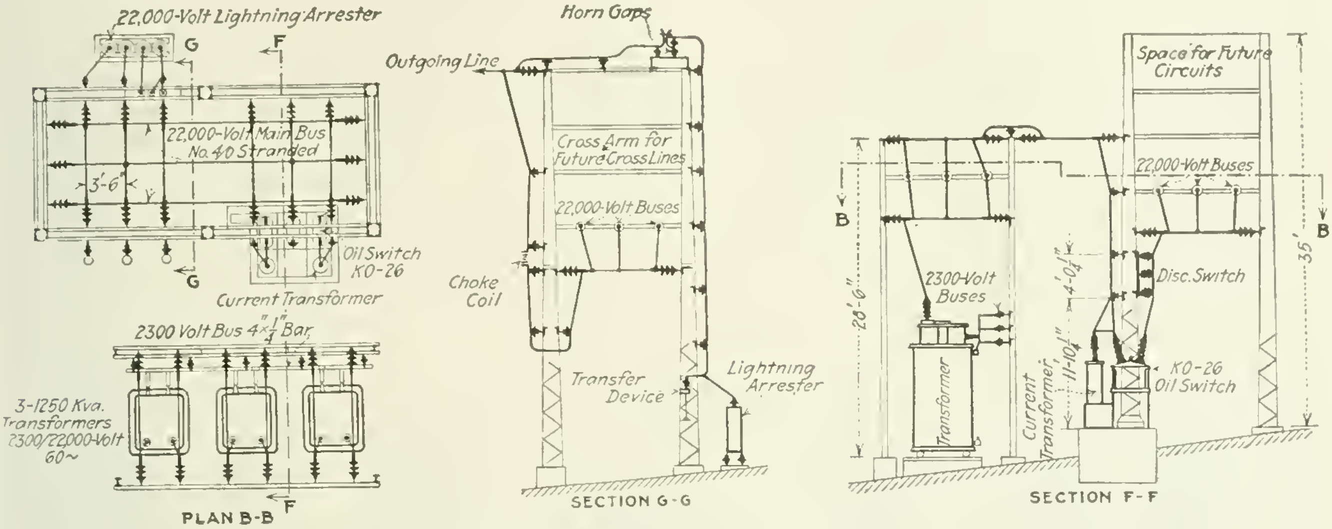


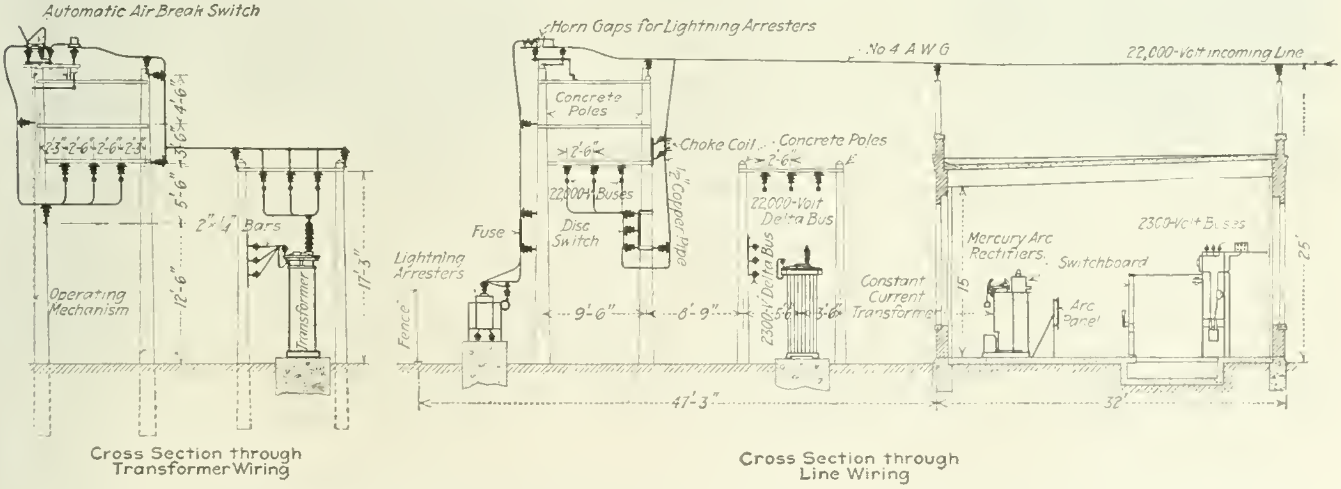
FIG. 1—75,000-VOLT SWITCHING STATION IN WHICH PRACTICALLY ALL SWITCHES ARE OF POLE-TOP TYPE. AIR-BREAK SWITCHES SPREAD OUT ON TOP TO AVOID TROUBLE FROM ARCS. (SEE FIGS. 10, 11 AND 12)

Large transformers of the older type were water-cooled, requiring elaborate piping and pumping installations, cooling ponds or cooling towers. This was always a source of worry to operators as well as to station designers, since outdoor piping and water pumping were very difficult to design properly, and since in the winter time great difficulty was usually experienced in maintaining the equipment in good operating condition. Modern transformers are therefore being designed for self-cooling. Most of the units are of the radiator type, this construction having given satisfaction even for large transformers of very high voltage.



FIGS. 2, 3 AND 4—45,000-VOLT UNIT-TYPE SUBSTATION

The Oil Circuit Breaker.—Oil circuit breakers of high rupturing capacity and designed for voltages of 150,000 have withstood the severe operating conditions obtained out of doors and may be considered thoroughly reliable. However, with ever-increasing voltages the oil circuit breaker is increasing enormously in size, and it will probably reach its limit soon, when it will become necessary to develop entirely new methods of switching and of breaking the circuit. It is likely that when line voltages go up to 250,000 and higher the present type of oil circuit breaker will have to be of such large proportions and will require such enormous quantities of oil that its use will be impossible.



Cross Section through Transformer Wiring

Cross Section through Line Wiring

FIGS. 5 AND 6—45,000-VOLT SUBSTATION EMPLOYING PIN INSULATORS, THUS PERMITTING USE OF CONCRETE POLES

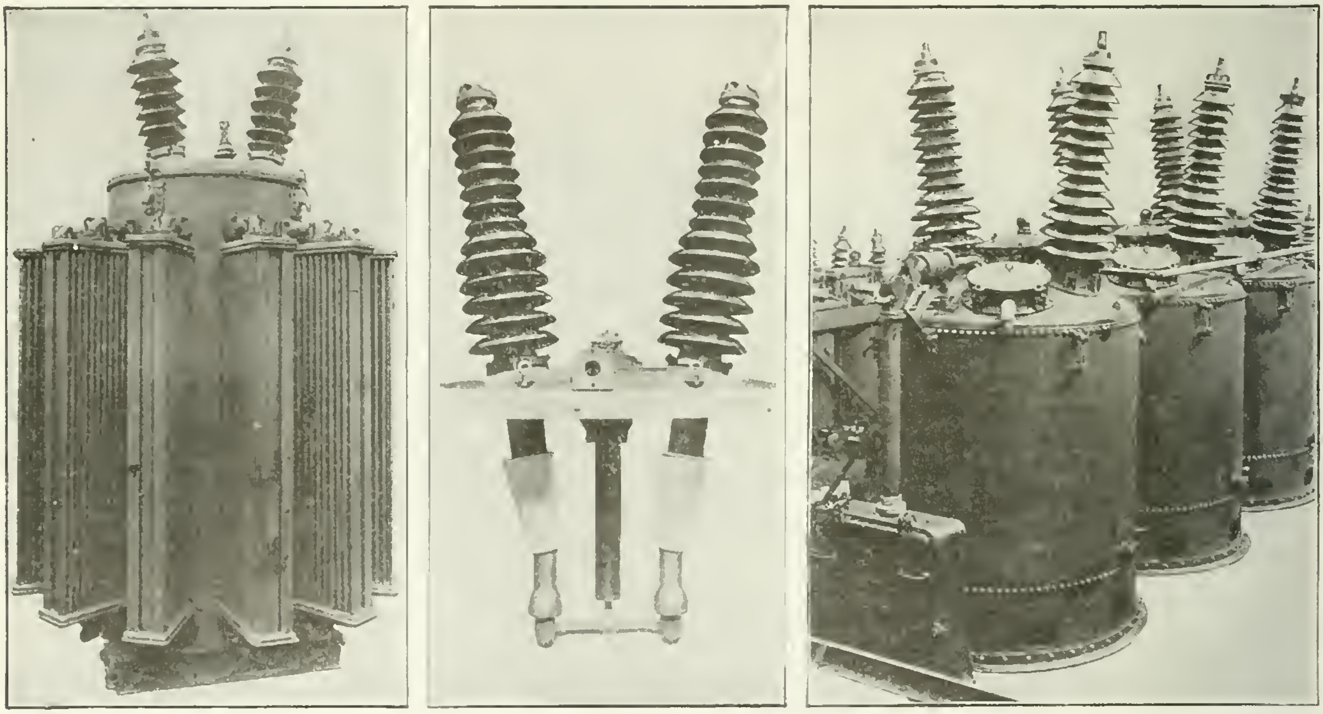
Lightning Arresters.—The lightning arrester has also been greatly improved within recent months. Many new devices have been introduced to prevent the burning out of charging resistances and the blowing up of tanks. The oxide-film arrester which was placed on the market recently promises to overcome many of the objections to the older types of arresters, but it has not been in operation long enough to make it possible to give accurate figures as to its operation, particularly for very high voltages and outdoor use.

Choke Coils.—The improvements made recently on choke coils are practically all of a mechanical rather then electrical nature. Good choke coils have been developed which maintain their shape under operating conditions, and the flimsy coils of the past, in which the windings often came in contact with each other and even melted together, are gradually disappearing. However, there does not seem to be any agreement among manufacturers as yet on the proper dimensioning of choke coils, such as diameters, shapes of conductors, number of turns and amount of reactance. Since engineers asking bids on choke coils, as a rule, do not specify their requirements except as to current and voltage rating, competition tends to make manufacturers reduce the copper to a minimum, which, of course, does not result in reliable coils. This subject should be thoroughly considered by the standardization committees of the A. I. E. E., the N. E. L. A. and other societies interested, and an understanding should be reached as to what constitutes a standard choke coil for a given voltage, a given current and a given frequency. At present no distinction is being made between choke coils of various frequencies.

Air-Break Switches.—A great many types of air-break switches, disconnecting switches, busbar supports, etc., have been developed for outdoor use and have been tried out and found satisfactory under all kinds of weather conditions, even though this line of apparatus still offers and will continue to offer for some time to come a large field for new inventions and developments.

There are two distinct types of air-break switches and mechanically operated disconnecting switches on the market at present. In the first type the motion of the blade is affected by an insulator which pivots around its own axis. The insulator being exposed to torsion at every operation, its top, to which the blade is attached, or its pin very often breaks and causes considerable operating trouble. In the other type the motion of the blade is affected by an insulator which rocks around a shaft at right angles to the center line of the pin. With this type the porcelain is always exposed to a bending moment and breaks even more often than with the pivot type. Neither of these types, although both give excellent results in many cases, can be considered as final. New apparatus will have to be developed based upon sounder mechanical principles and operating experience. Ice and sleet trouble on air-break switches, although partly overcome, should still be the subject of thorough study by switch designers and inventors if a perfect air-break switch is to be developed. The hoods which are generally used as sleet protectors do not always serve their purpose; they very often act as accumulators of ice and snow rather than shields. New methods will have to be devised to protect the switch contacts.

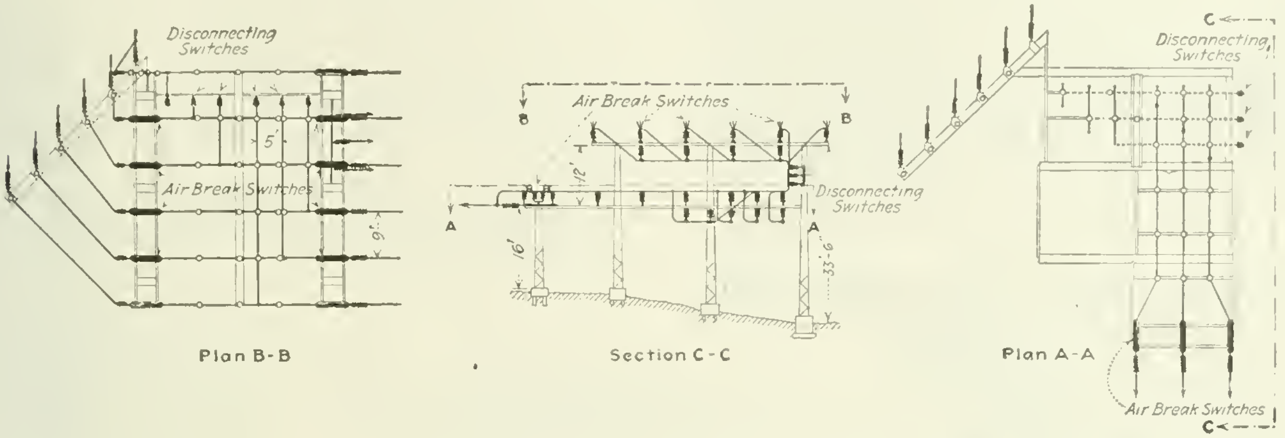
Bus Supports.—Various types of bus supports are now obtainable, suitable for outdoor substations and arranged to accommodate copper pipe of various sizes, both for horizontal conductors and for vertical conductors. While the post-type or pillar-type supports are both too heavy and too expensive for the purpose, petticoat insulators with suitable cap and pin design are satisfactory for solid (non-flexible) buses in outdoor stations. For vertical conductors it is advisable to mount the insulator at 45 deg. to the horizontal to prevent rain water from accumulating on the inside of the petticoats. This can be accomplished by the use of properly designed angular pins and angular caps. The part of the support which is to be attached to the steelwork, be it the pin or the cap, should have not more than two bolt holes, so that it can be accommodated on a single steel member. If three or four more mounting bolts are used, it is necessary to provide two steel members for each support. Either the cap or the pin or both should be adjustable so that the support can be mounted either on a steel member which runs parallel to the conductor or at right angles to same. It is very essential to have this adjustment since it is generally necessary to order bus support before the station steel design is finished and is not possible to tell in advance exactly how each member will be arranged.



FIGS. 7, 8 AND 9—SELF-COOLING 2500-KVA., 66,000-VOLT OUTDOOR TRANSFORMER; TERMINALS AND SWITCH CONTACTS OF 140,000-VOLT, 400-AMP. OIL CIRCUIT BREAKER; 135,000-VOLT, 400-AMP. OUTDOOR OIL SWITCHES

STATUS OF STATION DESIGN

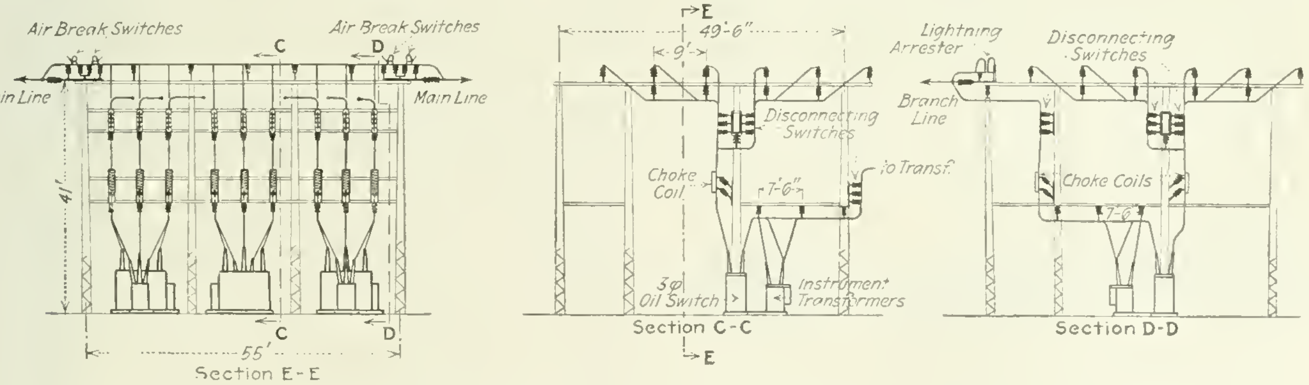
In spite of the wonderful improvements made within the last year or two on outdoor apparatus, most of the designs of the outdoor stations themselves are still open to a great deal of criticism. Most designers of outdoor stations still persist in using the old primitive method of setting four heavy steel towers, one in each corner of the station, and of connecting these towers in both directions by heavy steel trusses and span wires. Many times when it is necessary to make a connection between pieces of apparatus a span extending from one support to another is installed even when the apparatus to be joined is close together. This, of course, requires very heavy steel work and an endless amount of floor space. In addition to this, strain disconnecting switches or other types of hook-operated disconnecting switches are installed at great heights, and it is necessary to build high platforms to make it possible to operate these switches even when using the clumsy switch hook of 12-ft. or 15-ft. (3.7-m. to 4.6.-m.) length. Under present conditions, when every economy is of extreme value and when the waste of steel must be considered a crime, more consideration should be given this subject by designers of outdoor substations.



FIGS. 10, 11 AND 12—75,000-VOLT SWITCHING STATION SHOWN IN FIG. 1, USING PIN INSULATORS AND SOLID BUSES EXCLUSIVELY

It is obvious that when strain insulators are used and a strain span is installed for every bus, connection or tap the steel work will have to be very heavy (strong enough to take care of all the pulls to which it is subjected), whereas if a solid bus is used the steel work may be comparatively light, since it has only to carry the weight of buses, connections and insulators. The tendency in outdoor substation design must therefore be to eliminate strain spans and substitute solid bus work.

It must, of course, be admitted that, whereas it is a comparatively easy matter to design a station of the strain-span type, the design of a solid bus station requires a great deal of skill and designing ability. But when the results are considered it is well worth while to apply the best designing skill to developing outdoor stations which will occupy the minimum of space and will require the minimum of steel.



FIGS. 13, 14 AND 15—OUTDOOR STATION EQUIPPED WITH OIL CIRCUIT BREAKERS AND METERING EQUIPMENT (SEE FIG. 19)

In addition to the economy in steel, the solid-bus type of station has a great many more advantages as regards safety and continuity of operation. For instance, in the strain-span station any injury to even one disk insulator may cause a wire to drop across the buses, short-circuiting them and thus putting the whole station out of service. This is not likely to happen to a solid bus.

In order to reduce the number of insulators in the solid bus station to a minimum, tubing should be used for conductors in preference to wire or bar. Insulators spaced about 10 ft. (3 m.) apart on ½-in. (13-mm.) pipe bus will generally give a good appearance, whereas when a wire or a bar is used as a conductor supports will generally have to be installed ever 4 ft. or 5 ft. (1.2 m. to 1.5 m.).

In addition to the above-named advantages of the solid bus station the possibility of extension must be considered. A strain-type station is generally dead-ended, and a great deal of difficulty is experienced when it becomes necessary to add feeders or transformer circuits, whereas the solid-bus station can be designed as a unit type, so that any number of circuits can be added at any time and it is not necessary to make the initial installation of steel work and concrete heavy enough to take care of future requirements.

The general requirements to be met in the design of outdoor substations are: (1) simplicity, (2) safety, (3) a minimum of steel, (4) a minimum of space, (5) flexibility and interchangeability of circuits, and (6) possibility of extension without disturbing old circuits. All connections should be made by clamp fittings, so that apparatus can be disconnected, removed or replaced without keeping the circuit or the bus out of service for an excessive period of time. Soldered or welded joints should therefore be avoided as much as possible. When running a pipe connection from a transformer or a switch to a bus care should be taken to allow for expansion and contraction, otherwise the bus may be pulled off its supports or the insulators broken. One right-angle turn in each connection will generally be sufficient for the purpose, and it is never necessary to provide unsightly loops.

The 45,000-volt station shown in Figs. 2, 3 and 4 inclusive is a good illustration of the unit-type idea. This station shows that with skillful designing the unit idea can be applied even when strain insulators are used. Strain insulators had to be used in this case because they were readily available, whereas solid bus supports could not be obtained within the time allowed. It will be noted that with this type of design the lines can run into the station from any direction.

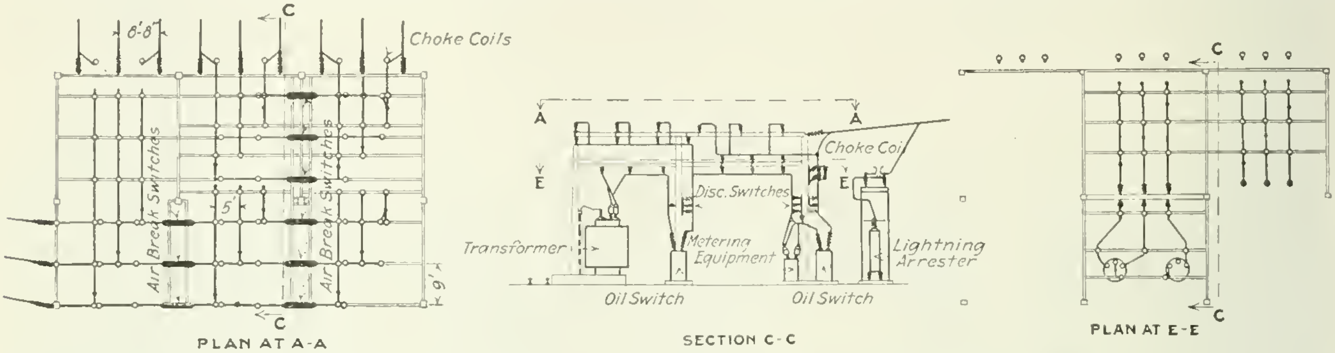
The lightning-arrester horn gaps are placed at the very top of the structure, and the lines go directly to the gaps and thence to the electrolytic tanks without any loops or semi-loops in the discharge circuit. This arrangement should be adhered to wherever possible, since a direct path from the line to the arrester is always the best.

Provision is made on the low-tension side of the transformers for phasing out. Three bars are installed the full length of the three transformers which make up a bank, and connection bars are provided from each transformer to these buses, so that whenever it is necessary to interchange a phase it can be done by simply interchanging the connection bars, which are attached to the buses by means of clamps. This arrangement is preferable to the phasing out of the high-tension side of the transformers. The low-tension circuits connect with underground cables through a set of potheads mounted on one of the steel columns. Bar connections are provided between the potheads and the low-tension transformer delta buses.

Figs. 5 and 6 show a 45,000-volt station which is similar in type to the one above, with the exception that it is a solid-bus station. The use of a solid bus made it possible to use concrete poles instead of steel, thus not only reducing the cost but making it possible to complete the work in a much shorter time than would be possible with steel poles on account of the long delivery on steel. If strain buses were used, concrete poles would, of course, be out of the question. There are other interesting features in this station. It is a combination indoor and outdoor station. The 2300-volt switching and the constant-current transformers for lighting as well as the instrument switchboard are housed, whereas the transformers and the high-tension switches are outdoors. The line is equipped with an automatic air-break switch which was considered sufficient for the present load. However, as may be seen in the cross-section, provision has been made for the installation of oil circuit breakers to replace the automatic air-break switches as the load on the line increases.

Two sizes of concrete poles are used in this structure. The larger ones, used to support the line equipment, are 33 ft. (10 m.) long and have 18-in. (45-cm.) square butts and 8-in. (20-cm.) square tops. The smaller poles used for the transformer wiring are 23 ft. (7 m.) long and have 15-in. (38-cm.) butts and 8-in. (20-cm.) tops.

The 33-ft. poles have ¾-in. (19-mm.) reinforcing bars in each corner extending the entire length of the pole. Besides these there are two rods symmetrically placed in each of two opposite faces. These additional rods extend from the base 17 ft. (5 m.) up the pole. The rods are tied together about every 2 ft. (60 cm.). To permit attaching the steel cross members used in the station 1¼-in. (32-mm.) standard steel pipe is cast in the poles through which to run the clamping bolts. The 23-ft. poles are similarly reinforced in the corners but lack the additional reinforcing.



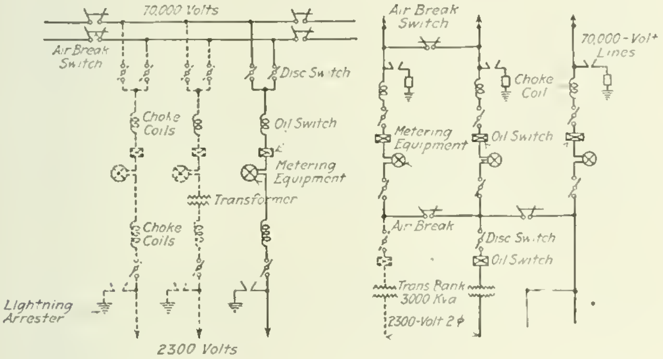
FIGS. 16, 17 AND 18—70,000-VOLT OUTDOOR TRANSFORMING AND SWITCHING STATION (SEE FIG. 20)

The argument is often heard that whereas in stations of comparatively low voltages a solid bus may be satisfactory, this construction is not advisable with stations which must operate at very high voltage, because a greater distance must be maintained between conductors and because of the extensive use of pole-top switches. This is not at all true, since solid-bus stations have been designed, built and maintained for 75,000 volts and even higher.

Figs. 1, 10, 11 and 12 show a 75,000-volt switching station in which practically all the switches are of the pole-top type. As a result the wiring seems rather complicated on first sight. In spite of this the construction is very simple and the steel work is very light. None of the steel poles is over 1.5 ft. (45 cm.) wide at the base, and all the cross-pieces consist of single steel members. No trusses or plate girders are required. All conductors, switches and insulators are easily accessible for repairs, and it is not necessary to deënergize the whole station for the purpose of working on one circuit. All disconnecting switches are operated by mechanisms from the ground, and no operating platforms are required.

The station is merely a switching station for the purpose of selecting a branch line from a double-circuit 75,000-volt transmission line. Air-break switches are provided in each main line at each side of the connection to the branch line. These had to be spread out on top of the structure in order to avoid trouble from the arcs and to provide the necessary clearance between phases. The branch circuit, however, required only a double-through disconnecting switch so the necessary switching equipment is arranged in vertical planes, thus reducing the space and the lengths of the steel members to a minimum.

Figs, 13, 14, 15 and 19 show a station similar in character to the one described except that an oil circuit breaker has been added in the branch line together with metering equipment. High-tension metering equipments are now standard apparatus and operate satisfactorily. They generally consist of an oil tank in which are contained two current transformers and two potential transformers, requiring a total of only three high-tension terminals, whereas if each current and potential transformer had its individual tank a total of six high-tension terminals would be required. The meter itself is generally placed in a steel compartment on the side of the metering equipment. If a building is nearby, the meters may be installed inside by simply running the secondary instrument leads from the instrument transformers to the metering equipment in an underground conduit or overhead on a messenger suspension.



FIGS. 19 AND 20—SCHEMATIC DIAGRAM OF CONNECTIONS FOR STATIONS SHOWN IN FIGS. 13 AND 16

Figs. 16, 17, 18 and 20 show that the ideas developed above can be applied also to more elaborate stations. This station contains not merely switching and metering devices but also self-cooled transformers of considerable size and for 70,000-volt operation. The station is built on a hillside in a limited space. It is obvious that it would be impossible to accommodate all the apparatus and wiring in the given space if strain disconnecting switches were used, or if it were necessary to provide strain spans for every connection. Only through the use of solid buses and mechanically operated disconnecting switches in vertical planes was it possible to design a station for this restricted space.

Outdoor substations should be well lighted for the purpose of inspection and repair by night. Floodlighting, which was first suggested by the author in these columns for outdoor stations, has been found to be not only preferable to other forms of illumination but the only satisfactory method, and it is now in common use.

All of the stations described above, which may be considered models of modern outdoor stations were designed and installed by the J. G. White Engineering Corporation of New York.

SPEEDING UP MANUFACTURING BY IMPROVING ILLUMINATION

Actual Plant Tests Indicate 15 per Cent Increase in Production at Cost of 5 per Cent of Payroll—Equipment Found Relatively Inexpensive

RESULTS of tests being conducted by engineers of the Commonwealth Edison Company to determine quantitatively the effect upon industrial output of increased and improved illumination were outlined in a paper entitled "Production Lighting Intensities," read before the recent convention of the Illuminating Engineering Society by William A. Durgin. The ninety-three plants thus far surveyed total 17,400 employees, cover a floor area of 96 acres and aggregate a lighting load of 1420 kw. While the survey is largely inspectional, listing the number, style and condition of units used, and applying arbitrary utilization factors to obtain the intensities produced, very considerable confidence is felt in the average results, which show a mean of 1½ ft.-candles now in use with variations from 0.01 ft.-candle to 10 ft.-candles and an average consumption of 0.33 watt per square foot and 80 watts per employee. For these same plants the I. E. S. code would provide an average intensity of 5.5 ft.-candles, 3.66 times the present level. The intensity would vary from 2 to 12 foot-candles; the average watts per square foot would be 1, and the watts per employee 240, or three times the present consumption. The average of 1½ ft.-candles is produced by such units as in Fig. 1.

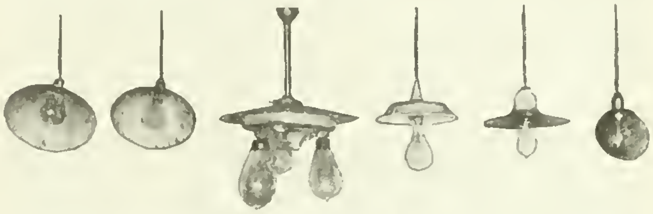


FIG. 1—TYPES OF LIGHTING EQUIPMENT FOUND IN MANY FACTORIES

In order best to explain the method of making tests and to indicate results thus far obtained the original paper is quoted as follows:

"Such tests are much more difficult than at first thought appears. Our revised program contemplates a four months' run—the first month with the equipment as it exists, the second with proper equipment to give 50 per cent higher intensity than the maximum recommended by our code, the third month at the lower code level for ordinary practice or what is generally considered good present practice, and the fourth again at the higher or productive intensity level. For such a test the plant production records must be accurately

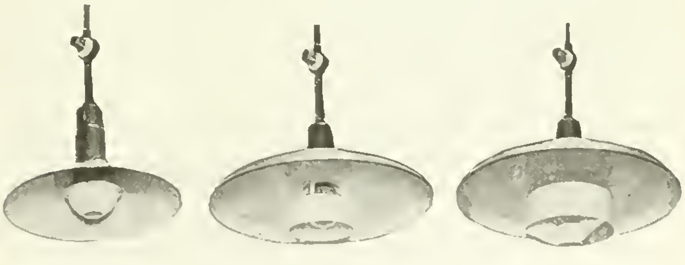


FIG. 2—TYPES OF GLARELESS FIXTURES RECOMMENDED IN SEVERAL PLANTS

kept and a fair percentage of the work must be done in hours of darkness. The chief difficulties are two—(1) to find plants with adequate production record systems, and (2) to induce the plant to return to the lower level of intensity at the end of the second month of the run after the advantage of good lighting has been once experienced.

"Thus far we have sold the productive intensity idea and necessary equipment to eleven plants. From two of these we have secured reliable data. The first has already been noted briefly in Mr. Millar's paper on 'Lighting Curtailment.' The test was run in a machine shop producing soft metal bearings, operations ranging from rough to fine. Only two months of the program were run, but in the month at which the intensity was maintained at 12 ft.-candles production in the several operations was increased from 8 to 27 per cent over that of the previous month, when an intensity of 4 ft.-candles was used. In this instance general lighting with deep-bowl reflector equipment was employed for both intensities and every precaution taken to eliminate commercial bias. The superintendent was so impressed with the value of the higher intensity that he had it extended to the other floors of the building. In the second accurate test the program could not be followed carefully, the comparison being between bare lamps on drop cords and a properly designed reflecto-cap installation. The new equipment gave about twenty-five times the intensity previously used and showed an increased production of from 30 to 100 per cent in the several operations of a large pulley machine shop. Again the superintendent was enthusiastic. In the other nine plants it has been impracticable to run tests, but in every case the superintendents and owners are fully convinced of the truth of our statement that the average effect will prove at least a 15 per cent increase in production at an increased cost of not more than 5 per cent of the payroll.

"To get results quickly it is impracticable to secure the absolute best equipment for each installation. In our own company, therefore, we have adopted definite specifications employing three general types of equipment:

"1. Gas-filled lamps with steel reflectors and eye shields in the 200, 300 and 500-watt sizes.

"2. Gas-filled lamps with deep-bowl reflectors for extreme mounting heights.

"3. Vacuum lamps and deep-bowl reflectors for certain drop-cord applications.

"Our effort is concentrated upon the first class, examples of which are shown in Fig. 2. In using these eye-shield units it is of first importance that the shields be sealed in place and only removable by the foreman or other authorized employee, for the ordinary workman believes but one part of the code. He wants more light, but he knows nothing of the effect of excessive brightness contrasts and if left to himself will remove the shield as a useless obstruction. Recent installations of all three units are equipped with such sealing wires.

"Of the three we are especially emphasizing the 300-watt unit. It has an efficiency of some 84 per cent, a maximum brightness of 7500 millilamberts on the interior of the diffuser ring, and is well adapted to installation on present outlets. In many plants it is hardly possible to rewire now; in others it is very questionable whether such rewiring is warranted. But with this unit giving its maximum candlepower at the 50 deg. angle it is entirely practicable to produce reasonably uniform lighting with spacings of 14 ft. to 16 ft. (4.2 m. to 4.8 m.) at mounting heights from 10 ft. to 16 ft. (3 m. to 4.8 m.).

"Where 12 ft. to 18 ft. (3.6 m. to 5.4 m.) mounting heights above the floor are possible, spacings as high as 20 ft. (6 m.) can be used with the 500-watt unit, with an acceptable result in uniformity of intensity and diffusion of light. This unit has an efficiency of 77 per cent and a maximum brightness of 2300 millilamberts, the view of the interior of the ring being largely cut off by the blades. Again it may be emphasized that our object is not ideal illuminating engineering; it is practical application with as little change in wiring as possible. In these installations we are to secure productive intensity quickly at minimum expense with equipment which will continue to supply that intensity during its life.

"Of primary importance, therefore, is the ease with which such equipment can be maintained. With the drop-cord units of Fig. 1, bare or shaded by the tin dirt collector, even the extremely serious defects in intensity produced and brightness contrasts permitted are hardly as important as the extreme inefficiency which results after the machine has spattered them with oil or the workman has manipulated them with dirty hands. We have tested several such units taken directly from factories and have found the utilization efficiency less than 25 per cent."

PLANNING THE EDUCATION OF THE POWER-PLANT MEN

Illinois Fuel Administrator Expects to Send Weekly Letter to All Plant Operators and Owners to Impress Methods of Conservation

To keep before power-plant owners and operators the various economies that will effect the saving in coal requested by the Fuel Administration and to maintain interest in conservation at the proper pitch, Joseph Harrington, administrative engineer for Illinois, has adopted a plan of sending weekly letters to all plants in the state. In each letter one specific subject will be treated. It is the intention that the entire week be given by each owner to a careful examination of his plant with reference to the subject of the letter. If improvements are possible, immediate steps are to be taken to better conditions. During the following week there will be another letter on a different subject and so on until all factors influencing economy in the boiler room have been covered.

The series started with a general letter and a questionnaire on coal storage. "Directions for Operating Hand-Fired Boilers" was the subject for another week. Boiler covering, flue-gas analysis, coal weighing, soot, water purification, boiler-room records, etc., are also to be covered.

A copy of the letter on firing methods includes paragraphs on blowing flues and similar work, number of boilers to be kept in service, method of firing, draft control, when furnace should be fired, control of steam pressure and night service.

Attitude of Central Stations on Rates

Questions Which Are Involved in War and Peace Adjustments of Rates to Meet Changed Economic Conditions—Duration of the Period of High Costs

In these statements, as in the similar expressions of views in the articles printed on Sept. 7 and Nov. 2, widely different opinions on rate questions are given. The rate situation is involved with other large economic questions affecting the country, and its treatment is tempered in individual localities by the degree in which the communities are influenced by the general problems.

CONSIDERATION of rate-making problems is still continuing because no change has developed in the underlying factors of cost. The statements quoted below include the viewpoint of one company which, while it did not find increases necessary, adopted the policy of suspending periodical decreases.

"CONTINUE TO ASK FOR JUST INCREASES"

B. C. Cobb of Hodenpyl, Hardy & Company, Inc., New York, and president of the Consumers' Power Company and other operating properties of the Commonwealth Power, Railway & Light Company, says to the ELECTRICAL WORLD:

"All of the properties in which we are interested—*i.e.*, the subsidiary properties of the Commonwealth Power Railway & Light Company, located in Michigan, Ohio, Indiana and Illinois—have been endeavoring to get increases in rates charged for services, not only rates for electric service, but rates for gas and railway service as well, and they are in a certain measure meeting with success.

"We have found the attitude of the commissions, public authorities and the people not just the same in all of the communities and states. However, I am inclined to believe that there is a growing sentiment in favor of granting the utility properties a higher rate of charge; in other words, I think there is a realization of the fact that unless they are allowed to increase the charging rate they will be unable to subsist.

"Generally speaking, the rates secured so far have failed to offset entirely the higher operating costs. However, they have been helpful and I am sure will be followed by other increases."

Writing under a later date in further reply to an inquiry from the ELECTRICAL WORLD, Mr. Cobb amplifies his statement as follows:

"We are still meeting with success in obtaining increases in rates for service. Not always do we get what we believe we are justly entitled to. The sentiment, however, as I stated to you in my former letter, in favor of granting the utility properties higher rates of charge, I still think, is growing.

"I think it is generally conceded that the class of service using the greater portion of the output—*i.e.*, power business—should bear the largest proportion of the increase in rates, and I think it is in this class of service that most of the increases have been secured. This is quite logical, for it was this class of service which was first and most affected by the increased costs of coal, labor and material. Private plants have felt these increased costs the same as the central stations—even more so—and the tendency has been to some considerable extent, I think, to shift the load from these private plants to the central stations.

"I don't intend by the foregoing to say that the lighting rates should not be increased, for this is directly contrary to my thoughts. We are gradually, wherever there may be cause, increasing our lighting rates, feeling that the time has come when the lighting consumer should begin to bear a portion of the increased costs.

"I am not of the opinion, now that the war is over, that we are going to see any sudden decrease in cost of production, and I firmly believe that it behooves the central-station operator to continue manfully to ask for increases wherever and whenever it can be justly shown they are needed."

A VIEWPOINT NOT BASED ON INCREASED RATES

An important central station in the Middle West which has not raised its electric service rates has the following comment on the rate situation in general:

"Our rates were thought to be both war-proof and peace-proof. Since the war started we have not found it necessary to increase rates, and we do not anticipate that it will be necessary in the future. We believe prices of commodities that go to make electric service have about reached their peak as far as we are concerned.

"Two factors have been important among those which made it possible for us to keep from increasing rates. They were (1) our ability to reduce the cost of operation by retrenchment, by changing lamp policies, by elimination of gratuitous services and by other means, as the cost of operation rose, and (2) the increase in net earnings made possible through discontinuing a well-established policy of periodically reducing rates.

"In spite of the fact that the rates have not been raised, neither the security holders nor the reserves have suffered. It is foreseen that after the war there will be some who will say that the company must have been making more than a fair return in peace times, else it could not have gone through the war without relief in the form of higher rates. In answer to this the company can point to the actual increase in net earnings which has been the result of its new policy of adhering to present rates instead of reducing them periodically as it previously had done."

This same company during this period of rate disturbances has studied some of the factors in residential rates. The rates in general are of the demand and energy type. In its rate structure the lighting consumer with less than 1½ kw. connected is billed on an estimated demand which is a fixed percentage of the connected load taken in conjunction with a certain number of hours' use of that demand. The estimated demand is based on lighting load only. Studies have shown that peak demands in residential districts are no longer created by lighting. Appliances are the ruling factor. While no change in the rates taking this into effect is contemplated, the situation is fully realized. The company feels that it is virtually giving these small consumers a lower rate by delaying the recognition of these facts.

SMALL ADVANCES MADE IN AMERICAN LIGHT & TRACTION PROPERTIES

Alanson P. Lathrop, president American Light & Traction Company, says to the ELECTRICAL WORLD:

"We have received a small advance in our electric rates in one company and are endeavoring to get a still further advance in the same company, but with what degree of success remains to be seen.

"Another of our companies received an advance of 1 cent per kilowatt on all classes of business, effective on Nov. 1."

NO RAPID DECREASES IN RATES

C. A. Paul, manager of the United Illuminating Company, Bridgeport, Conn., does not anticipate any rapid decrease in electric utility rates in the after-the-war period. Public service companies did not increase their rates until long after general commodity and labor costs rose far above normal, and a gradual subsidence in prices rather than any sudden drop is to be expected after hostilities are concluded. Mr. Paul believes that the cost of coal will be high for a long time in comparison with pre-war prices, and this, with the high wages labor is likely to demand, will make reductions in rates difficult. Ultimately it would seem that wages must be lowered somewhat to compensate for the recession expected, in the general price list, but it is apprehended that this will be accomplished only in the face of great opposition on the part of labor.

Calibration of Power-Factor Indicators

Method of Calibrating Polyphase Power-Factor Indicators of Which the Resistances of the Potential Circuits Are Not Equal—Also Applies to Indicators in Which Current Coil Is in One Phase of a Two-Phase Line

BY WALTER WESTCOTT HOKE

In the Feb. 2, 1918, issue of the ELECTRICAL WORLD there was published an article by Thomas W. Varley dealing with the direct-current calibration of power-factor indicators. Mr. Varley brought out the advantages to be gained by such a method, and, as a result, the writer, in collaboration with H. Heitman, undertook to calibrate the Philadelphia Electric Company's polyphase power-factor indicators of the electrodynamometer type by means of the above method.

THE principle of operation and the details of construction are not always exactly the same for different makes of instruments, and hence this article is supplementary to that by Mr. Varley in that it describes a way to calibrate polyphase power-factor indicators of which the resistances of the potential circuits are not equal, and indicators of which the current coil is connected in one phase of a two-phase line.

Consider the vector relation between the current in the current coil and the currents in the potential coils for a three-phase indicator. For unity power factor (Fig. 1) the current I_{p_1} in one potential coil leads the current I_c in the current coil by 30 deg., while the current I_{p_2} in the second potential coil leads by 150 deg. Now for a lagging power factor (cos Θ) the torque acting on potential coil 1 is proportional to the flux threading it, owing to the current, I'_c times the component of the vector I_{p_1} along the vector I'_c. Hence:

$$T_1 \propto \Phi_{c_1} I_{p_1} \cos(\Theta + 30).$$

In a like manner:

$$T_2 \propto \Phi_{c_2} I_{p_2} \cos(\Theta - 30).$$

As a means of calibration it can be readily seen that if currents proportional to $I_{p_1} \cos(\Theta + 30)$ and $I_{p_2} \cos(\Theta - 30)$ are passed through the potential coils, the same deflection corresponding to the lagging power factor cos Θ will be obtained. Evidently alternating as well as direct current can be used provided that the currents in the potential circuits are in phase and the current coil circuit is connected to the same source. Such currents in the potential circuits must then be in the following ratio:

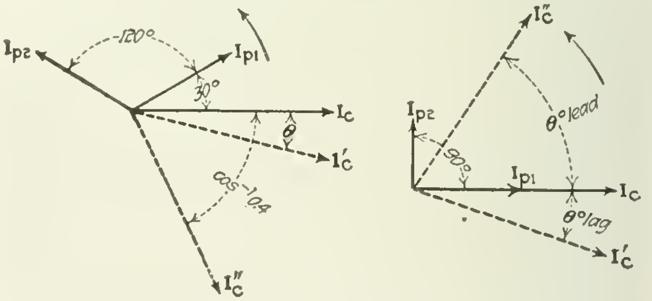
$$\frac{i_1}{i_2} = \frac{\cos(\theta + 30)}{\cos(\theta - 30)} \times \frac{R_2}{R_1},$$

where R_1 and R_2 are the normal resistances of potential circuits 1 and 2 respectively. This can be accomplished by placing a resistance R_x in series with potential circuit 1. Since both circuits are connected in parallel across the same voltage (Fig. 3),

$$(R_1 + R_x) i_1 = R_2 i_2,$$

or

$$R_x = R_1 \left[\frac{\cos(\theta - 30)}{\cos(\theta + 30)} - 1 \right].$$



FIGS. 1 AND 2—VECTOR RELATIONS BETWEEN CURRENTS IN POTENTIAL AND CURRENT COILS FOR THREE-PHASE AND TWO-PHASE INDICATORS

For a leading power factor, the current i_1 becomes greater than i_2 and the additional resistance is placed in series with R_2. In that case:

$$R_x = R_2 \left[\frac{\cos(\theta - 30)}{\cos(\theta + 30)} - 1 \right].$$

For leading or lagging power factors equal and less than 40 per cent, the components of I_{p_1} and I_{p_2} along I_c become in phase. In order to secure the proper amount and direction of current in the potential coils, the latter are placed in series and a shunt connected across either R_1 or R_2 (Fig. 4), if the power factor is lagging or leading respectively. This shunt will have the following value, for a lagging power factor:

$$R_x = R_1\, i_1/(i_2 - i_1)$$

or

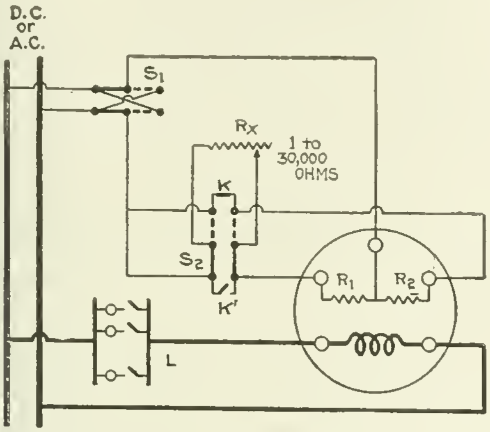


FIG. 3—ARRANGEMENT FOR CONNECTING ADJUSTABLE RESISTANCE IN SERIES WITH POTENTIAL CIRCUIT

$$R_x = \frac{R_2}{[\cos(\Theta - 30)/\cos(\Theta + 30)] - (R_2/R_1)},$$

and for a leading power factor:

$$R_x = R_2\, i_2/(i_1 - i_2)$$

or

$$R_x = \frac{R_1}{[\cos(\Theta - 30)/\cos(\Theta + 30)] - (R_1/R_2)}.$$

For a two-phase indicator (Fig. 2) the current I_{p_1} in one potential coil is in phase with the current I_c in the current coil, while the current in the second potential coil leads I_c by 90 deg. Hence the currents to be passed through the potential coils will have to be in the following ratio:

$$i_1/i_2 = (\cos\Theta/\sin\Theta) \times R_2/R_1.$$

When the vector I_c lags the components of I_{p_1} and I_{p_2} along it are in opposite directions. Hence for power factors equal or greater than 80 per cent a resistance of $R_2[(\cos\Theta/\sin\Theta) - 1]$ is placed in series with R_2, while for power factors less than 80 per cent a resistance of $R_1\,[(\sin\Theta/\sin\Theta) - 1]$ is placed in series with R_1. Considering a leading power factor, the components of I_{p_1} and I_{p_2} along I_c'' are in the same direction. Since the current in one of the potential coils must be reversed and if the inside leads from these coils are not accessible, shunts again have to be connected across either of the potential coils placed in series. But in this case R_2 is larger than R_1 and these resistances change with different makes of instruments. On that account the leading power factor at which the current i_2 becomes greater than i_1 will vary. But it will be found that for power factors greater than 50 per cent a shunt of $R_1/[(\cos\Theta/\sin\Theta) - (R_1/R_2)]$ is placed across R_2, while for power factors less than 50 per cent a shunt of $R_2/[(\sin\Theta/\cos\Theta) - (R_2/R_1)]$ is placed across R_1. However, for two-phase indicators of the General Electric type, unlike the Weston type where the potential coils are joined inside the instrument (Figs. 3 and 4), the four potential-coil terminals are connected to four outside posts. In that particular case it is more convenient to add resistances to either potential circuit according to the power factor in exactly the same manner as for lagging power factors, but to reverse the current in one of the potential coils. This method does not hold for three-phase indicators of the same make.

The wiring used for this method of calibration is shown in Figs. 3 and 4. Reversing switch S_1 is convenient for giving the proper direction of current through the potential coils, for if the latter currents are not in the proper direction with respect to the current in the current coil the needle will tend to indicate 180 mechanical degrees away from the required power factor. However, some instruments are provided with such scales as to take advantage of a reversal of power. The double-throw switch S_2 in Fig. 3 is used in conjunction with keys K and K^1 to place the additional resistance R_x in series with either potential circuit, while in Fig. 4 S_2 is used to place the resistance in parallel with either circuit. The lamp bank L governs the normal current through the current coil. R_x consists of two resistance boxes, one ranging from 1 ohm to 10,000 ohms and the other from 10,000 ohms to 100,000 ohms in steps of 10,000.

Figs. 3 and 4 apply to both Weston and General Electric instruments, with the distinction that for the latter the resistances in series with the potential coils and forming part of the potential circuits R_1 and R_2, as shown in the figures for the Weston type, are not within the instruments but have to be connected externally to the potential-coil posts. Another distinction arises from the fact that for two-phase indicators of the General Electric make the potential coils have to be connected together externally. Evidently the wiring shown in Fig. 3 suffices for the calibration of the latter instruments.

As to the procedure to follow, the normal resistance of the potential circuits of all the instruments to be calibrated are first determined. In this connection a small portable Wheatstone bridge can be used. Three-phase indicators are calibrated from unity to 40 per cent power factor leading or lagging. Then lagging power factors for two-phase indicators are calibrated. Should the latter be of the General Electric class, leading power factors are calibrated at the same time. Next the wiring is changed to that shown in Fig. 4. Leading power factors and finally the remaining points for the three-phase instruments are calibrated. If some of the

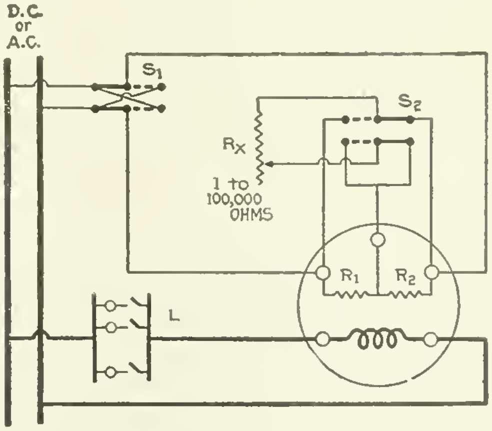


FIG. 4—METHOD OF SHUNTING RESISTANCE ACROSS POTENTIAL COILS

instruments have the normal resistances of their potential circuits very nearly equal, the resistances calculated for one may be used for all of those instruments.

The accompanying table proves convenient for the computation of the resistances, and in this connection slide-rule work is sufficient, since a deviation of 1 per cent from the actual value of the computed resistance has no effect on the reading taken on the scale, even for power factors close to unity where the divisions of the scale are greatest. Should the resistances R_1 and R_2 be nearly equal, as is often the case for three-phase indicators of the Weston class, their ratio may be taken as unity, this materially reducing the computation of the shunts to be placed across either R_1 or R_2, and the error involved will not be appreciable. This never applies, however, to two-phase indicators having their current coils connected in one of the phases, for in that case R_2 is larger than R_1.

RESISTANCES PLACED IN SERIES OR IN PARALLEL WITH POTENTIAL CIRCUITS

Per Cent Power Factor	Three-Phase Indicators		Two-Phase Indicators	
	Lag	Lead	Lag	Lead *
100	0		0 (R_2 open)	
95	0.47 R_1 with R_1	0.47 R_2 with R_2	2.04 R_2 with R_2	$\frac{R_1}{3.04-(R_1/R_2)} R_2$ across
90	0.78 R with R_1	0.78 R_2 with R_2	1.07 R_2 with R_2	$\frac{R_1}{2.07-(R_1/R_2)} R_2$ across
85	1.11 R_1 with R	1.11 R_2 with R_2	0.61 R_2 with R_2	$\frac{R_1}{1.61-(R_1/R_2)} R_2$ across
80	1.53 R_1 with R_1	1.53 R_2 with R_2	0.33 R with R_2	$\frac{R_1}{1.33-(R_1/R_2)} R_2$ across
70	2.87 R_1 with R_1	2.87 R_2 with R_2	0.02 R_1 with R_1	$\frac{R_1}{0.98-(R_1/R_2)} R_2$ across
60	6.66 R_1 with R_1	6.66 R_2 with R_2	0.33 R_1 with R	$\frac{R_1}{0.75-(R_1/R_2)} R_2$ across
50	0 (R_1 open)	0 (R_2 open)	0.73 R_1 with R_1	$\frac{R_1}{0.58-(R_1/R_2)}$† R_2 across
40	$\frac{R_2}{7.20-(R_2/R_1)} R_1$ acros	$\frac{R_1}{7.20-(R/R_2)} R_2$ across	1.29 R_1 with R_1	$\frac{R_2}{2.29-(R_2/R_1)} R_1$ across
30	$\frac{R_2}{3.40-(R_2/R_1)} R_1$ across	$\frac{R_1}{3.40-(R_1/R_2)} R_2$ across	2.18 R_1 with R_1	$\frac{R_2}{3.18-(R_2/R_1)} R_1$ across
20	$\frac{R_2}{2.10-(R_2/R_1)} R_1$ across	$\frac{R_1}{2.10-(R_1/R_2)} R_2$ across	3.90 R_1 with R_1	$\frac{R_2}{4.90-(R_2/R_1)} R_1$ across
10	$\frac{R_2}{1.42-(R_2/R)} R_1$ across	$\frac{R_1}{1.42-(R_1/R_2)} R_2$ across	8.95 R_1 with R_1	$\frac{R_2}{9.95-(R_2/R_1)} R_1$ across
0	0		0 (R_1 open)	

NOTE—R_1 and R_2 are the normal resistances of the potential circuits. For a three-phase indicator R_1 and R_2 are nearly equal. For a two-phase indicator R_2 is larger than R_1.

* Some two-phase indictors have their potential coils brought out to four posts. Hence for leading power factors in this particulaar case it will be found more convenient to use the same data as for lagging power factors for two-phase indicators, but to reverse the direction of current in one potential coil.

† If negative, put R_2 [1.73−(R_2/R_1)] across R_1.

By using this method the Philadelphia Electric Company is able to check in one hour's time an average of ten indicators, both two-phase and three-phase.

Comments.—As brought out in the foregoing, it is necessary, in order to obtain the required power factor (cos Θ) for three-phase indicators that the currents passed through the potential coils be proportional to I_{p_1} cos (Θ + 30) and I_{p_2} cos (Θ — 30) or (I/R_1) cos (Θ + 30) and (I/R_2) cos (Θ — 30). Mr. Varley must have dealt with instruments having the resistances of their potential circuits R_1 and R_2 equal, then I_{p_1} equals I_{p_2} and the currents that he passes through the potential circuits are then proportional to cos(Θ + 30) and cos(Θ — 30). The actual values of the resistances to be placed in series with the potential circuits are the same, however, regardless whether R_1 equals R_2 or not; but for the values of the shunts the ratio R_2/R_1 does not cancel out, as can be seen from the calculations made. For that reason the writer is not able to simplify the values of the shunts for three-phase indicators as given in the table from 40 to 0 per cent. If the ratio R_2/R_1 was to be taken as unity, it would only be duplicating Mr. Varley's work. Only when R_2 and R_1 are equal to within 1 per cent can their ratio be taken as unity.

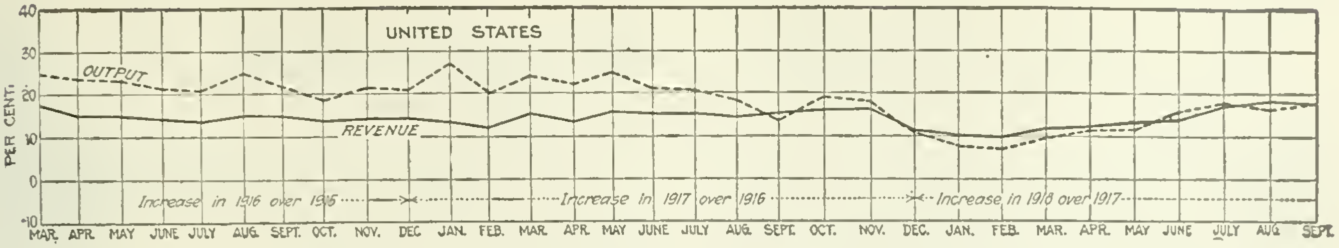
In general, the writer believes that the table given in this article is simpler than the one which was presented by Mr. Varley.

The values given for two-phase indicators in this table are entirely different from Mr. Varley's, the reason probably being that the latter applied to indicators having the current coil connected in the middle wire of a two-phase, three-wire line, whereas the writer refers to indicators having it connected in one outside wire. This latter connection is that of the Weston and General Electric types and is the most frequent. Here again the column for lagging power factors is a great deal simpler, since it gives the actual values of the resistances to be placed in series with either potential circuit from 100 to 0 per cent. The leading column is for the Weston class, leading factors for General Electric instruments being calibrated as for lagging factors, this being explained in this article.

An article will be presented later on the direct-current calibration of the Westinghouse indicators which operate on the principle of the moving vane. According to reports from Philadelphia, the method is proving successful in practical operation.

TO RETIRE the full war debt in twenty years would mean that the major part of the burden would fall on the present generation. I do not believe it would be either wise or necessary to hasten the process in so short a period. Industry needs an interval of moderate taxation in order to prepare itself for development and future uncertainties; the people should have a breathing spell in which to readjust their business interests to what will be new conditions. I would suggest that a sinking fund, perhaps a very moderate sinking fund, be established in due time, not to be large at least for several years after borrowing for war and after-war purposes comes to an end, always taking into account that industry must not be affected by the requisite taxation beyond a degree which it could bear. Later it might be entirely feasible to increase the size of the sinking fund.—*Jacob H. Schiff in New York Times.*

Central Station September Operations



THE GREAT FACT IS THE CONTINUED LARGE INCREASE IN VOLUME OF OUTPUT

With returns from 48 per cent of the central-station industry, the September record is a gain of 18 per cent in revenue and of 18.1 per cent in kilowatt-hour output, as compared with September, 1917. This is roughly equal to the best record of any month in the year and indicates the heavy demand which the industries of the country continued to make upon the central stations at the beginning of the fall season. The rates of increase in revenue and output remain close together, and it is interesting to note that this condition has now lasted more than a year. In September, 1917, the rate of revenue increase was a trifle larger than the rate of output increase, and it was a fair deduction that rate advances were beginning to affect the returns. In the period which intervened between that date and September of this year the output and revenue curves crossed several times in the ELECTRICAL WORLD diagram, and from month to month it was somewhat uncertain which line would rise over the other.

Now with each month that passes the situation will tend to become more and more normal as peace-time production supplants the war industry demand. The return to the normal production condition will have one kind of effect upon central-station operations if it is accompanied by a reaction toward or to the old costs of materials and labor; it may have another effect if there is to be no change in costs of providing service.

The great fact which continues to shine in the returns is the large increase in the volume of production of the central stations.

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Industry Represented	Revenue from the Sale of Energy			Kw.-Hr. Output		
		1917	1916	Per Cent Increase	1917	1916	Per Cent Increase
Oct..	62	$25,748,000	$22,334,000	15.4	1,522,149,000	1,279,140,000	19.5
Nov.	62	26,665,000	23,183,000	17 0	1,485,370,000	1,292,113,000	15 7
Dec..	58	28,144,000	25,026,000	12.4	1,517,001,000	1,362,299,000	11.0
		1918	1917		1918	1917	
Jan..	62	27,035,000	24,977,000	8 2	1,508,353,000	1,422,121,000	6.3
Feb.	60	24,690,000	22,307,000	10.6	1,254,217,000	1,168,288,000	7.1
Mar.	60	25,396,000	22,702,000	12 3	1,418,222,000	1,294,561,000	9.4
Apr.	60	25,864,000	22,966,000	12.6	1,450,221,000	1,297,843,000	11.5
May	62	25,365,000	22,426,000	13.1	1,537,527,000	1,372,935,000	11.9
June	60	26,070,000	22,599,000	15.3	1,531,099,000	1,319,444,000	16.0
July	56	21,935,000	18,559,000	18 2	1,370,461,000	1,156,692,000	18.5
Aug.	58	26,891,000	22,690,000	18 5	1,647,510,000	1,417,150,000	16.3
Sept.	48	22,522,000	19,082,000	18 0	1,301,785,000	1,102,185,000	18.1

Based on the returns from 48 per cent of the industry, the ELECTRICAL WORLD estimate for the entire industry for September is: Revenue, $46,290,000; output, 2,712,000,000 kw.-hr.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States			Percentage of Industry Represented	Atlantic States			Percentage of Industry Represented	Central States			Percentage of Industry Represented	Pacific and Mountain States		
			1917	1916	Per Cent Increase		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase		1917	1916	Per Cent Increase
REVENUE	Oct	64	$3,057,000	$2,530,000	20 7	66	$10,683,000	$9,173,000	16.5	52	$7,422,000	$6,304,000	17 8	85	$4,586,000	$4,327,000	6.1
	Nov	64	3,391,000	2,834,000	19 7	65	10,159,000	8,873,000	14.5	52	8,454,000	7,063,000	19 7	84	4,661,000	4,410,000	5 9
	Dec	64	3,483,000	2,999,000	16.1	58	10,834,000	9,949,000	8.8	48	8,935,000	7,464,000	19 7	82	4,892,000	4,614,000	0 6
			1918	1917			1918	1917			1918	1917			1918	1917	
	Jan	63	3,393,000	2,990,000	13 8	64	9,677,000	9,517,000	1.6	53	8,862,000	7,639,000	16.8	86	5,113,000	4,831,000	5.8
	Feb	62	2,995,000	2,272,000	8.0	57	9,473,000	8,658,000	8.6	53	7,779,000	6,746,000	15.3	84	4,443,000	4,131,000	9 5
	March	62	2,985,000	2,724,000	9.2	59	9,904,000	8,922,000	11.0	53	7,947,000	6,735,000	18.0	84	4,560,000	4,321,000	5 5
	April	62	2,890,000	2,578,000	12 1	59	0,054,000	8,946,000	12.4	53	8,431,000	7,103,000	18.7	84	4,489,000	4,339,000	3.5
	May	62	2,810,000	2,530,000	11.5	64	19,929,000	8,613,000	15.3	53	8,217,000	6,956,000	18.1	83	4,805,000	4,327,000	12.0
	June	63	2,925,000	2,584,000	13.3	63	0,048,000	8,761,000	14.7	49	8,124,000	6,824 000	19 0	84	4,973,000	4,432,000	12 2
	July	62	3,037,000	2,511,000	20.9	62	19,278,000	7,961,000	16.5	42	4,998,000	4,116,000	21.4	88	4,622,000	3,971,000	16.4
	Aug	63	3,138,000	2,585,000	21.4	63	10,147,000	8,722,000	16.3	42	8,223,000	6,823,000	20.5	85	5,383,000	4,560,000	18.0
	Sep	53	2,746,000	2,365,000	16.1	50	9,149,000	7,766,000	17.8	30	6,858,000	5,734,000	19.6	71	3,769,000	3,217,000	17.1
			1917	1916			1917	1916			1917	1916			1917	1916	
KW.-HR. OUTPUT	Oct	64	121,666,000	94,853,000	28 5	66	589,242,000	472,619,000	24 5	52	417,018,000	351,713,000	17 0	85	394,223,000	359,955,000	9.6
	Nov	64	130.311,000	108,561,000	20 0	65	532,301,000	445,537,000	19 6	52	443,374,000	384,480,000	15 2	84	379,384,000	357,535,000	6.1
	Dec	64	135,703,000	111,342,000	21 8	58	548,316,000	486,368,000	12.7	48	437,264,000	367,534,000	12.8	82	395,518,000	377,058,000	4.8
			1918	1917			1918	1917			1918	1917			1918	1917	
	Jan	63	125,212,000	111,339,000	12 4	64	477,200,000	466,158,000	2 3	53	486,291,000	453,009,000	7 3	86	419,651,000	391,624,000	7.3
	Feb	62	110,454,000	102,562,000	7 7	57	438,721,000	403,122,000	8 3	53	358,276,000	342,257,000	4 5	84	346,766,000	320,025,000	8 4
	March	62	121,518,000	111,576,000	8 9	59	501,320,000	452,250,000	10.8	53	398,166,000	356,860,000	11.5	84	397,218,000	373,875,000	6.2
	April	62	117,416,000	101,888,000	15 2	59	497,460,000	431,786,000	15.2	53	437,054,000	392,304,000	11 4	84	399,126,000	372,465,000	7 1
	May	62	121,751,000	105,601,000	15.3	64	512,202,000	455,977,000	12 3	53	441,202,000	404,560,000	9.0	63	462,372,000	406,797,000	13 6
	June	63	125,809,000	103,292,000	21.8	63	527,773,000	461,396,000	14.4	49	423,439,000	366,382,000	15 5	84	454,078,000	388,374,000	16.9
	July	62	135,960,000	105,373,000	29.0	62	518,566,000	435,464,000	18 0	42	254,189,000	216,296,000	17.5	88	461,746,000	395,559,000	16.7
	Aug	63	143,566,000	114,017,000	25.9	63	567,672,000	490,505,000	15.7	42	447,829,000	399,278,000	12.1	85	488,443,000	413,350,000	18.1
	Sept	53	112,590,000	96,853,000	16.2	50	479,134,000	405,091,000	18.3	30	380,737,000	327,139,000	16.4	71	329,324,000	273,102,000	20.6

CONSERVATION OF WATER POWER IN NEW ENGLAND

Benefits of Conserving Power Through Storage Developments Discussed Before Special Legislative Committee on Conservation of Resources

The benefits of conserving water power through storage developments were discussed by a number of prominent engineers at Boston recently before the special legislative committee on the conservation of natural resources. Among the members of the committee are Chairman A. R. Weed of the Massachusetts Gas and Electric Light Commission, Chairman John N. Cole of the Massachusetts Waterways Board and Charles T. Main of Boston, consulting engineer.

The hearing was called with special reference to proposed storage developments on the Millers River, but during the session a general discussion developed of the benefits of storage in New England as a whole. The principal speakers were E. M. Whitney, Winchendon, Mass.; Guy M. Cox and William S. Whitney, counsel and chief engineer respectively of the American Woolen Company; W. Rodman Peabody, counsel for the Turners Falls Power & Electric Company; R. E. Barrett, general manager of the Connecticut River Conservation Company and engineer of the Turners Falls company; N. P. Avery, for the Holyoke (Mass.) Water Power Company; Arthur T. Safford, consulting engineer, Lowell, Mass., and R. A. Hale, principal assistant engineer Essex Water Power Company, Lawrence, Mass. Mr. Main also contributed to the discussion. The last-named speaker is a member of the engineering advisory board of the United States Fuel Administration, New England division. The speakers favored a comprehensive development of storage and stream-flow control under state regulation, though some differences of opinion arose as to the value of specific projects.

The development of increased power from the Millers River was first taken up by the committee. Mr. Whitney stated that in his opinion redevelopment of existing power sites as utilized would not increase the output of the stream over 10 per cent. He favored the construction of storage facilities, however, as a manufacturer using power, and expressed the opinion that state regulation of storage would be necessary. Without it, it is difficult to secure the largest possible use of the water for each and every power consumer.

Mr. Cox, for the American Woolen Company, stated that that organization is not interested in any further development of the river. He questioned the financial justification of a storage system. The company has a plant at South Royalston, 6 miles down-stream from Winchendon, and owing to the use of water by the Winchendon Electric Light Company and others, especially at night, the Woolen company, it was stated, cannot utilize the full flow of the stream.

Chief Engineer Whitney pointed out that on account of the demand for process steam it would be necessary to use about 70 per cent of the present coal consumption even if the full power of the river were continuously available. This figure is based upon the company's experience at the Washington Mills, Lawrence, when about 6000 hp. in steam-driven prime movers is shut down. At present there is no regulation in a broad sense of the stream flow in the Millers River.

Speaking for the Turners Falls Power & Electric Company, the second largest hydroelectric system in New England, Mr. Peabody favored a plan to establish storage reservoirs on the Millers River. This stream discharges into the Connecticut above the Montague City hydroelectric station of the Turners Falls company, and its equalization would be of value in the general supply of hydroelectric energy to central Massachusetts. The Cabot interests of Boston, operating the Turners Falls company, favor the development of a conservation plan by a private corporation under as strict state regulation as is necessary.

Mr. Peabody pointed out that coöperative, voluntary action rather than state development leads to the most satisfactory relations among the users of a stream. Storage development is a problem applying to seasonal conditions more than to the handling of twenty-four-hour load changes. Mr. Peabody said that the company's experience with storage has shown in a general way that it is practicable to pay for water passing through its wheels an approximate capital charge of $50 per 1,000,000 cu.ft. (28,000 cu.m.) of storage on a 58-ft. (18-m.) fall, or a yearly rate of about $4 per 1,000,000 cu.ft.

Mr. Barrett pointed out that the Turners Falls company is now coöperating in the building of storage reservoirs in New Hampshire and Vermont, and with promising results. On the Mascoma River, in New Hampshire, one-half the cost of storage development is being paid by the Connecticut River Conservation Company (formed by the New England Power Company and the Turners Falls Power & Electric Company), and the remainder by other beneficiaries.

Mr. Avery questioned the value of storage projects in connection with streams of the moderate size of the Millers River and the Deerfield River, with respect to large power-developing concerns situated in the middle Connecticut Valley. He contended that such developments are chiefly of local value, but said that the Holyoke company did not desire to oppose any broad program of betterment. He felt that the federal authorities or the various states of northern New England might well take up the development of storage facilities on a considerable scale in New Hampshire and Vermont.

Mr. Safford said that his experience indicates that it will pay to expend about $200 per 1,000,000 cu.ft. of storage where a 300-ft. (90-m.) development of the river can be attained. He cited a case in New Hampshire where it is proposed to develop 3,000,000,000 cu.ft. (85,000,000 cu.m.) of storage. About 100 ft. (30 m.) of the fall is on a local stream, and the project cannot be made to pay merely as a local undertaking, but with users in Massachusetts meeting about half of the cost the plan appears feasible. To improve flowage conditions on a large river a very large amount of storage must be provided. Here is an important field for interstate coöperation. Mr. Safford said that various textile mills in Lowell are now replacing their older and less efficient waterwheels with modern units, in order to obtain additional power under their leases of power on the so-called "mill-power" unit basis and also as a fuel-saving measure.

Mr. Hale pointed out that waterwheels of 75 to 80 per cent efficiency are now taking the place in various instances of units formerly operating at 60 per cent.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

STREET-LIGHTING CONTROL MOUNTED ON ONE POLE

Transformer Fuses and Time Switch for Street-Lighting System in a Small Town Distant from Central Station Controlled Automatically

Complete control of a distant street-lighting system is obtained by a central station in the East by placing the necessary apparatus on one ordinary line pole. The energy for the system is transformed on the pole to the voltage required by the street-lighting systems by means of the transformers shown in the illustration produced herewith. Leads are connected to the fuses at the top of the pole and then to the time switch installed about 8 ft. (2.4 m.) above the ground so that it can be easily adjusted by linemen who inspect it regularly. From there the wires are connected to the transformer the secondary of which supplies the energy for the street lamps.

By this construction a control station is eliminated and the system is accurately controlled as to lighting and extinguishing of lighting at such times as have been predetermined.

METHOD OF PRESERVING DISTRIBUTION RECORDS

How Mass of Detail Necessary in Connection with Secondary System Is Kept by Department That Has No Space for Large Maps

The distribution department of the Topeka (Kan.) Edison Company has no convenient place to hang a large map; moreover, it is believed in the department that a large map filled with detail concerning the primary and secondary distribution circuits of a company becomes so blurred with finger marks that it soon loses the sharp detail which a good map should have. Nevertheless, the value of a good map was appreciated and an effort to prepare one that would be satisfactory was made. For this purpose the city was divided into eighteen districts and ten outlying semi-rural districts were also mapped. These maps were made by revising the official map of the city and dividing it into sections.

From the sections 22-in. by 30-in. ((55-cm. by 76-cm.) tracings were made, which gave a map on a scale of 300 ft. to 1 in. (3600 to 1). From the tracings the department had Van Dyke negative prints made, and from these negatives blueprints were taken. This produced a blueprint in which the lines were blue and the background was white. This combination was more satisfactory than a blue background with white lines for making notations, as data could more easily be seen on the white than on a blue background. These prints were bound in an oilcloth folder. On each print were shown all of the company's secondary lines, the location, size and number of all of the poles of all the public service companies in the city participating in the joint pole agreement, and the secondary lines of the Edison company, as well as the sizes of wire, transformer locations, lightning-arrester locations and types of lightning arresters. All this pertained to the secondary system; the primary system was shown in another set of maps.

This record is found to be very helpful in locating poles which customers want moved and, in fact, for finding out anything about the secondary system except the details of arming and wire position. It is not believed by J. E. Gosset, superintendent of distribution, that detail of such minute character is needed by a company in a city the size of Topeka. Such additional data as are needed are kept in a book.

MINIMIZING MOTOR TROUBLES MET WITH IN ROLLING MILL

Slight Overvoltage Will Sometimes Cause Serious Overheating if the Motors Are Operated Continuously at Their Top Rating

BY J. HUFF

In the press of his daily work the plant electrician is prone to forget that a liberal application of common sense will cure many of the ills to which electrical apparatus is heir. This fact is well illustrated by an event that recently occurred in a rolling mill engaged on government work and pushed to the limit of its capacity.

The mill had been operating on a twelve-hour-day basis until the necessities of the government dictated that the machinery be kept running during the entire twenty-four hours. A new shift was put on and everything moved along well for two or three days. Then the "tilting-table" motors, which were of the induction slip-ring type and up to this time had given satisfactory service, began to show marked signs of overload. Failure became frequent, the mill was subjected to periods of enforced idleness, the disposition of the chief electrician was adversely affected, and the maintenance men were kept so busy changing motors that they had little time for other considerations.

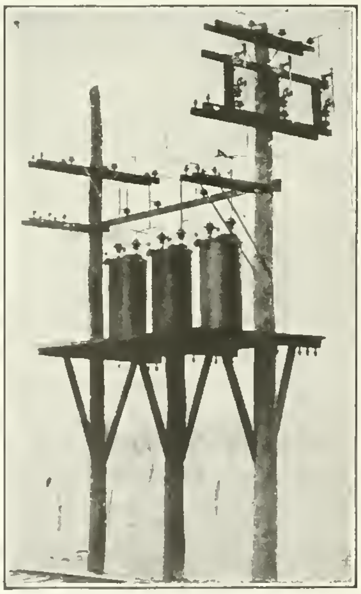
Finally there came a time when all the spare motors were in the repair shop. Not only the mill hands but the maintenance men as well were forced to wait while motors were being rewound at a cost of $350 each. The situation evidently called for generalship, and the chief electrician detailed a man to give his entire attention to the relays which should have afforded protection for the motors in question, which were subject to the manipulation of the table operators. This arrangement proved unsatisfactory because of the antagonistic attitude taken by the head roller, who naturally resented any program that tended to slow down the rate of production in his department.

After spending something like $5,000 on motor repairs and wasting much valuable time it was decided to investigate the starting resistances. No trouble was apparent. In the course of this investigation, however, it was found that the supply voltage was somewhat higher than that for which the motors were designed, and the expedient of permanently connecting a little resistance in the motor leads was resorted to. In view of the conditions to be met the I^2R loss was negligible, and on the whole the solution of the problem was as satisfactory to all concerned as it was simple.

ECONOMICAL SUBSTATION BUILT ON RIGHT-OF-WAY

Transforms Energy from 11,000 Volts to 2300 Volts for Distribution in Towns Distant from Main Station—Three-Pole Construction Very Rigid

By constructing an outdoor substation on the transmission line right-of-way the Elmira (N. Y.) Water, Light & Railway Company has been able to serve a small town distant from the main power plant in an effective and economical manner.



SMALL TOWN SUBSTATION

The substation, as shown in the accompanying illustration, consists of three transformers mounted on a three-pole-supported platform, one pole of which is the terminus of the 11,000-volt line and the other pole the beginning of the 2300-volt consumer distribution feeder. Eleven-thousand-volt lines terminate in the tall pole, run through the knife switches and then are strung to the smaller poles. Taps are taken off these three lines to the transformer to form a delta connection. The lead wires from the 11,000-volt bus to the transformer terminals are held rigid by three insulators mounted on a board fastened in a horizontal position to the two end poles. This eliminates any chance of the wires getting out of place. The 2300-volt lines start at the main pole and run to the opposite one and then to the distribution line. Connections are made to the secondary terminals of the transformer from these three lines.

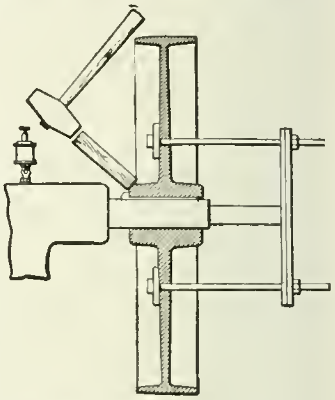
It happens that this substation is also on the railroad right-of-way, and the railroad feeders, telephone and signal wires are held in place beneath the platform by insulators. This prevents any danger of their coming in contact with the high-tension lines.

WAY OF REMOVING TIGHT FLYWHEELS AND PULLEYS

Use of Wedges or Gasoline Torch Will Usually Suffice and Home-Made Rigging Will Serve When the Former Fail

BY H. S. RICH

When it is necessary to remove a tight flywheel or pulley which it seems impossible to budge it is then that ingenuity more than sheer force is demanded if no damage is to be done to either the wheel or the shaft.



METHOD OF REMOVING PULLEY

First remove the set screws very carefully without wrenching off the heads. Then with proper-shape drifts drive out the key, marking it so that the small end may be identified for replacement.

The trouble will likely begin now, so be reasonable and careful. The first mental impulse will probably tell you to get behind the wheel with as much leverage as possible and try to start it along the shaft. Sometimes this works, but too much force may spring the shaft or crack the bearing. Try a number of thin hard-wood wedges or iron shims if they are to be had and force them tightly behind the wheel on both sides of the shaft. While a helper taps on first one wedge, then the other, strike the hub of the wheel repeated blows so that it may start. In the meantime pour kerosene into the set-screw holes to let it work around the shaft.

If the wheel still refuses to move, apply two gasoline torches to the hub for a few minutes, being careful not to heat the shaft. This will expand the hub slightly, and then by striking the wedges it may be started a little.

If all these efforts fail to produce any effect, then a special rigging like one pictured herewith may be used. It consists of two flat plates to fit behind the spokes of the wheel each with a hole drilled through the center. Through these holes run square-head bolts about 12 in. (30 cm.) long, threaded for about 9 in. (23 cm.) of their length. Over the threaded ends slip two flat plates 3 in. (8 cm.) wide and 0.5 in. (13 mm.) thick with heavy nuts. Between the last plates mentioned and the end of the shaft place a piece of pipe or round bar 5 in. (13 cm.) long and with a heavy wrench turn first one nut then the other till the whole is tightened up and a pulling stress is exerted on the pulley. Help it along by hitting the rear of the pulley hub as the nuts are taken up. No wedges are now needed.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

NO CURTAILMENT MADE IN STREET-LIGHTING CHARGES

Full Amount of Contract Collected Because of Increased Cost of Glassware, Labor and Electrical Energy

The Clinton (Iowa) Gas & Electric Company operates an ornamental boulevard lighting system consisting of five-light electroliers on which the top lamp is burned only on Monday and Tuesday. The top lamps are 70-watt type C units and the bottom lamps are 40-watt units. The company gets $5 per month for these posts and has been able to collect the full amount because it pointed out to the city authorities the increased cost of glassware, labor and electrical energy. Practically no difficulty was experienced in doing this.

WAR-TIME PROBLEMS OF THE UTILITIES COMMISSION

Illinois Commission During Recent Period Confronted with Necessity to Speed Rate Cases and with Other Serious Problems

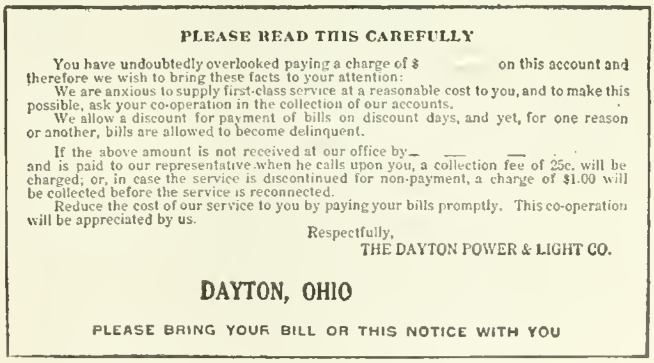
In a report on the war-time problems of the Public Utilities Commission of Illinois the engineering department of the commission reviewed the policies actuating the commission in its program of accelerating rate cases by shortening valuation and other time-consuming procedure. In addition it was stated:

> In meeting the various service conditions during this period other problems have arisen of as serious a character as those involved in rate determinations. Utilities entered upon this period with certain definite equipment and plants for handling their business. Almost overnight in some cases they found themselves confronted with the necessity of furnishing largely increased outputs under heavily increased expenses in order to meet demands principally occasioned by industries connected with the production of war material. In some cases the plants of these utilities were incapable of meeting these conditions and giving satisfactory service to regular customers. These facts have been brought forth repeatedly in hearings before the commission and in informal matters which have not been placed upon the docket. These matters have been handled individually as each individual case has warranted.
>
> In some cases the commission has gone to the extent of ordering an interconnection between utility properties for the purpose of making additional capacity available for the purpose desired. Numerous negotiations looking toward interconnection have been carried on informally, with results which have been quite satisfactory. In one case the commission has been called upon to differentiate between certain classes of consumers, indicating which class should have preference in calling for reserve capacity of utility equipment. In making such differentiation the commission was governed by the wishes of the national government as expressed in some of its priority orders.
>
> Regarding the future trend of utility rates and regarding the future methods best to be followed by the commission, considerable conjecture exists. We are bound to face the proposition that even with the declaration of peace and the return of our country to more normal conditions, prices and operating conditions will not immediately revert to their former basis, and it is extremely doubtful if they will ever revert to that basis. It is also to be anticipated that very different operating conditions will prevail in the future from those in the past. During recent periods the government has endeavored to instill in the public mind ideas of conservation to a greater extent than the American people have ever before attempted. These efforts of the government have been assisted by prevailing prices, which have offered great incentives to economy and adoption of labor-saving methods.
>
> The question as a whole is a very large one, and time alone can tell in what manner its solution will be worked out. It appears certain, however, that during the next few years adjustments of utility rates will have to be made upon a very wide scale. It is not anticipated by the commission that these adjustments, which will be more or less upon a permanent basis, will be attempted under the methods which have recently prevailed. Neither party to the case, we believe, would be willing to follow such methods —at least in the completeness in which they have recently been adopted. It would appear that upon the return of conditions to a more normal basis adjustments of utility rates would have to be undertaken based upon a more complete investigation and a greater knowledge of the details which prevail. Further than this it is folly to predict.

STRICT POLICY ADOPTED TOWARD DELINQUENTS

Dayton Company Sends Out Only One Notice, After Which 25 Cents Is Charged if Collector Is Sent Out and $1 for Reconnection Charge

Owing to the increased costs of supplying service, the Dayton (Ohio) Power & Light Company has adopted the policy of charging 25 cents as a collection fee, when a collector has to call, and a reconnection charge of $1. As a result of this policy the company has prepared a new delinquency notice as shown. This particular notice is the only one the company now sends out to its delinquent customers. At one time the company was sending out two notices to a customer before he was cut off for non-payment.



PLEASE READ THIS CAREFULLY

You have undoubtedly overlooked paying a charge of $ on this account and therefore we wish to bring these facts to your attention:

We are anxious to supply first-class service at a reasonable cost to you, and to make this possible, ask your co-operation in the collection of our accounts.

We allow a discount for payment of bills on discount days, and yet, for one reason or another, bills are allowed to become delinquent.

If the above amount is not received at our office by________ and is paid to our representative when he calls upon you, a collection fee of 25c. will be charged; or, in case the service is discontinued for non-payment, a charge of $1.00 will be collected before the service is reconnected.

Reduce the cost of our service to you by paying your bills promptly. This co-operation will be appreciated by us.

Respectfully,
THE DAYTON POWER & LIGHT CO.

DAYTON, OHIO

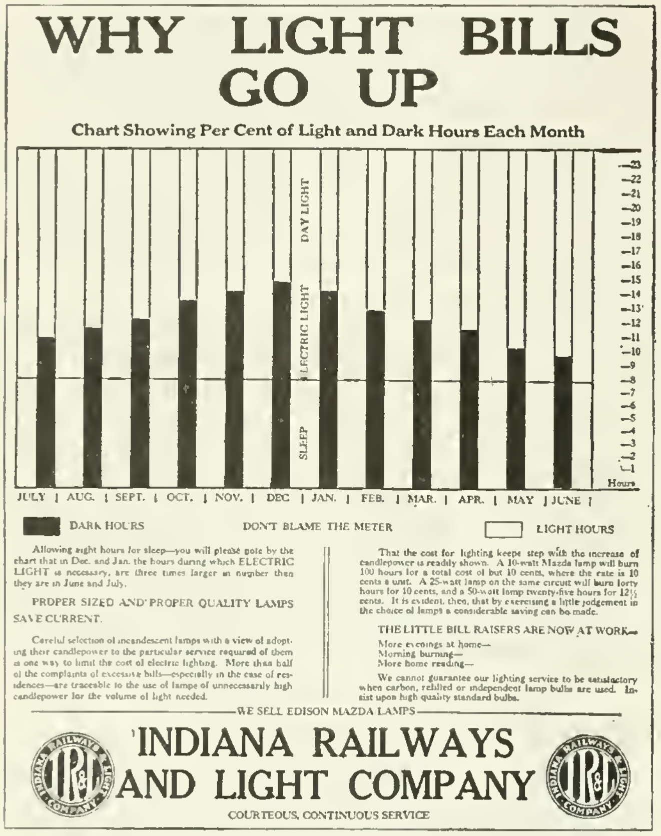
PLEASE BRING YOUR BILL OR THIS NOTICE WITH YOU

A POINTED HINT TO DELINQUENTS

ANTICIPATING COMPLAINTS ON BILLS THOUGHT TOO HIGH

A Little Advertising in the Autumn Saves Hours of Explanation Later in the Year When Accounts Reach Customers

In preparation for the time when bills which will appear exceedingly high will be presented to its customers, the Indiana Railways & Light Company, Kokomo, Ind., uses advertising of the character shown here. In normal years many central stations have found it good policy to use this class of advertising in the fall. This year the necessity for it was all the more urgent because the change in the clocks accentuated the increase which usually occurs in electric service bills at this season.



Allowing eight hours for sleep—you will please note by the chart that in Dec. and Jan. the hours during which ELECTRIC LIGHT is necessary, are three times larger in number than they are in June and July.

PROPER SIZED AND PROPER QUALITY LAMPS SAVE CURRENT.

Careful selection of incandescent lamps with a view of adopting their candlepower to the particular service required of them is one way to limit the cost of electric lighting. More than half of the complaints of excessive bills—especially in the case of residences—are traceable to the use of lamps of unnecessarily high candlepower for the volume of light needed.

That the cost for lighting keeps step with the increase of candlepower is readily shown. A 10-watt Mazda lamp will burn 100 hours for a total cost of but 10 cents, where the rate is 10 cents a unit. A 25-watt lamp on the same circuit will burn forty hours for 10 cents, and a 50-watt lamp twenty-five hours for 12½ cents. It is evident, then, that by exercising a little judgement in the choice of lamps a considerable saving can be made.

THE LITTLE BILL RAISERS ARE NOW AT WORK—

More evenings at home—
Morning burning—
More home reading—

We cannot guarantee our lighting service to be satisfactory when carbon, refilled or independent lamp bulbs are used. Insist upon high quality standard bulbs.

WE SELL EDISON MAZDA LAMPS

INDIANA RAILWAYS AND LIGHT COMPANY

COURTEOUS, CONTINUOUS SERVICE

HOW MIDDLE WEST UTILITY SEEKS TO EDUCATE CUSTOMERS

THE LABOR SHORTAGE IN SMALL CENTRAL STATIONS

Under Present Conditions Manager of Small Company Is Harassed by Many More Difficulties than He Encounters in Normal Times

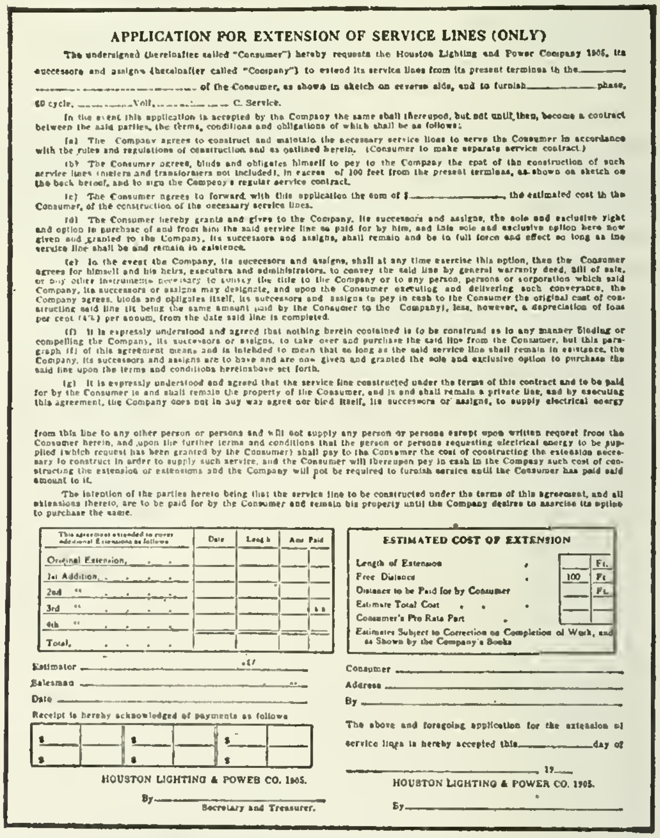
The shortage of labor is a problem which is giving the operators of small central stations no little concern. The smaller stations have never been financially able to employ the higher-grade engineers but have had to rely on one fairly competent chief for general supervision and two or three shift men combining the duties of engineer and fireman whose experience is limited to a working knowledge of threshing engines or like equipment. Often the job of chief engineer devolves on the manager with his other duties, and under normal conditions such arrangements have been found satisfactory.

Now, however, employees are restless and are demanding higher and higher wages and frequently leaving on short notice. Operators consequently must spend valuable time in training raw recruits, and equipment depreciates rapidly because of inexperience and neglect. Employees' bonuses for good and continued service have been successful to a degree but have not solved the problem. So serious has this become that some of the very small companies have curtailed their hours of service simply because they could not secure help with which to operate a twenty-four-hour schedule.

CITY REDUCES ITS FREE EXTENSION DISTANCE

Houston Company Now Has to Provide Only 100 Ft. of Line—Customer to Pay for All in Excess of This

A new ordinance has just been passed by the city of Houston, Tex., reducing the distance for which services must be provided by the electric light company in connecting up new consumers. The old ordinance provided for 300 ft. to the right or left of any service line, but the new ordinance reduces this distance to 100 ft. and specifies that anything in excess of 100 ft. shall be paid for by the customers. To take care of this new condition and assist in making it perfectly clear to the customers, the Houston Lighting & Power Company has developed a new card form of extension contract, which is reproduced here. On this contract every detail covering the extension and its costs is carefully set forth, and it is proving a very helpful bit of system.



APPLICATION FOR EXTENSION OF SERVICE LINES (ONLY)

The undersigned (hereinafter called "Consumer") hereby requests the Houston Lighting and Power Company 1905, its successors and assigns (hereinafter called "Company") to extend its service lines from its present terminus to the ________ ________ of the Consumer, as shown in sketch on reverse side, and to furnish ________ phase, 60 cycle, ________ Volt, ________ C. Service.

In the event this application is accepted by the Company the same shall thereupon, but not until then, become a contract between the said parties, the terms, conditions and obligations of which shall be as follows:

(a) The Company agrees to construct and maintain the necessary service lines to serve the Consumer in accordance with the rules and regulations of construction and as outlined herein. (Consumer to make separate service contract.)

(b) The Consumer agrees, binds and obligates himself to pay to the Company the cost of the construction of such service lines (meters and transformers not included), in excess of 100 feet from the present terminus, as shown on sketch on the back hereof, and to sign the Company's regular service contract.

(c) The Consumer agrees to forward with this application the sum of $________, the estimated cost to the Consumer, of the construction of the necessary service lines.

(d) The Consumer hereby grants and gives to the Company, its successors and assigns, the sole and exclusive right and option to purchase of and from him the said service line so paid for by him, and this sole and exclusive option here now given and granted to the Company, its successors and assigns, shall remain and be in full force and effect so long as the service line shall be and remain in existence.

(e) In the event the Company, its successors and assigns, shall at any time exercise this option, then the Consumer agrees for himself and his heirs, executors and administrators, to convey the said line by general warranty deed, bill of sale, or any other instruments necessary to convey the title to the Company or to any person, persons or corporation which said Company, its successors or assigns may designate, and upon the Consumer executing and delivering such conveyance, the Company agrees, binds and obligates itself, its successors and assigns to pay in cash to the Consumer the original cost of constructing said line (it being the same amount paid by the Consumer to the Company), less, however, a depreciation of four per cent (4%) per annum, from the date said line is completed.

(f) It is expressly understood and agreed that nothing herein contained is to be construed as in any manner binding or compelling the Company, its successors or assigns, to take over and purchase the said line from the Consumer, but this paragraph (f) of this agreement means and is intended to mean that so long as the said service line shall remain in existence, the Company, its successors and assigns are to have and are now given and granted the sole and exclusive option to purchase the said line upon the terms and conditions hereinabove set forth.

(g) It is expressly understood and agreed that the service line constructed under the terms of this contract and to be paid for by the Consumer is and shall remain the property of the Consumer, and is and shall remain a private line, and by executing this agreement, the Company does not in any way agree nor bind itself, its successors or assigns, to supply electrical energy from this line to any other person or persons and will not supply any person or persons except upon written request from the Consumer herein, and upon the further terms and conditions that the person or persons requesting electrical energy to be supplied (which request has been granted by the Consumer) shall pay to the Consumer the cost of constructing the extension necessary to construct in order to supply such service, and the Consumer will thereupon pay in cash to the Company such cost of constructing the extension or extensions and the Company will not be required to furnish service until the Consumer has paid said amount to it.

The intention of the parties hereto being that the service line to be constructed under the terms of this agreement, and all extensions thereto, are to be paid for by the Consumer and remain his property until the Company desires to exercise its option to purchase the same.

This agreement extended to cover additional Extensions as follows	Date	Length	Amt Paid	
Original Extension,				
1st Addition,				
2nd "				
3rd "				
4th "				
Total,				

ESTIMATED COST OF EXTENSION

Length of Extension		Ft.
Free Distance	100	Ft.
Distance to be Paid for by Consumer		Ft.
Estimate Total Cost		
Consumer's Pro Rata Part		

Estimates Subject to Correction on Completion of Work, and as Shown by the Company's Books

Estimator ________
Salesman ________
Date ________

Receipt is hereby acknowledged of payments as follows

$		$		$	
$		$		$	

HOUSTON LIGHTING & POWER CO. 1905.
By ________
Secretary and Treasurer.

Consumer ________
Address ________
By ________

The above and foregoing application for the extension of service lines is hereby accepted this ________ day of ________ 19__

HOUSTON LIGHTING & POWER CO. 1905.
By ________

FORM FOR EXTENSION APPLICATION USED BY TEXAS COMPANY

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Size and Working Cost of Machines for Continuous-Current Transformation. — THOMAS CARTER. — This article discusses various methods of continuous-current transformation. The author (1) considers the differences existing between three schemes using a motor-generator and arrives at expressions for the relative sizes of these machines which are plotted in curves based on an assumed 100 per cent efficiency; (2) draws certain conclusions from these expressions and curves in regard to the first cost of the machines and their method of operation; (3) introduces corrections for the actual case when efficiency is not 100 per cent and deduces curves of over-all efficiency of transformation which show that the cheapest set to buy is also the cheapest set to run; (4) concludes by comparing a machine having a double-wound armature with a motor-generator as regards voltage regulation and by mentioning briefly certain well-known schemes for variable-speed motors which may be simply dealt with on the principles pointed out.—London *Electrician*, Oct. 11, 1918.

The Semi-Diesel Oil Engine.—JAMES RICHARDSON.—The author discusses the theory of the semi-Diesel oil engine as indicated by the following topics: Definition of the semi-Diesel engine, disadvantage of high compression, fuel economy, cycle of operations, flexibility, scavenging, injection, fuel, starting, reliability and regularity in operation. In conclusion, the writer states that the rapid extension within the last few years not only of the field of application but also of the size of engine and power developed per cylinder with semi-Diesel engines foreshadows considerable development in the near future. But practical difficulties would seem almost to confine the semi-Diesel engines to the two-stroke cycle. Developments toward improving the efficiency of scavenging and compression may well be expected.—London *Engineering*, Oct. 25, 1918.

Efficiency of Machines with Aluminum Windings.—G. SCHONWALD.—The question is considered whether aluminum is likely to be used as a material for the windings of electric machinery after the war, and calculations are made recording the changes in the dimensions of the machinery that would be necessary to obtain efficiencies as high as are obtained with machines having copper windings. Hitherto the requirements of the war have made it necessary to use existing frames and to replace the copper with aluminum in such a way as to obtain the greatest output with the smallest amount of material. This method is considered at length by R. Richter in his book entitled "Electric Machines with Windings of Aluminum, Zinc and Iron." It is now shown that machines of equal efficiency may be built with windings partly of copper and partly of aluminum. For instance, a direct-current machine may have armature winding of copper and field winding of aluminum. In this way about three-fourths to four-fifths of the copper may be replaced by aluminum. The aluminum windings contemplated are not the uninsulated ones that were already used before the war, but windings insulated in the same way as copper windings usually are. The question whether this machine would be able to compete commercially is difficult to decide at present, but on the assumption that the cost of the copper windings on the main and commutating poles amounts to one-half or three-fourths of the price of the cast-iron yoke and pole cores, the price of the aluminum windings should not exceed that of the copper windings for equal weights by an amount exceeding 30 to 45 per cent in order that the original copper machine and the modified aluminum machine should cost the same amount. It appears that there is some prospect of machines with aluminum windings being able to compete with machines with copper windings after the war.—*Science Abstracts, Section B,* September, 1918. (Abstracted from *Electrot. u. Maschinenbau,* May 26, 1918.)

Generation, Transmission and Distribution

Steam Turbines for Natural-Steam Power Plant at Larderello, Italy.—Mention has heretofore been made of the natural-steam power plant installed at Larderello in the province of Tuscany, Italy, and in the present article a description is given of the steam-turbine plant by which the supply of natural steam is utilized. In this region there is a constant emission of steam and hot water from crevices and fissures in the ground. In order to increase the output from these crevices holes were sunk to supplement the natural flow. Some of these holes are as much as 16 in. (40 cm.) in diameter and range in depth from 200 ft. to 500 ft. (60 m. to 150 m.). The supply was thus largely augmented, and on closing in the top of some of the bore holes it was found that the steam pressure reached about 45 lb. (22,000 kg. per sq.m.) gage. This observation led to the idea of utilizing the steam for power production. The plant for the utilization of this natural-steam supply consists essentially of three 2500-kw. turbines constructed and erected by Franco Tosi of Legnano, Italy. These turbines run at 3000 r.p.m. and are coupled to Brown-Boveri generators supplying three-phase current at 4000 volts and at 50 cycles per second. The turbines are of the standard exhaust steam type with reaction blading. Further details of the plant arrangement and equipment are given in the article.—London *Engineering*, Sept. 27, 1918.

Calculation of Inductive Circuits in Parallel.—FERNAND ERNSTEIN.—In this study the author shows that it is possible to treat by the method of complex quantities and without too long calculations the general case of *n* inductive circuits in parallel and mutually influencing one another.—*Revue Générale de l'Electricité*, Oct. 19, 1918.

Tests and Measurements on Electric Lines.—LOUIS PUGET.—The classic method of measuring electrical resistances by means of the Wheatstone bridge necessitates the use of cumbersome and costly devices, can be employed only by experienced men and has technical objections besides. The author indicates two processes for measuring resistances and for locating losses to earth by methods of comparison. These methods, which can be carried out by the regular employees, require only a milliammeter and a commutator. In hunting for defects of insulation they permit immediate determination whether the defect is at either extremity of the line or in the intermediate part. If it is in the intermediate part, the calculation reduces itself into simple division.—*Revue Générale de l'Electricité*, Oct. 19, 1918.

Installations, Systems and Appliances

Automatic Three-Phase Switch.—W. ERNST.—Automatic switches are used for intermittent work, as with pumps and compressors, or in cases where some sort of distant control of the motors is used. In installations of considerable size there are complications owing to the necessity of bringing the rotor starter out of the short-circuit position. This means some difficulty with special reversing relays if the design is such that the auxiliary motor, which is generally used, changes its direction of rotation. A simplification, however, has been effected in a plan outlined in this article by which the auxiliary motor always rotates in the same direction.—London *Electrician*, Oct. 11, 1918.

Snook Apparatus for the Generation of High-Tension Unidirectional Currents.—RUSSELL S. WRIGHT.—The Snook apparatus consists essentially of a high-tension alternating-current transformer in conjunction with a rotating secondary commutator or rectifier, the latter being driven in exact synchronism with the periodicity of the current.—London *Electrician*, Oct. 4, 1918.

Storing Direct-Current Aluminum Arresters for the Winter.—F. T. FORSTER.—This article points out the ill effects of leaving the plates of an aluminum arrester standing in the electrolyte when out of service in the winter months. A satisfactory method of preparing arresters for storage is given, and if these instructions are followed no trouble should be experienced when putting the arresters back in service.—*General Electric Review*, November, 1918.

Electric Thermal Storage for Heating Rooms.—The article is based on the work of the Commission for Heating and Cooling Apparatus concerning the possibility of storing heat for room warming by utilizing surplus energy from hydroelectric stations during night hours when the demand for lighting and power is comparatively low.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Schweiz. Elektrot. Verein*, Bull. 9, June, 1918.)

Industrial Electric Furnaces.—JEAN ESCARD.—The author classifies the principal types of electric furnaces actually used in industry according to their method of operation, giving a summary description of them and indicating the conditions which should govern their installation and performance.—*Revue Générale de l'Electricité*, Oct. 19, 1918.

Electrophysics and Magnetism

Electrical Resistance of Porcelain at Different Temperatures.—R. G. ALLEN.—The resistance of eight samples of porcelain was investigated up to about 250 deg. C., three methods of measurement being employed. These involved the use of (a) a megger, (b) a high-resistance galvanometer, (c) a 0.005-mfd. condenser, the rate of leakage of which was determined by a Kelvin multicellular electrostatic voltmeter. Over the limited temperature range investigated it was found that the specific insulation resistance d and the absolute temperature T were related by the formula $\log d = a/T + b$, due to Rasch and Hinrichsen. a and b are constants for the material under consideration, and the author suggests that these may serve to identify the origin of the porcelain.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Royal Dublin Society Proceedings*, June 1918.)

Insulating Properties of Erinoid.—R. G. ALLEN.—Tests were carried out on different colored samples of erinoid and also on red vulcanized fiber with the object of comparing the properties of the two materials for insulating purposes. The author finds that in the case of tubes of erinoid the specific insulation resistance is higher when unprepared than when machined, and blonde erinoid has a higher specific resistance than any of the other varieties and higher than the red fiber tested. When dry, erinoid is a good insulator, but slightly hygroscopic, though not so much so as fiber. When its surface is not machined the resistance of erinoid depends greatly on the value of the applied voltage unless water electrodes are used. This dependence is very slight in the case of unmachined fiber either with mercury or water electrodes. But in the case of machined erinoid the resistance is almost indepedent of the voltage. Rasch and Hinrichsen's relation between temperature and resistance holds both for erinoid and fiber (over the range 0 deg. to 80 deg. C.).—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Royal Dublin Society Proceedings*, August, 1918.)

Hysteresis Losses for Direct-Current and Alternating-Current Magnetization.—L. DREYFUS.—The author discusses the results of Gumlich and Rose on the total losses in ring specimens magnetized by alternating current (*Abstract* 1098—1905). Gumlich and Rose expressed the losses as the sum of two terms, namely: $vnB^{1.6}$ and v^2fB^2, where $v =$ frequency. The first term is the ordinary hysteresis loss, giving constant Steinmetz coefficient n. The second term is the eddy-current loss; f, however, is not constant, but diminishes to $B = 12{,}000$, and then becomes fairly constant. The author points out that there is no proper theoretical basis for the assumption of identity of static and dynamic hysteresis loops. The eddy-current loss being calculated, there is a further hysteresis loss which increases with v^2.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Archiv. f. Elektrot.*, 6, pp. 437-440, 1918.)

Instrument for the Analysis of Wave Shapes.—A. ROTH.—Resonance methods have been applied to the oscillograph to enable wave shapes to be analyzed, but this method involves the difficulties of use of the oscillograph. The instrument here described enables the magnitude of harmonics to be obtained directly by a reading on a dynamometer. The method of measurement is simple, no rotating parts are required, and the apparatus is suitable for use on high voltages. The principle of action is based on the properties of parallel oscillating circuits of different natural frequencies. After making a mathematical investigation of the characteristics of such circuits, the instrument is described. It consists of a dynamometer with two fixed coils and one moving coil. One of the fixed coils is connected across the line in series with a non-inductive resistance; the second is connected across the line in series with a circuit consisting of two parallel oscillating circuits with natural frequencies greater and less than that of the harmonic that is being sought; the moving coil is connected across the line in series with an oscillating circuit adjusted to the frequency of the harmonic. The two fixed coils are differential in their action. Under these circumstances, if the constants of the various circuits are suitably chosen, the instrument responds only to currents of the frequency of the harmonic to be measured, and its reading will be proportional to the magnitude of that harmonic. In the second part of the paper the details of the practical application of the method are considered, as well as the precautions necessary to eliminate errors due to the presence of harmonics other than the one being measured. The dimensions and construction of the instrument are given and the disturbing effects calculated that are introduced by the use of iron in the magnetic circuit, the self and mutual inductions of the coils, and by the change of the resistances of the coils owing to temperature variations. Lastly it is shown how the natural frequencies of the oscillating circuits should be adjusted. A number of wave shapes are analyzed by the instrument and by a mathematical method, and the results are found to be in good agreement. The instrument gives accurate values for harmonics that have a magnitude greater than 1 to 1.5 per cent of the fundamental. It is a drawback of the method that the phase relations of the harmonics are not determined.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Archiv. f. Elektrot.*, 6, pp. 359-376 and 388-406, 1918.)

Electrochemistry and Batteries

Electricity Releases Chemistry's Power.—JAMES M. MATTHEWS.—At the outbreak of the war imports from Germany were shut off and the nations were unpreparedly thrown upon their own resources. This condition and our entry into the war have resulted in our chemical industry growing as if by magic, and it is now our fourth largest enterprise. In this expansion electricity has played an important part, and in the maintenance of the industry on its new great scale electricity will be indispensable. Before the war the fixation of nitrogen had been carried on in Germany on a large scale by methods which had been kept secret, and Germany was enabled to store large quantities of nitrogen made by this process in addition to that obtained from the Chile saltpeter which had been accumulated. American chemists and electrical engineers have rediscovered these secrets and are now making nitrogen by these processes, greatly improved by American methods. It has been estimated that the production of nitric acid in the United States by next spring will be nine times normal. America will be more than independent in obtaining nitrogen compounds, especially as she can make synthetic nitrates cheaper than she can buy Chile saltpeter. To replace the supply of potash cut off from Germany American chemists and electrical engineers have shown the way to the potash in our lakes, slates, rocks and seaweed, and also how it can be precipitated electrically from the dust-laden waste gases of cement mills and blast furnaces. Formerly fully 90 per cent of our artificial dyes and colors which replaced natural dyes were imported. Our chemists have, however, not only made America the largest producer of natural dyestuffs in the world but have discovered upward of 200 artificial dyes which meet America's needs for acid, basic, chrome and direct dyes. The writer then continues to show how electrochemical products indispensable to warfare have been developed in this country. He also shows that chemistry's basic industry relies on electrical power.—*General Electric Review*, November, 1918.

Telegraphy, Telephony and Signals

Wireless Telegraphy System of the French Government.—J. B. POMEY.—The system of wireless telegraphy of Bouthillon consists of charging a condenser by a constant emf. The process consists in a rise in the charge on the condenser until a spark passes across the gap and discharges the condenser. This is again charged, and so on. The charging currents flowing at the moments of the breakdown of the gap tend to a limiting value, and when this is reached the condition of musical sparking is obtained. The equations of the system are worked out both for revolving spark discharges and for stationary gaps, and the stability of the operation is investigated.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Rev. Gén. d'Elec.*, May 11, 1918.)

Charging of a Condenser with Alternating Current.—J. B. POMEY.—The conditions that exist during the charging of a condenser shunted by a spark gap and fed from an alternating-current supply are examined from a mathematical point of view. The relations between the constants of the circuit are obtained for the maximum energy to come into play. In order that the sparks should pass in the same direction, the musical frequency must be half that of the supply. The value of the sparking voltage for the state of musical sparking is determined. It is probable that this corresponds to a very stable state.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Rev. Gén. d'Elec.*, July 6, 1918.)

Miscellaneous

Technics of Magneto-Magnets.—ELLIS H. CRAPPER.—It is generally agreed that the laws and characteristics of the magneto-magnet are not so well defined as those of the electromagnet associated with the design of an ordinary dynamo, in which soft iron and not hard steel is the material utilized. The complexities are accentuated in the case of permanent magnets of the magneto type in consequence of their special shape, which gives full scope to the introduction of irregular strains while the material is being cogged, rolled, bent, hardened, drilled and ground, operations which give rise to lack of uniformity in quality and hardness of the finished magnet. The author reviews the theory of permanent magnet properties and shows the application to the design of magneto-magnets.—London *Engineering*, Oct. 4, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities
in the Technical, Commercial and
Manufacturing Fields

DR. GARFIELD RESIGNS AS FUEL ADMINISTRATOR

Resignation, Tendered to Take Effect at the Pleasure of the President, Is Accepted—To Care for Domestic Consumers

The resignation of Dr. H. A. Garfield as United States Fuel Administrator and its acceptance by the President were announced at the White House on Dec. 3.

In the official announcement it was stated that Dr. Garfield had tendered his resignation to take effect at the pleasure of the President. It was made clear, the announcement said, "that the needs of domestic consumers will continue to receive the attention of the Fuel Administration until the winter is past."

Washington advices said that Dr. Garfield would continue his work until the first of the year, but that he would then resume his duties as president of Williams College.

Dr. Garfield was called to Washington by President Wilson to take charge of the government control of production and distribution of fuel. The work was developed so that it dealt not only with production and distribution, but also with the economical use of different forms of fuel. It covered the question of prices, wholesale and retail, and comprised rigid supervision of larger users of fuel as well as educational campaigns among consumers.

TRANSFERRING THE WORK OF THE FUEL ADMINISTRATION

Assimilation of Some Departments of the War Organization Is Begun by the Bureau of Mines and the Geological Survey

After the close of a conference with Van H. Manning, director of the United States Bureau of Mines, and Dr. George Otis Smith, Director of the United States Geological Survey, United States Fuel Administrator Harry A. Garfield announced that the assimilation of some departments of the Fuel Administration would be begun soon by the two first-named government departments.

The statistical bureau of the Fuel Administration is to be taken over by the Geological Survey.

The work of the conservation bureau is to be taken over by the Bureau of Mines, which will continue the work of maintaining the quality of coal and improving processes of mining which has been developed by the Fuel Administration.

The Bureau of Mines also will take over the engineering program of the Fuel Administration looking to the development of electrical power at or close to coal mines.

The United States Fuel Administration, which will be terminated automatically upon proclamation of peace, will pursue its course with that end in view, relinquishing its various activities as they become unnecessary under armistice conditions, and continuing to function where its services still are required.

RESTRICTIONS ON PRICES AND ZONES FOR BITUMINOUS COAL

Production and Distribution So Satisfactory that Dr. Garfield May Abolish All the Restrictions—Anthracite Will Still Need Attention

Bituminous coal production and distribution have reached such a satisfactory point in relation to demand that he is contemplating the possibility of abolition of all price and zone restrictions on bituminous coal on Dec. 15, United States Fuel Administrator H. A. Garfield said on Nov. 30.

Anthracite distribution remains a problem that will require the active attention of the Fuel Administration for an indefinite period, he said. Other branches will so far have completed their work by Jan. 1 that only a nucleus of their organizations will be necessary after that date, Dr. Garfield said, so far as present circumstances indicate.

Why Labor Is High Nowadays

This is how the ELECTRICAL WORLD artist was impressed by the statement of S. B. Irelan, manager of the Montgomery Light & Water Power Company, a Doherty property, that he has solved the problem of why he cannot get negro labor at the gas plant at the old figures, if at all. Mr. Irelan submits in evidence an actual occurrence of recent date, to wit:

Negro Applicant—Boss, I hear yuh needs a stokah.

Boss—We do. Do you want a job?

N. A.—Yassuh. How much yuh pay?

Boss—You come to work to-morrow, and we will pay you what you're worth.

N. A.—I cain't do it, boss, 'caze Ah gets mo'an dat now.

ENGINEERING SOCIETIES TO HAVE EMPLOYMENT BUREAU

Decision of the Engineering Council—Replying to Letter on Reconstruction Commission, President Wilson Favors Existing Machinery

At a special meeting of the Engineering Council called on Nov. 21 to determine approximate limitations on its field of activity and to consider a working program, it was decided that an engineering societies' employment bureau should be established at once, principally to meet the new need which has arisen for an agency to aid engineers who have been in military service to find suitable positions.

The four secretaries of the founder societies of the United Engineering Society are appointed as the board of managers, and Walter V. Brown is made secretary in immediate charge. This action was taken as the result of the joint meeting held the previous day by the present secretaries and the American Engineering Service. The resolutions further provided that the American Engineering Service be instructed to turn over its entire office equipment and records and instruct its operating staff to report for further service to said bureau when organized, and that thereupon the American Engineering Service be automatically discharged. It was determined that the work should be started on the basis of no charge, with headquarters in the Engineering Societies Building, New York.

The work of the American Engineering Service was cited as having been of inestimable value to the government through the coöperation between the four founder societies and the government, and a resolution was passed expressing high appreciation of the accomplishments of George J. Foran and his associates during his chairmanship.

The Field of the Engineering Council

As defining its field of activity, the following resolution was passed: "The Engineering Council understands its field of activity to be approximately as follows: (1) The council may deal with any matter of general interest for which joint action of two or more of its member societies would have been appropriate if council had not been established. (2) The council may initiate and carry through projects of the general character defined in the bylaws for which the necessary financial provision has been made; but council shall not undertake expenditures in excess of appropriations for its uses made by the United Engineering Society on behalf of the founder societies and the contributions from other member societies, unless specific provision shall have been made therefor by subscription, donation or otherwise; moneys received by the Engineering Council shall be turned into the treasury of the United Engineering Society and disbursed by it for the purposes designated. (3) The council may take up and in its discretion act upon any matter of general interest referred to it by any member society or by any other society, national, state or local, or any branch of government, or by any individual or group of individuals."

It was further resolved "that the Engineering Council will as a rule avoid considering any matter which is specifically within the province of only one member society and not of the others."

A letter was addressed to President Wilson on Nov. 15 by J. Parke Channing, in which he said, in part:

"I am advised that you have under consideration the appointment of a reconstruction commission to develop a comprehensive program for the nation's conversion from a war to a peace basis.

"As chairman of the Engineering Council I respectfully ask that you consider the appointment of at least one engineer upon this commission, basing my recommendation upon the fact that all construction and practically all manufacturing is under the management of engineers."

Under date of Nov. 20 the following reply was received by Mr. Channing from the White House:

"My Dear Mr. Channing: I have your letter of Nov. 15, which Mr. Rickard has been kind enough to hand me. You may rest assured that I realize what a service engineers can render in reconstruction problems from time to time. We are handling reconstruction questions just now by a process of consultation between existing instrumentalities, which I hope will prove useful and effective. Cordially and sincerely yours,

"Woodrow Wilson."

It was voted to abolish the War Committee of Technical Societies, and the chairman and members of the committee were thanked for their patriotic service.

United Electric Company Men Celebrate Victory

187th ST.
DEC. 6th
FIRST UNITED MAN WITH THE 69th
TO RETURN HOME WILL DESCRIBE
CHATEAU THIERRY

The employees of the United Electric Light & Power Company, New York City, met on Friday evening at the company's auditorium to listen to tales of the war. To the service flag of the company, containing 242 stars, four gold stars and one white star were attached with appropriate ceremony, and the moving picture "America's Answer" was shown.

CONCLUDING WAR WORK IN POWER APPARATUS

Gratitude Expressed for the Co-operation of Manufacturers—Varying Opinions Are Found in Regard to the Outlook for Business

In Bulletin No. 4, dated Nov. 30, of the electrical and power equipment section (of which Walter Robbins is chief) of the War Industries Board special thanks are expressed for the work of the war service group committees and the support given to their work. The bulletin follows:

Unless we are in receipt of some further commissions or requests from any of our war service committees, our work from now until our closing day, Dec. 20, will be confined almost entirely to making records of contracts which are to be canceled and in clearing up and properly arranging our files.

All restrictions imposed through this division having been now removed, we feel this will probably be our last and closing bulletin.

In many respects the relations with the various industries, particularly as represented by their war service committees. have given us great pleasure. Successful performance of the duties placed upon us would have been impossible without the hearty, patriotic and self-sacrificing support we have received throughout. We all feel we could not bid you an official good-by without special thanks to the members of these committees and to all of you an expression of appreciation of the manner in which you have supported these committees.

In some industries it has been necessary to apply restrictions against which we could offer no compensation by way of work of other classes. While, as has often been said, in many instances the acceptance of these restrictions, if the war were to be of great length, was almost equivalent to financial suicide, they have been accepted graciously and gracefully. Fortunately for all of us, most of the companies so restricted will be able quickly to regain their stride. That the duration of these restrictions in many cases was short-lived could not have been anticipated and does not in the least lessen our appreciation of the sacrifices accepted. In no instance has there been any holding back or failure to coöperate and support the moves that were necessary.

In Bulletin No. 3, dealing with readjustment matters, the section says under date of Nov. 26:

Final Conferences.—Many of the commodity sections are planning to hold final conferences with their war service committees. At the request of the industry in some cases restrictions will be continued. We have received no request from any of the industries handled by this division and may therefore fairly presume, and will presume in the absence of request immediately, that you do not desire restrictions maintained. We do not see, therefore, why we should call the war service committees to Washington and shall not do so unless you specifically request a meeting. Probably many of you will attend the Chamber of Commerce meeting at Atlantic City. All of you who do attend will probably be present at the meeting of the machinery group. We can arrange at that time for a meeting with all of you that desire so as to avoid a special trip to Washington. Unless we hear to the contrary, we will understand that to be the plan in all cases.

Brass Tubes.—All restrictions are being released to-day.

Cancellation Records.—Data as to proposals for cancellation are being cleared through the commodity section in interest. We are not concurring in these cancellations, but are, on the contrary, simply noting them and making records in case it should be found later that such records would be useful. In some cases we feel in position to make suggestions with reference to the cancellation, but these are in the minority. We are being asked what effect each given cancellation will have on the labor situation, but find ourselves unable to answer this question without referring to the company under discussion, so may be forced to obtain the data from you, although we think not.

Allied Purchasing Commission.—Of the total volume of unfinished orders placed through the allied purchasing commission we are unofficially advised that from 25 to 40 per cent will be canceled, this being very much lower than we at first thought.

Demobilization.—It has been found impracticable to undertake demobilization entirely by persons and occupations. When, however, any industry, or even individual factory, in any community can show a large proportion of its employees in any single unit, request for demobilization of that unit will be given every consideration.

Stock Bulletins.—Will each of you kindly make a definite note to cancel our names from your mailing list for stock bulletins? They now serve no useful purpose and simply make that much additional mail.

Questions.—If any of you have questions, please ask them as they will give us a line on the kind of information you would like to have.

Date of Completion.—We are unable to set an exact date, but unless called upon for services of other character than now being performed, we expect to finish our work and disband most of the organization of this division on Dec. 21. It will probably be necessary for some members of this little organization to return to Washington after Christmas, or to return more or less frequently for some time to come. Generally speaking, however, unless called upon for some new service, by the government or by you, we shall probably disband as an organization on that date.

Monthly Reports.—We now offer you definite release with the understanding that the December report, covering November, may be omitted and that you may abandon your own machinery for preparation of any future issues.

Circulars.—Priority and other circulars with reference to details and of particular interest to particular cases are constantly under preparation.

Business Situation.—We have been asked frequently for an expression of opinion as to the probable trend of business in the immediate future, to which our answer must be that we have been so thoroughly immersed in the war program that we are less competent to advise than you yourselves and therefore attempt no guess as to what lies before us. The demand for labor in certain industries indicates that they at least have no fear as to the future. Contrary to such opinions, obviously manufacturers of explosives and materials incident thereto have no great expectations for the moment. Between extremes there are varying opinions.

TAKING MEN MUSTERED OUT BACK INTO THE SERVICE

Executive Committee of Empire State Gas & Electric Association Recommends that Men Released by Government Be Re-employed

At a recent meeting of the executive committee of the Empire State Gas & Electric Association a resolution was passed providing that the association recommend to its members that they make provision to take back into their employ any who left to enter the service of the government either voluntarily or through the draft, as soon as such men may be mustered out of service.

Plan for Soliciting Outlet Business

A standardized plan of soliciting convenience-outlet business for electrical contractors everywhere, originated by the Society for Electrical Development for use in connection with the September campaign to "save fuel, food, time, labor, by wire," is being distributed to the trade by the society at a nominal price. The forms have been put up in lots sufficient for securing thirty jobs of housewiring or installation of service outlets

ENGINEERS SAIL UPON A MISSION IN FRANCE

Representatives of Four American National Engineering Societies Go at Invitation of French to Study Reconstruction Problems

At the invitation of the Société des Ingénieurs Civils and a committee of the French Engineers' Congress, and with the official approval of the French government, a delegation of American engineers has been appointed to study with French engineers certain problems involved in the industrial rehabilitation of France after the war.

This delegation was invited to go to Paris to examine in joint conference questions of the utilization of commercial ports, the development of navigable waterways, the development of water power and the improvement of road systems. Although these were the only subjects mentioned specifically, the congress will probably take up many other questions of development in which all engineers are directly interested.

The invitation was sent to the American Society of Civil Engineers and was accepted at once by cable, the acceptance stating that such a delegation would be organized in coöperation with the other American national societies.

The following delegates were appointed:

American Society of Civil Engineers—J. F. Case, chairman; George W. Tillson, George W. Fuller, A. M. Hunt, Nelson P. Lewis and George F. Swain.

American Society of Mechanical Engineers—Charles T. Main, president.

American Institute of Electrical Engineers—Lewis B. Stillwell.

American Institute of Mining Engineers—E. Gybbon Spilsbury.

The delegates sailed from New York on Dec. 5 on the Espagne.

Let Team Work Carry Us Through Reconstruction Dangers

BY WILLIAM H. WINSLOW

Vice-president Superior (Wis.) Water, Light & Power Company

THE armistice signed on Nov. 11, 1918, brought to a conclusion a war that had been waged for more than fifty-one months with steadily increasing violence and in which upward of twenty nations had become involved. And yet on Aug. 1, 1914, the belief was practically universal that no war between even two great nations could be carried on for as many as twelve months without being brought to a close by the financial and economic collapse that would be caused by the enormous expenditures involved. As we now know it was the theories of the economists and financial experts that collapsed, and it will be the part of wisdom to view with considerable skepticism any attempts to write in advance the economic history of the period on which we are just entering.

This, however, does not mean that because the fog is thick it will not pay to keep a sharp look-out ahead, and there are certainly already some reefs visible. Prominent among these is the wage question. We have had four years of increasing wages, and it is well to note that the bulk of the increases have been made voluntarily by employers, partly to meet increasing living costs and partly to hold their employees against competition from war industries. We are now presumably facing a period of declining prices for most commodities, including labor, but every effort should be made not to reduce real wages; in other words, to prevent money wages declining faster than living costs. Here it would seem is the most dangerous feature of the situation. We must apparently continue to feed a large part of the world for some time to come, which is likely to throw food prices out of line with the general economic situation of the country. As food averages something like 40 per cent of the wage earner's budget, it is clear that when wages have been advanced only enough to cover the increased cost of living no great reduction can be made while food prices remain where they are without causing trouble. Of course, the high wages paid in shipyards and other war plants greatly exceed the advances needed to cover increased living costs, and these can and must be reduced where the plants continue to operate. Here again it is well to note that in most cases these reductions will probably be made by the employed rather than by the employers. Just as during the last four years employers have had to advance wages to keep their men from taking other jobs, so now employees will probably have to take reduced wages to prevent other men from taking their jobs. All this, of course, is based on the supposition that the cessation of war work and the return of our army to civil life will make workers more numerous than jobs. If this does occur, it is difficult to see how any one can prevent the law of supply and demand from operating in the usual manner. An effort to hold the pendulum at the top of the present swing is likely to wreck the clock. It is very unfortunate that the average wage earner thinks of his earnings in terms of money rather than purchasing power, and if, as time goes on, nominal wages have to shrink in common with the price of other commodities, employers would do well to point out to their forces by means of charts that real wages—*i.e.*, purchasing power—have not declined.

Never has there been a time when it was more important for all elements of the economic structure to keep their heads and avoid any rash or arbitrary action in connection with the readjustments that must take place.

For the better part of two years now all of us have to a large extent ceased to think in terms of selfishness and united in the great common aim of winning the war. Let us hope that now that the war is won we can carry over into the reconstruction period enough of the feeling of team work to bring us safely through its dangers.

Business Men in Reconstruction Conference

Many Problems of Vital Importance to Industry Are Taken Up in Atlantic City Meeting of the United States Chamber of Commerce

BUSINESS men representing about 400 industries met at the reconstruction conference of the United States Chamber of Commerce in Atlantic City this week and considered the industrial problems brought by peace.

President Harry A. Wheeler of the organization asked if the United States should not lead in proposing an international plan for rationing basic materials and stabilizing their cost, so that the temptation to profit selfishly by the original ownership and control shall be replaced during the period of reconstruction by a broad recognition of the needs of all nations to reëstablish their productive power under as little restraint and as rapidly as the circumstances may permit. Making the plan and carrying it into effect, he said, should be left to those who best know the processes of production and distribution.

The principle of economic boycott is neither politically nor economically sound, Mr. Wheeler declared, nor is the principle of "favored nation" in commercial treaties. These would tend only to drive the nations further apart and increase the unrest in the industrial world.

An international problem of reconstruction is the use of the remaining ocean tonnage and of the new fleets as they leave their ways in the common service of all nations. Loss of shipping has, more than any other single factor, overthrown the normal operations of commerce and trade.

ATTITUDE OF PRESIDENT WILSON

Mr. Wheeler told of an inquiry sent by him on Nov. 23 to President Wilson, asking if it would not be desirable if American industry should name a thoroughly representative committee, particularly informed regarding the basic industries of the country, to be present in France during the course of the peace conference and available for counsel on such phases of the peace negotiations as may bear directly upon commerce and industry. In his reply President Wilson said:

"You may be sure that I would send a message to the meeting at Atlantic City if I knew what message to send, but frankly I do not. It is a time when we must all thoughtfully take counsel and apply the wisest action to circumstances as they arise."

The address of Mr. Wheeler also touched on the need of equitable readjustment of government contracts, the raw materials controlled by the government, the large holdings of machinery and commodities capable of being released for resale, price fixing, the treatment of new industries largely developed to supply commodities formerly imported from Central Europe, whether the right to combine should be extended to domestic operations, whether there should be consideration by Congress of all statutes constituting our anti-trust legislation and the relation of labor to the period of readjustment.

Mr. Wheeler read a letter which he had received from Bernard M. Baruch, chairman of the War Industries Board. Mr. Baruch said in part:

> The War Trade Board and the Shipping Board are releasing restrictions upon imports and exports as rapidly as shipping is becoming available. Contracts with the government are being adjusted. In the meantime there must surely be some arrangement of business, but I am certain that the business man of America can and will meet the situation which confronts him.
>
> The cancellations of contracts does not mean a repudiation of contracts, and the government of the United States will not, I am sure, take from the industry of the country anything to which it is entitled to under each and every contract. It will be the endeavor of the War Industries Board to aid to this end in every way possible.

MR. SCHWAB ON OUR MERCHANT MARINE

Charles M. Schwab talked of the great importance of a merchant fleet. He said in the course of his address:

> Our great outlet for all our manufacturers must be foreign markets. How are we going to get into the foreign markets unless we have the ships and the mercantile marine to carry our goods to the foreign market? Therefore, gentlemen, it is our duty, it is the duty of every society, it is the duty of every chamber of commerce, it is the duty of every single individual, to raise their voices, to let their clamors be loud and long for the development and maintenance of this mercantile marine of ours.
>
> The shipyards of the United States during the year 1919 are capable of producing with ease and economically between 8,000,000 tons and 10,000,000 tons of merchant ships. We will have produced in this year now ending somewhere between 3,500,000 and 4,000,000 tons. The United States has now under its control between 7,000,000 tons and 8,000,000 tons of ocean shipping.
>
> With the 8,000,000 tons or 10,000,000 tons that we may add from our shipyards during the next twelve months, the United States will possess properly and economically operated a merchant marine that should make our industries secure and establish the greatest asset in this transition period from war to commercial work that, in my opinion, can be had. We ought, as manufacturers, every one of us, to impress upon everybody in Washington, with all the power that we have, as I repeat again and again, the important fact that the greatest step to help in this transition period is going to be the quick and permanent establishment of our foreign shipping ability.
>
> We manufacturers have got to open our eyes to a wider vision of the present and the future with reference to our workmen. We have got to devise ways and means by which capital and labor, which have so often been termed synonymous, shall share equally. Not in theory but in practice we have got to devise ways and means of education. We must not only talk about these things but we must do these things. We have got to realize that many unjust remarks will be made by labor and they probably have been made by capitalists and employers in the past. That is one of the lessons this great war has taught us—true democracy. The thing we have to do is to teach, not patronize; to educate and have the American laborer know and feel that he can stand with his head in the air, as you can and as I can, and say with pride, "I am an American citizen."
>
> Each manufacturer must study his own case and his own situation from his own standpoint and must know his own conditions. There can be no general rule that will be applicable to all. We ought to urge a continuance of work in every direction. Matters will adjust themselves industrially

in this country sooner or later by the natural course of events, but what we want to prevent is that sudden slip of the cog which will give us a social jolt that may be dangerous to our industries for years to come.

Secretary of Commerce Redfield urged American industry to beware of the temptation hastily to lay rash hands upon wages. He advised it to "concentrate thought, purpose and effort on output." Mr. Redfield said in his concluding remarks:

> There is no doubt, humanly speaking, that prosperity lies ahead of America, but there is yet an unsolved doubt as to what use America will make of her prosperity. Do we think of our sister nations as twenty years ago a trust magnate thought of the concerns whose business he would like to grasp? We have outgrown that in our domestic commerce. I do not speak of it as being illegal—it is more illegal to-day in the minds of the business men than on the statute books—but when we get beyond that three-mile limit are we going to be as far advanced in our thought as we are at home? Can we carry the spirit of American law where the law of America does not prevail? If we do not, we may become fat and rich and possibly win the contempt of the world in so doing. Will our thought be to aid with a spirit of service running through all, serving those who have served us first? How will the world feel toward America twenty years hence? It all depends. If you can leave to your sons as they go about the earth the knowledge that America rose to a height of marvelous power, financial, military, political, industrial and economical, and she used that power to her own good always and also always for the good of the world, then your sons can walk as no German can walk, can travel the whole round orb of the globe, among friends knit to one another with bonds of esteem and affection which cannot be broken.

P. H. Gadsden, before the public utilities and electric railway group, discussed the difficulties of the electric railways, saying that what is needed at this time is "a thorough and impartial study of the whole question of electric railway franchise, with the end in view of establishing the industry on a wholesale economic basis which will guarantee continued efficient service to the public. Such a study should be made primarily from the standpoint of the public interest—what is best for the communities served. It is a national problem and not one for the owners of the railways alone or chiefly."

DOHERTY OPPOSES GOVERNMENT OWNERSHIP

Henry L. Doherty remarked before the petroleum group: "I do not believe in government control or government ownership. Government operation is inherently inefficient. If we are faced with government domination of business, it will be our duty to go back over the records and show what has occurred under government operation during the last year and a half."

A. C. Bedford, chairman of the board of the Standard Oil Company of New Jersey and chairman of the National Petroleum War Service committee, said that he could not agree "with that portion of President Wilson's message which deals with the employment problem. "Statistics show that a large percentage of foreign laborers in this country," he said, "are preparing to go to their native countries. They have made big wages during the war period and they are going back to work out the reconstruction problems in their own countries. I doubt if this will be offset by Europeans coming to this country." He said he did not fear that there will be idleness among labor because of inability to provide sufficient employment, but rather that there would not be enough labor.

SEIZURE OF CABLE LINES IS QUESTIONED IN COURT

Suit to Prevent Postmaster-General's Plan Is Begun in United States District Court—Grounds of the Complaint

A suit to prevent Postmaster-General Burleson from retaining, operating and amalgamating the cable lines of the Commercial Cable Company was begun in the United States District Court, New York, on Dec. 4. A bill of complaint was filed by Charles E. Hughes as chief counsel for the company. An injunction restraining the government from further control of the cable properties was asked pending decision on the law.

In the complaint Mr. Hughes recites the authority given by Congress on July 16, 1918, to the President authorizing him "during the continuance of the present war whenever he should deem it necessary for the national security or defense to supervise or take possession and assume control of telegraph, telephone, marine cable or radio system or systems or any part thereof and operate the same for the duration of the war, but not beyond the date of the proclamation by the President of the United States of the exchange of ratifications of the treaty of peace."

The complaint then quotes the President's words to Congress in which he "formally and officially announced the termination of the war." On Nov. 16 the Postmaster-General "announced informally through the public press that he had taken possession and assumed control of all marine cable systems" of American corporations. The complaint adds: "That his action was based on a proclamation of the President of the United States dated Nov. 2, 1918 (the actual date of execution being unknown to your orator, but your orator alleges upon information and belief that it was subsequent to Nov. 11, 1918). . . , That on or about the sixteenth day of November defendant issued an order, without date, assuming to take control of said cable system."

The bill attacks the seizure of the cable system on the ground, in part:

> That the said seizure or attempted seizure of your orator's said cable system is unconstitutional, unauthorized, *ultra vires*, illegal and void, for the reasons that the war within the meaning of said resolution had terminated prior to the time of said seizure and the alleged authorization thereof; that the Congress had no power or authority under the Constitution to authorize the taking possession and control and operation of said cable system under the circumstances existing at the time of said seizure, and that said seizure was not reasonably necessary for the national security or defense; and that said seizure deprived your orator of its property without due process of law, and that said seizure took your orator's private property for public use without just compensation to your orator, and that said seizure was an unreasonable and arbitrary seizure, and that said seizure was not for public use, and that defendant is not an impartial tribunal to determine your orator's compensation for the use of said marine cables, and that proper and legal provision has not been made for the payment to your orator of said compensation, nor even for the keeping by your orator of the regular profits of its own property, and, finally, that the purpose, plan and effect of said seizure to unite, consolidate and unify your orator's said cable system with that of your orator's competitor, the Western Union Telegraph Company, is in violation of the anti-trust act of Congress of July 2, 1890, both in its immediate effect of suppressing competition now existing and in its effect in disorganizing your orator's organization, plant and equip-

ment, so as to disqualify your orator from taking up and resuming such competition when said cable system is returned to your orator on the signing of a treaty of peace and the proclamation thereof.

That the recent war referred to in said joint resolution is no longer in continuance, it having been terminated beyond possibility of renewal on Nov. 11, 1918, by an armistice; that said proclamation dated Nov. 2, 1918, did not become a proclamation and was not proclaimed or announced, signed, countersigned, made public or effective until after Nov. 11, 1918, namely, about Nov. 16, 1918, and that no seizure or possession of said cables was attempted, claimed or made until on or about Nov. 16, 1918.

That it is not necessary for the national security or defense that your orator's system of marine cables shall be seized, or taken possession of, or assumed control of by the defendant or any one else; that the national security or defense will not be furthered in the slightest degree by defendant taking possession and assumi g control of your orator's marine cables; that the national security or defense was fully attained by the signing of said armistice and by the discontinuance of hostilities under the said present war; that a full, adequate, complete, quick and correct cable service has been during the period of the war and still is being given by your orator on its cable system to the government of the United States, and that all government messages are given precedence over all other messages, and that there has been no complaint or occasion for complaint on the part of the government in regard to the quick and accurate transmission of its messages, and that your orator's cables are worked and operated to their utmost capacity by a most competent staff of officers and cable operators, and that said service could not be increased or bettered, and that the operation of said cable lines by or under the control of the defendant would be less efficient and satisfactory not only to the government in the transmission of its cablegrams, but to the public in the transmission of public messages generally, and that the seizure of said cables on the ground that they were or are necessary for the national security or defense was and is a mere pretext without substance or basis of fact whatsoever.

ANNUAL CONVENTION OF MECHANICAL ENGINEERS

President Main Calls Attention to Work of Members in the War and to the Certainty that We Are Unprepared for Peace

The American Society of Mechanical Engineers held its thirty-ninth annual meeting in the Engineering Societies Building, New York, on Dec. 3 to 6. Charles M. Schwab and Orville Wright were made honorary members in recognition of their achievements.

President Charles T. Main said in his address that the members of the society were important factors in the solution of the numerous engineering problems that arose in connection with the prosecution of the war. He mentioned the work of the engineering service committee in furnishing specialists for the numerous demands of the government and the industries generally. The society has been very active in fuel conservation through its membership on the fuel conservation committee of the Engineering Council in coöperating with the Fuel Administration at Washington and by services of its members on the commissions of the various states.

In speaking of reconstruction problems President Main said: "It is now time to give careful consideration to the readjustment after the war, so that this country shall maintain its industrial and national integrity with due regard to our obligations to other countries. We were unprepared for war, which was a possibility, and we are unprepared for peace, which is a certainty.

"The future will have problems and trials. The contests will not be of battles but of industry. The conquests will not be of territory or thrones but markets. Plans have been under consideration for some time past in England, France and Germany for regaining the commerce lost during the war. Upon our ability to resume our normal lines will depend to a large degree our prosperity at home and our trade expansion abroad. We were unprepared for war, and it was a stupendous task to readjust our industries to a war basis. It will be no easy task to readjust ourselves for peace. In this readjustment our vision must extend beyond the state and the nation out into the broad world. Bills have already been presented in Congress for the creation of a federal commission on reconstruction."

The following officers were elected: President, Mortimer E. Cooley, Ann Arbor, Mich.; vice-presidents, F. R. Low, New York; Henry B. Sargent, New Haven, Conn., and John A. Stevens, Lowell, Mass. William H. Wiley, New York, was re-elected treasurer.

TERMINATION OF THE WAR INDUSTRIES BOARD

With the Resignation of Bernard M. Baruch as Chairman, the Board Will Cease to Exist on the First of January Next

In accepting the resignation of Bernard M. Baruch as chairman of the War Industries Board, effective Jan. 1, President Wilson has agreed that the board shall cease to exist on that date.

Mr. Baruch said that the facilities of the board had been put at the disposal of the various contracting agencies of the government and that the activities believed to be of lasting value were being transferred to permanent departments of the government where they might be carried forward. He suggested that the various heads of commodity divisions might render much valuable assistance in the future as trade advisers to the Department of Commerce and the War Trade Board. The President indicated that he concurred.

ASK COMMISSIONS TO LESSEN REQUIREMENTS IN ACCOUNTING

Public Service Commissions Requested by Executive Committee of the N. E. L. A. Accounting Section to Lighten the War Burden

The executive committee of the Accounting Section of the National Electric Light Association has passed resolutions asking the public service commissions to lessen their requirements upon the companies in the way of annual reports. This request is made because of the serious depletion of trained forces in the accounting departments, the number of untrained employees and the heavy expenses of every character to which the companies are subjected. The commissions are asked to reduce their requirements for at least one year.

W. J. Meyers, secretary United Electric Light & Power Company, New York, and chairman Accounting Section's committee on form of annual reports to commissions, circulated the resolutions.

URGES ELECTRIFICATION OF THE CALIFORNIA RAILROADS

Representative of Oil Division of Fuel Administration Points to Oil and Capital Economy—Purchase of Power

Electrification of the mountain division of California railroads has been recommended to Director-General or Railroads McAdoo by D. F. Folsom, director of the Pacific Coast section of the Oil Division of the Fuel Administration, as a means of conserving fuel oil and reducing the operating expenses of the sections of the railroads involved by $4,923,300 a year. The recommendation, based on the report of W. F. Dietrich, engineer of the Oil Division of the Fuel Administration, shows that the electrification of 510 miles of railroad would mean an annual saving of 3,062,000 barrels of fuel oil, the total cost of which is $6,147,000, and that the cost of power to operate the trains over these sections at 0.75 cent per kilowatt-hour would be $2,000,000, indicating a reduction in the bill for motive power of $4,147,000 annually. The first cost of the electrification is placed at $23,012,000, on which there is estimated an annual profit of 9.4 per cent, after allowing for depreciation, amortization, taxes and interest.

The railroad divisions affected by the recommendation are the Sacramento division of the South Pacific, 157 miles from Roseville, Cal., to Sparks, Neb.; the Shasta division of the Southern Pacific, 215 miles from Gerber, Cal., to Ashland, Ore., and the San Joaquin combination division of the Southern Pacific and Santa Fé, 138 miles from Bakersfield to Saugus.

With oil valued at an average figure of $2.02 a barrel and electricity at 0.75 cent per kilowatt-hour (a total of $2,000,000), the annual saving in the cost of power is $4,147,000 in favor of electrification. The purchase of hydroelectric power is contemplated throughout the report, but it is pointed out than even if the electricity were generated by oil there would be a saving of about half the consumption of oil now used as locomotive fuel. Thus 267,400,000 kw.-hr. at 200 kw. per barrel would require 1,337,000 barrels of oil, or 43.6 per cent of the present consumption of locomotive fuel in the three districts. But if oil were used, it would cost $700,000 more than the cost of hydroelectric power at 0.75 cent per kilowatt-hour, the report states.

The following table gives a summary of the power required and the fuel oil saved by the proposed electrification of the divisions considered in the report:

Division	Kw.-Hr. per Year	Maximum Kw. Demand
Sacramento	104,200,000	47,600
Shasta	73,200,000	33,400
San Joaquin	89,000,000	40,000

The saving of oil in each district, according to the report, would be:

Division	Barrels	Value
Sacramento	978,000	$2,200,000
Shasta	907,300	2,055,000
San Joaquin	1,177,000	1,882,000

The comparative low value of the oil used in the San Joaquin division as shown in the foregoing tabulation is due to the proximity of the district to the largest producing oil fields in California, making it possible to supply steam locomotives with fuel at a much lower rate than in the other two cases considered.

For the purpose of comparison, the following figures of fuel-oil consumption by the Western railroads during 1917 are given in the report, together with the percentage that would be saved by electrification of the three divisions recommended in this report. In determining the amount of fuel oil that would be saved on the mountain divisions of the Southern Pacific company it was found that the method of calculating these figures varied with the data available for each district, but the final results are stated to be 90 per cent accurate:

	Barrels	Per Cent Saved
Southern Pacific	15,696,354	....
Santa Fé	5,856,901	14.22
All Western railroads	24,394,247	12.6
Total for California	10,450,000	29.3
Total California fuel-oil production	78,000,000	3.93

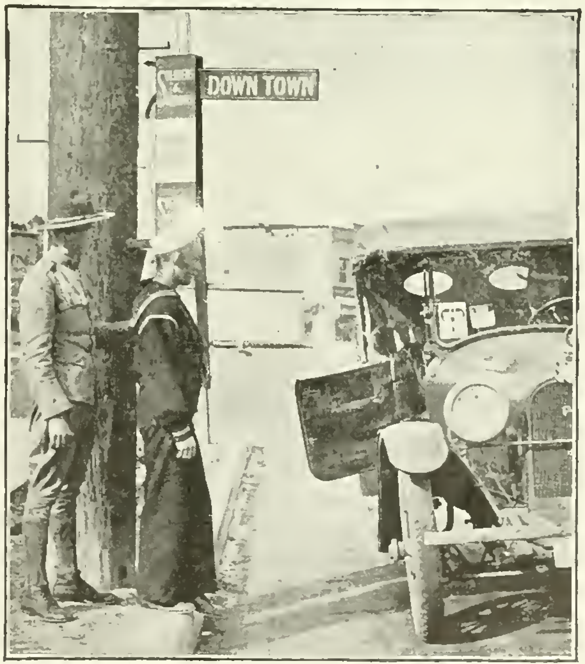
A summary of the first costs, the percentage of profit on the investment and the annual saving obtained in each of the three districts considered in the report is given as follows:

Division	First Cost	Annual Saving	Per Cent
Sacramento	$8,100,000	$1,592,600	7.6
Shasta	8,038,000	1,903,800	11.7
San Joaquin	6,784,000	1,426,900	8.7
Total	$22,912,000	$4,923,300	9.7

In calculating the profit on the investment in the report 12 per cent is allowed for depreciation, amortization, taxes and interest.

No recommendation or suggestion concerning the source of the supply of power is contained in the report. Mr. Folsom stated, however, that should his recommendation be adopted generating stations would have to be built to meet the demand.

Southern California Contractors and Dealers Help the Boys



Soldiers and sailors' "auto courtesy signal systems" were erected throughout southern California by the Southern California electrical contractors and dealers.

G. E. Arbogast, president of the association, wrote to the ELECTRICAL WORLD that while it was believed by many people that this device is a valuable invention it was not patented and the association was glad to furnish details to any one who desired to use it for patriotic purposes. The cost figured close to $10 each, erected.

WAR SERVICE ACTIVITIES OF ILLUMINATING ENGINEERS

Government Appreciation Expressed—More Rugged Tungsten Lamps to Be Produced—Psychological Effect of Lighting Curtailment Emphasized

Preston S. Millar of New York and Harold Almert of Chicago were speakers at a joint meeting of a group of engineering societies in Chicago Nov. 25. Mr. Millar told of the activities of the war service committee of the Illuminating Engineering Society and of the appreciation of its work which had been expressed by government officials. In talking about the types of lighting the committee had studied the speaker divided his subject in four parts, namely, lighting for production, lighting for protection, lighting for safety, and the promotion of conservation by the elimination of non-essential lighting. In all types the prime considerations have been intensity, direction and degree of diffusion.

The speaker brought out several matters of news interest in his discussion. Not the least of these is that a new and more rugged tungsten lamp with a braced filament is being brought out to replace carbon and "gem" lamps. In this connection he reproduced a table which showed that between the years 1912 and 1917 the demand for carbon lamps had fallen off in this country from 59 per cent of the total to 13 per cent of the total. Among the members of the Association of Edison Illuminating Companies the decrease in the same period was from 75 per cent to 10 per cent. In Chicago the ratio was 9 per cent in 1916 and 5 per cent in 1917. The speaker also said that a study of coal-mine lighting is being made with the expectation that a method of mine lighting may be developed which will make production more rapid. Data collected by insurance companies were cited to show that while good lighting has decreased industrial accidents somewhat, still 18 per cent of industrial accidents are attributable to poor lighting. Dwelling on safety considerations, he discussed unwise curtailment, particularly in industrial plants. A further measure of curtailment in semi-public places such as stores had been planned for this winter, but the signing of the armistice will probably prevent its being carried into effect.

In discussing lighting curtailment Mr. Millar brought out very clearly that the psychological effect of dark signs and dark show windows was just as much sought as was the result in actual coal saving. He also expressed the opinion that daylight saving as a fuel conservation measure fell far short of what was expected from it by its sponsors.

In closing he paid a high tribute to the public utility men who accepted the sacrifices asked of the industry in such whole-souled patriotic spirit. He also related how the point of view of the war service committee of the Illuminating Engineering Society had changed during the period of its life. At first it was prone to oppose restrictions on lighting. Later, however, its point of view became changed so that in all questions it was able to look at its problems with consideration for promoting the war ability of the nation first, the welfare of the public second, the success of the lighting industry third, and other industries fourth.

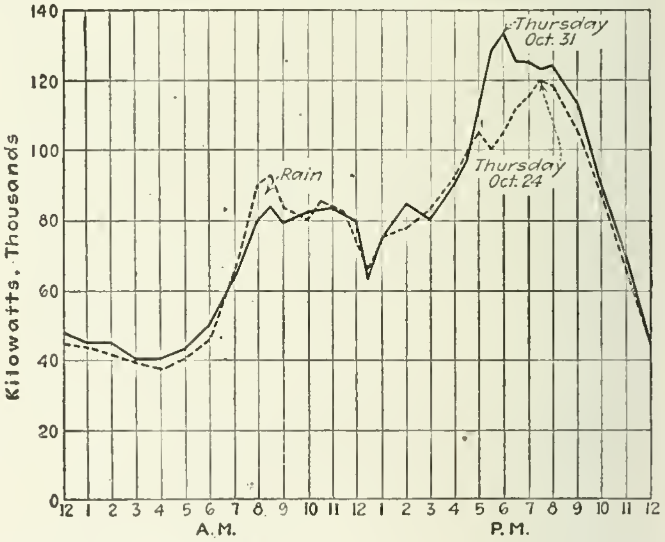
Mr. Almert in his address outlined the activities of the Illinois Fuel Administration, pointing out some of the instances in which interconnection of public utilities had been urged in the interest of coal economy. He stated that there is now no danger of a coal shortage in Illinois but urged all engineers to continue to promote economical practices.

MERCHANDISING MEN PLAN ANOTHER PORTABLE CAMPAIGN

Heads of Principal Central-Station Commercial Departments Will Meet in Connecticut to Plan the Sale of 50,000 Lamps in 1918

The group of central-station men which has recently been engaged in marketing a standard type of portable reading lamp has announced that this first campaign was a marked success and that another is now being planned. On Dec. 6 the group met at the Hotel Taft, New Haven, Conn., for a dinner and a preliminary discussion of plans. On the next day they were to drive to the factory of the Edward Miller Company, Meriden, Conn., to complete arrangements for the sale of approximately 50,000 portable lamps in 1919. It is probable that the retail price of these lamps will be considerably higher than the price which was in effect this year. In 1918 the standard lamp sold for $6.75. The lamps which will be handled in 1919 will probably retail at between $12 and $14 each.

How Clock Change Affects Chicago Company



Two Thursdays as nearly alike as to weather and other ruling conditions as possible but differing by the recent "setback" in the clocks were chosen to show the effect of the change in time on the load of the Commonwealth Edison Company of Chicago. In the mornings very little difference in the character of the two curves developed. Except for a short, sharp peak attributable to rain, there is no difference until the hour of sundown. Then the overlapping of the lighting in the offices and the industrial power causes a steep rise of about 30,000 kw. The net increase in demand, however, is somewhat less, being around 15,000 kw. The average consumption is greater on Oct. 31 than on Oct. 24 by an amount in excess of 44,000 kw.-hr. These curves and data are all based on the company's 60-cycle load alone. They do not include any of its 25-cycle railway load. The curves are thought to be particularly interesting as they indicate that in the autumn of the year a saving could still be made by continuing on the summer-time schedule.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month

New York Jovian League.—At the meeting of the New York Jovian League held Nov. 26 Henry J. Carroll of the New York Telephone Company gave an illustrated lecture entitled "On the Battle Line with the Telephone."

A. I. E. E., Fort Wayne Section.—Capt. R. N. Vyvyan of the British Royal Air Force told the Fort Wayne Section, A. I. E. E., Nov. 21, of experiences at the front with wireless telegraph and telephone apparatus in artillery coöperation.

Officers of Chicago Electrical Credit Association.—At the twenty-third annual meeting of the Electrical Credit Association of Chicago, held at the Hotel La Salle, Nov. 21, H. E. Wilkins of the Belden Electric Manufacturing Company was elected president for the ensuing year.

Cleveland Engineering Society.—On Nov. 26 the Cleveland Engineering Society was addressed on the subject "Inventions Helpful in Winning the War" by J. F. Oberlin, patent attorney of Cleveland. On Dec. 3 Willard Beahan addressed the society on the subject "War-Time Labor."

Southwestern Electrical and Gas Association.—The second quarterly conference of the Southwestern Electrical & Gas Association has been set for Monday, Dec. 9, at the Hotel Bender, Houston, Tex. The program is to be announced at a later date. S. R. Bertron is chairman of the committee.

Institute of Radio Engineers.—On Dec. 11 the Institute of Radio Engineers will hold a meeting at the Engineering Societies Building at which Charles S. Ballentine of Philadelphia, will read a paper on "The Operational Characteristics of Thermionic Amplifiers and a Dynamic Method of Determining the Mutual Conductance."

A. I. E. E., Urbana Section.—At a meeting of the Urbana (Ill.) Section, A. I. E. E., held Nov. 20 the election of officers for the coming year was announced. A. R. Knight was elected chairman and E. H. Waldo secretary-treasurer. It was decided that no meetings shall be held this winter unless the S. A. T. C. is mustered out.

A. I. E. E. Schenectady Section.—Prof. C. A. Adams, president of the American Institute of Electrical Engineers and chairman of the electric welding committee of the Emergency Fleet Corporation, will deliver an address, "Electric Welding with Special Reference to its Application to Shipbuilding," before the Schenectady Section, A. I. E. E., on Tuesday, Dec. 10.

A. I. E. E., Lynn Section.—At a meeting on Nov. 20 of the Lynn Section, A. I. E. E., M. O. Troy read a paper entitled "The Transformer Industry and Some of Its Problems."

Electrical League of Cleveland.—At the Nov. 27 meeting of the Cleveland Electrical League Richard F. Grant spoke on the probable business conditions in the immediate future. The subject of his paper was "The Direction of the Wind."

National Association of Electrical Contractors and Dealers.—Comprehensive plans for the improvement of trade relations were outlined by W. H. Morton, general manager of the National Association of Electrical Contractors and Dealers, at a meeting of the Massachusetts branch of the association in Boston last week. Mr. Morton stated that a program was being considered for the realization of coöperation throughout the electrical industry.

Engineers' Club of Philadelphia.—The regular monthly meeting of the Engineers' Club of Philadelphia will be held Tuesday, Dec. 17, at Witherspoon Hall. Frederick K. Morris of Columbia University will read a paper on "The Fourth Year." which will be illustrated with motion pictures and lantern slides illustrating activities in the war zone. On the same day at the Tuesday noon luncheon of the club Commander F. G. Coburn, U. S. N., manager of the naval aircraft factory at the Philadelphia Navy Yard, will speak on the subject of "Aëroplane Construction."

Western Society of Engineers.—S. J. Duncan Clark of the Chicago *Evening Post*, speaking before the Western Society of Engineers at Chicago on Nov. 18, dwelt at some length on reconstruction problems as well as on a trip to the western front. He predicted that England will become a leader in social democracy. His opinion in this matter is based on judgments formed after viewing in England the preparations for amicable relations between employers and employees, through governmentally sanctioned committees of workmen and employers organized by industries. In France not so much work has been planned in this respect.

Three Hundred and Forty-second Meeting of the A. I. E. E.—The Philadelphia A. I. E. E. meeting has been set for Dec. 13 and 14. The two principal papers for Dec. 13 are "The Use of Electric Power in the Mining of Anthracite Coal," by J. B. Crane, and "Drum Shape as Affecting the Mine-Hoist Duty Cycle and Motor Rating," by F. L. Stone. The evening session will be devoted to research discussion. R. A. Millikan will address the meeting on the subject of "Research in America after the War," and W. R. Whitney will speak on "American Engineering Research." Saturday morning, Dec. 14, will be devoted to a technical excursion to the shipbuilding plants on the Delaware River.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Rate Increase at Homer, Ill.—The Illinois Public Utilities Commission has authorized a temporary increase in rates for the Homer Electric Light & Power Company, which it is figured will give a yield of 7 per cent on a valuation of $30,000. The lighting rate on a sliding scale of four steps ranges from 17 cents to 9 cents per kilowatt-hour with a $1 minimum bill.

Commission Upholds Pooling of Power Production.—Through stock ownership, the Alton Gas & Electric Company and the East St. Louis Light & Power Company in southern Illinois are controlled by the same interests and are under the same management. These companies filed application on April 17, 1918, for increase in rates for power service. The Illinois Public Utilities Commission by a temporary order on July 29, 1918, authorized the rates proposed to become effective July 1, requiring reparation if lower permanent rates were fixed. The East St. Louis Light & Power Company operates a generating station in Alton, and the East St. Louis Suburban Railway Company, which is under the same management, operates a generating station in East St. Louis. These stations are jointly supplying energy to the territory. The third source of energy lies in the circuits of the Mississippi River Power Company, which are connected with the East St Louis Light & Power Company. Several other companies operating in this district are affiliated with these companies in stock ownership, and these three sources of power supply are all pooled and the expense of the power divided between the companies. The city of Alton in opposing the proposed rates contended that since the most efficient station is in Alton the consumers there should receive the benefits of the cheaper generation from this plant, and that the cost of production of the three power sources should not be considered by the commission in fixing rates for Alton. The commission held that a generating station in Alton was not more advantageous than one in East St. Louis, the location of the station in either place having the same advantages as regards facilities for freight shipment, water and labor supplies. While the Alton station appears to be in better physical condition, the advantages of the combined production of power for these companies seem very apparent. The commission was of the opinion that no material injustice is done by the pooling of the means of production by these companies.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Honor Roll of the Associated Manufacturers.—On March 1, 1918, the honor roll of the Associated Manufacturers of Electrical Supplies numbered 14,656. This number has been greatly increased, and Charles E. Dustin, the general secretary, writes members that there is a general desire that a new honor roll be prepared showing the total number that have entered the service of the government from the beginning of the war to the day of victory, as well as the number of those who have given their lives to the great cause of humanity. For this purpose blanks have been sent to the members so that additions may be made to the service flag and an early report prepared.

Rate Increases to Utilities.—Commenting on the public utility situation, Arthur S. Huey, vice-president of H. M. Byllesby & Company, says: "Every one realizes that the operating costs of electric and gas companies have increased tremendously, and we appreciate the attitude of the public who, through their officials, have permitted rate increases in almost all of the cities and towns served by companies under the management of H. M. Byllesby & Company. We believe that this fair attitude on the part of the public is due to the policy of our companies in the past in steadily reducing rates whenever the cost of production would permit. As a result of rate increases now in effect the earnings of our companies are being maintained, and we are able to give 100 per cent service. How long it will be necessary to charge the higher rates depends, of course, upon operating costs. It is our intention, however, to reduce them to a pre-war basis as rapidly as possible."

American Light & Traction Operating Results.—In a statement to stockholders President Alanson P. Lathrop of the American Light & Traction Company said in regard to operations in the period ended Sept. 30: "The gross business of the subsidiary companies for the nine-month period has increased as follows: Gas sales, $1,008,954, or 10.24 per cent; electric sales, $222,528, or 12.32 per cent; traction receipts, $427,797, or 42.73 per cent. For the quarter ended Sept. 30, 1918, the decrease in net earnings over the corresponding quarter of 1917, based on the actual operating results, was $60,025, notwithstanding that during this quarter tax charges in the subsidiary companies were increased $90,000, while fuel and labor costs increased $234,600. The net earnings during the summer months have been reduced to a considerable extent by the daylight-saving law, which has been in effect since April. On the return to sun time on Oct. 27, 1918, losses from this cause will be largely eliminated."

Raise Rates or Operate on Part Time.—The Lompoc Light & Power Company, which supplies electricity to consumers in Lompoc, Los Angeles County, has filed with the California Railroad Commission an application for authority to either increase its rates for electricity or close its plant for use between 11 o'clock at night and the time lights are required the following evening. The application states that the high cost of oil, labor and materials makes the application necessary.

Safety in Lighting.—The National Safety Council, in "Safe Practices," on preventing accident hazards and practices for their elimination, says in referring to lighting: "Adequate light will materially reduce the number of accidents occurring in yards and buildings. Many industrial plants find it necessary to operate night gangs, and for this reason the proper lighting of the yard should not be overlooked. As a rule yards are less likely to be properly lighted than are other departments, and, as a result, many serious or fatal accidents have occurred."

Lightless Night Order Suspended in Massachusetts and Connecticut.—Fuel Administrator Storrow of Massachusetts has issued an order suspending until further notice operation of the "lightless night" order which has restricted the use of display and ornamental lighting on Monday to Thursday evenings weekly. Mr. Storrow declared that the soft-coal situation in Massachusetts is at present satisfactory, and that a reasonable use of electrical energy for ordinary lighting purposes should now be permitted. "Where a saving of light may be made, however, without inconvenience or hardship," the order states, "we believe that the people of Massachusetts will voluntarily curtail to that extent such energy consumption and thereby save coal that might otherwise be wasted." A similar suspension has taken effect in Connecticut.

Old-Type Instrument Wanted for the National Museum.—Charles Wirt, president Wirt Company, Armat Street, Germantown, Philadelphia, writes to the ELECTRICAL WORLD: "The United States National Museum has a valuable collection of early electric lighting apparatus which is being added to as gifts can be secured. I should like very much to secure for this collection a specimen of the early lamp indicator (engine-room voltmeter). This type was built by the New York Edison Works, also known as Bergman & Company, Seventeenth Street and Avenue B, and appeared about 1883 or 1884. This was a large-sized instrument of wooden-box construction built to stand upon a shelf with leveling screws and pointer swinging horizontally. This instrument in principle was a Wheatstone bridge, having two carbon lamps and two metallic resistances, comprising the four arms of the bridge. It was a very sensitive instrument and had the bad fault of varying with the variation in the lamps, as these were very far from being stable in continued use. If any of your readers know of the existence of one of these old type instruments, it would be well placed in the National Museum, where it would form part of a comprehensive collection."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Jurisdiction of Courts.—Matters within jurisdiction of the Public Service Commission must first be determined by the commission before the courts will take jurisdiction of any phase of the controversy, the Supreme Court of Pennsylvania held in Klein-Logan Company versus Duquesne Light Company (104 A. 763). A bill in equity to enjoin the electric company from terminating a renewal contract requiring the furnishing of electricity at certain rates was properly dismissed on the ground that the question was for the Public Service Commission in the first instance, in view of the public service law of 1913.

Proper Height of Lines Through Highway.—Companies engaged in transmitting electrical energy along the public highway must exercise such care as a careful and prudent person, having in view the dangers to be avoided and likelihood of injury, would exercise under the circumstances in placing their wires so as not to interfere with traffic, the Supreme Court of California held in Fairbairn versus American River Electric Company (175 P. 637). An electric company carrying a high-tension wire strung over a public highway must place it high enough to allow the passage of haystacking derricks underneath, where such derricks are properly and frequently moved over the highways in the district. That telephone and high power wires are strung along highways at a less height than those of an electric company does not constitute protection to such company in the case of injury occurring by coming in contact with its wires. Where a person was injured by receiving a high-power electric current through a hay-stacking derrick, brought into close proximity to electric wires from which the current arced to the derrick, the question of contributory negligence was for the jury. It was not error to modify instruction that defendant had a right to maintain a pole line along a road by adding to it that this was true if it exercised a high degree of care.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

A. W. Pipa has been appointed new-business manager of the Newburyport (Mass.) Gas & Electric Company.

A. S. Burdette has resigned as manager of the Greer (S. C.) office of the Southern Public Utilities Company to enter the army.

W. F. Bellinger has been appointed assistant superintendent of operation of the Georgia Railway & Power Company, Atlanta, Ga.

C. N. Rothrock has succeeded A. S. Burdette as manager of the Greer (S. C.) office of the Southern Public Utilities Company.

Burton T. Moury, a local electrical contractor, has been appointed acting manager of the Taunton (Mass.) municipal lighting plant.

John J. Chisholen, formerly superintendent of power of the New Orleans (La.) Railway & Light Company, is now superintendent of power for the Woodward (Ala.) Iron Company.

J. K. Sicellings has resigned as local manager of the Iowa Light, Heat & Power Company in the Remsen and Le Mars district to enter the steam-engineering school of the United States Navy.

W. M. Hammond, who was formerly assistant chief accountant of the State Public Utilities Commission of Illinois, is now acting chief accountant and statistican, replacing M. J. Murphy, who has recently resigned.

A. C. Babson, formerly manager of the Watertown and Watertown Extension divisions of the Wisconsin Gas & Electric Company, has been appointed assistant general manager of the company, with residence at Kenosha, Wis.

F. C. Jeannot has resigned from the Dayton Power & Light Company, for which he was the Wilmington district superintendent, to become superintendent at Sharon, Pa., for the Mahoning & Shenango Railway & Light Company.

W. H. Hartman, formerly foreman of construction with the Duquesne Light Company, Pittsburgh, Pa., has been appointed general foreman of the substations division. Mr. Hartman is a graduate of the Carnegie Institute of Technology in electrical engineering, class of 1912.

John S. Everett, formerly accountant of the Central Maine Power Company, with headquarters at Augusta, will shortly proceed to France to audit the accounts of the Fifth and Sixth Marine regiments — the commands which stopped the German advance at Château Thierry. Mr. Everett recently enlisted in the Marine Corps.

L. B. Faulkner, manager of the Olympia (Wash.) Light & Power Company, has been elected president of the company to fill the vacancy caused by the death in October of General Hazard Stevens, who had held that position since the reorganization of the company in 1900. Mr. Faulkner has been manager, treasurer and trustee of the company since its organization and has taken an active part in the formation of the Northwest Electric Light & Power Association, of which he is now president. Since the organization of that association he has been a member of the executive committee.

George M. Keenan, has resigned from the Little Rock (Ark.) Railway & Electric Company to become connected with the Lehigh Navigation Electric Company, Allentown, Pa. Mr. Keenan went to Little Rock last spring as superintendent of the railway power plant.

John A. Fritz has resigned from the Scranton (Pa.) Electric Company, of which he was chief engineer, to become associated with the Penn Steel Company, Chester, Pa. Mr. Fritz had been with the Scranton company in the capacity of chief engineer since Feb. 1, 1910.

C. D. Carlson, chairman of the power and heating section of the new-business coöperations committee of the Ohio Electric Light Association, has resigned from the Cleveland (Ohio) Electric Illuminating Company to become associated with the Otis Steel Company of Cleveland.

William J. Reagan, who has been connected for a number of years with the sales department of the Utica (N. Y.) Gas & Electric Company, has been appointed commercial manager of the company in charge of both lighting and power departments. Mr. Reagan will also direct the appliance sales.

R. A. Philip, who will be consultant on electrical engineering matters, reports, estimates and appraisals of electric utility and power properties in the new consulting-engineer firm of Dwight P. Robinson & Company, Inc., was born in 1874. He is a graduate of the Rose Polytechnic Institute. His early experience was as assistant to the city electrician, Tacoma, Wash., and with the General Electric Company. Later he was electrical engineer of the Seattle (Wash.) Electric Company, where in 1900 his association with Mr. Robinson began. This has continued ever since.

C. W. E. Clarke, for seven years with Stone & Webster, five of them as mechanical engineer and head of the division, has become associated with Dwight P. Robinson in consulting engineering work in New York in Dwight P. Robinson & Company, Inc. Mr. Clarke has had a long and varied experience in the design of central power stations and mechanical engineering industrial plants. Some of his earlier work was as steam engineer of the electric zone, New York Central Railroad; designing engineer, Armour & Company, Chicago, and assistant to the chief engineer, Sargent & Lundy, Chicago. He has been intimately connected with or responsible for such stations as the new steam plant of the Buffalo General Electric Company, the South Boston plant of the Boston Elevated Railway, the new plant of the New Bedford Gas & Edison Light Company, the Lowellville plant of the Republic Railway & Light Company, the Fisk Street plant of the Commonwealth Edison Company, Chicago, the Yonkers plant of the electric zone, New York Central Railroad, and more than thirty others of various capacities, totaling many hundred thousand kilowatts.

Dwight P. Robinson, a former partner of Stone & Webster, in charge of their construction and engineering business, has opened offices in New York under the name of Dwight P. Robinson & Company, Inc., constructing and consulting engineers. Mr. Robinson's work runs back for a period of twenty-five years, during which he has been associated with Stone & Webster, first in the management of some of their electric railway and lighting properties, later, for fifteen years, as president of the construction and engineering branch of the organization. Since 1912 he has been a member of the firm. Some of the more generally known projects which came under his personal supervision were the extensive water-power developments serving the Puget Sound cities, the steam and water-power plants supplying Minneapolis, the electrical and transmission features of the Keokuk development on the Mississippi, the Big Creek development serving Los Angeles, large steam-power stations for Buffalo, Boston, Minneapolis, New Bedford, Youngstown and other smaller plants, aggregating over 500,000 kw. capacity, in addition to the new home of the Massachusetts Institute of Technology. Mr. Robinson is a graduate of Harvard University and the Massachusetts Institute of Technology.

Obituary

Edward P. Putnam of Waterville, Me., formerly employed in the engineering department of the Central Maine Power Company, died recently in army service at Charleston, S. C.

Henry E. Randall, Jr., general manager of the Ludlum Electric Furnace Corporation, died at Montreal, Canada, on Oct. 21 from influenza. Mr. Randall was graduated from the Massachusetts Institute of Technology in 1913 and was employed by the Shawinigan Water & Power Company, first on the Cedars Rapids development and later in the company's offices in Montreal. Before severing his connection with this company on Oct. 1 last to take up the work which he was doing at the time of his death he was power sales engineer for the Shawinigan company and manager of the subsidiary electrical companies.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

CREDIT MEN GIVE THE OUTLOOK ON BUSINESS

Situation Viewed in Retrospect and Prospect Shows Optimistic Feeling—Large Reduction in Number of Delinquent Accounts

A general summary of the activities of the Electrical Credit Association of Chicago in the past year, as expressed at the annual convention on Nov. 22, shows that the electrical business has been conducted on a more favorable basis during the past year than for many years previously. Reports made by members to the association, which really cover the entire Middle West, indicated that the number of delinquent accounts had decreased 23 per cent over the preceding year and that the amount of the delinquent accounts reported had decreased 3.6 per cent. The wide difference in the two percentages was attributed to the fact that a large number of slow-pay electrical contractors have gone out of business during the stringent war period in which building has been so seriously curtailed.

A report from the Pacific Coast indicated the belief in that section that the worst is now over for the jobber as far as the Pacific Coast credit problem is concerned. It is believed there that building will open up which will supply work for the contractor-dealer and give him an opportunity to meet any obligations he may incur.

The delegation from Cleveland expressed the belief that the government was acting in an entirely fair manner in the cancellation of all contracts. Collections in that district were at present characterized as good, although they had been somewhat "sticky" as late as a month ago. The outlook for the Cleveland territory was painted in especially brilliant colors owing to the belief that shipbuilding as well as industrial work will sustain the commerce and industry of the city. No difficulty is anticipated in absorbing the 50,000 men who will be returned to Cleveland through demobilization. While the opinion was expressed that utility business will pick up, no radical change in building conditions was expected immediately. It was thought that the credit man in that district must closely watch the electrical contractor lest he become over-zealous and incur too great obligations.

From Detroit came the viewpoint that credit conditions will change more rapidly during the reconstruction period than they changed even during the war period, when things were moving with exceedingly high speed. Detroit is well pleased with the business of the past year and expects good business in the future. The stock shelves of the world are bare. Orders may not be so large, but they will be numerous. This will necessitate close watching of credits and will make all ledger experience of great value. Detroit is much behind with its building, as is the entire State of Michigan. The opinion was expressed that credits in Detroit have been enhanced through the elimination of the sale of liquor.

Minneapolis delegates expressed nothing but enthusiasm over the big year which is seen ahead. At Columbus, Ohio, 98 per cent of the houses which are now built are occupied at good rentals. A building boom is expected there.

Frederick Vose of Chicago, secretary of the association and also of the national association, stated that after talking with men in many lines of industry, he felt there was no need for fear concerning business during the reconstruction period. He expressed the belief that business would go at full speed ahead for at least five years. The iron and steel industry is very confident, financial problems are well in hand, foreign financing is necessary, building will boom, foodstuffs and clothing will be needed, and the railroads will continue to be prosperous. The greatest danger lies in over-confidence.

CONDITIONS UNDERLYING NEW CONSTRUCTION WORK

It Will Be Some Months Before Electrical Material Is Used Extensively—Non-Investment Projects Will Probably Go Up First

Ever since the armistice was signed, and in fact since long before that, there has been considerable comment regarding the vast amount of new construction that cessation of hostilities would bring. To the electrical manufacturer and jobber new construction and expansion means added business. A careful investigation then of the influencing factors should be helpful. Jobbers will lay in stock on the basis of what they judge conditions will be. Manufacturers will purchase raw materials on the same basis. If these purchases are made without a comprehensive idea of conditions, it is easily conceivable, especially if the market is delayed, that losses will arise which may be met only with great difficulty.

Taking the general building situation first, it is reported, and probably correctly, that architects are all once more becoming busy and that there are large numbers of new projects under consideration. The sums involved run into quite large figures. However, the fact must not be lost sight of that building operations as a rule do not start in the winter. In fact, if the much-talked-of building boom does come, it is doubtful if actual operations will commence much before the first of March. On that basis it would be the first of May or later before builders would be ready for electrical equipment.

Furthermore, it is not every type of building that will be represented equally in this boom. It seems pretty definite that structures put up to rent for many years must wait for lower prices of labor, money and materials if a return on the investment is to be made from future rentals. Low-priced apartment houses on speculative land might be erected with the idea that excessive rentals for a year or two would absorb excessive construction costs. Office buildings, however, have not this advantage.

Buildings and construction work not expected to pay a return on investment apparently offer the best construction market. These include churches, schools and other municipal buildings, government and state buildings, street-lighting systems and private dwellings.

In other words, in spite of the dearth of new construction for some time, it hardly seems possible that investors are going to enter the market without its being apparent that the building will pay its way in the future. It seems logical to suppose therefore that to stimulate investment building lower prices must come for materials, labor and money. Some materials are already a bit lower as the tendency of producers is to stiffen the market.

Money is perhaps more of a controlling factor than the other two. It is high at present, and more Liberty loans are expected next year and there are federal taxes to pay in the spring. However, it is not inconceivable that the banks will come to the rescue of new building with cheaper money if this course should be found necessary to protect other great credits.

FAN-MOTOR MARKET IS STIMULATED BY ARMISTICE

Since the Restrictions on Manufacture Have Been Reduced, Makers of Appliances Are Ordering Motors in Large Quantities

There has been one market certainly that has benefited immediately from the signing of the armistice. That is the fractional-horsepower motor market. Earlier in the year the War Industries Board found it necessary to require a curtailment of output of virtually all of the small-motor-drive appliances other than tools. At that time manufacturers of these appliances were finding it difficult to satisfy the demand. Later when the restriction went into effect it, of course, meant a rationing of the market.

Shortly after the armistice was signed, however, the restrictions were cut in half, and at once appliance manufacturers began to besiege motor producers for small motors. A number of appliance manufacturers are bending every effort to get satisfactory stocks in local warehouses for the holiday trade. As a result the fractional-horsepower motor market has been receiving during the past ten days a very large volume of new business.

METAL MARKET SITUATION

Market Continues Dull—War Board Fixes Pig-Tin Prices—Good Demand for Spelter

The War Industries Board has authorized the United States Steel Products Company, the distributing agency for tin in this country, to sell pig tin in lots of not less than 25 gross tons at 71¼ cents a pound, Pacific Coast ports, and at 72½ cents at New York and Chicago to consumers, dealers and jobbers. These prices are to rule for December and January. Dealers can resell in lots of 5 gross tons or more to consumers or jobbers holding purchase licenses at a profit not to exceed 2½ per cent.

New business in copper is still at a standstill, and nothing in that direction is expected this month until some indication or news is received as to what the action of the copper producers, acting in unison with the wishes of the authorities at Washington, is to be regarding prices after Jan. 1. Many who were inclined to the belief that copper prices would be held unchanged until enough time had elapsed to develop the large expected peace demand are now inclined to moderate their views on price changes. The attitude of labor is the point that stands out most clearly, and a wage readjustment must come if labor wishes to work full time.

The slight hesitancy in the spelter market the past few days has been overcome by renewal of inquiries and orders from the galvanized trade, and to-day the demand is as good as at any time lately, with sellers again holding off.

NEW YORK METAL MARKET PRICES

	Nov. 25	Dec. 3
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26 00
Casting	Govt. price 26 00	Govt. price 26.00
Wire base	28 75	28 75
Lead, trust price	8 05	7 05
Antimony	8 75	8 62½
Nickel, ingot	40 00	40 00
Sheet zinc, f.o.b. smelter	15 00	15.00
Spelter, spot	8.70 to 8.80	8 75
Tin	71 00	72.50 (official)
Aluminum, 98 to 99 per cent	Govt price 33 10	Govt. price 33 10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	21 00 to 21 50	21.00 to 21 50
Brass, heavy	11 50 to 12.00	11 50 to 12 00
Brass, light	9 00 to 9 50	9 00 to 9 25
Lead, heavy	6 00 to 6 50	5.75 to 6 00
Zinc, old scrap	5 75 to 6 00	5 75 to 6 00

THE WEEK IN TRADE

A TEMPORARY depression still rests on the market. Manufacturers are making plans to take care of greatly increased commercial business and almost every one is optimistic over the outlook.

Christmas business, which was not expected to be very large this year, is now being looked forward to eagerly by retailers. Already some very good reports on this account are coming in.

Jobbers' stocks are much better this week than last everywhere. There are still a few spotted conditions, but, generally speaking, stocks are sufficient to meet all reasonable demands. Jobbers are buying much closer to demand than they did last month, and indications are that a more rapid turnover basis will be followed.

The meeting at Atlantic City this week is expected to help industry generally in its reconstruction problem. The transition from a war to a peace basis is full of uncertainties. Labor is very quiet just at present and still scarce, although becoming more plentiful.

NEW YORK

The market this week in most lines has been quiet, and buyers show a tendency to hold back for lower prices. Supplies on hand are getting lower and jobbers do not show a tendency to stock up at this time.

Practically everything in the electric appliance line, however, shows increased demand, with short stocks on hand. Better deliveries of vacuum cleaners can be expected before Christmas, but more or less on a pro rata basis Demand for all heating appliances has taken a big jump the past week, and the market is short of stocks. Brisk sales of fractional motors are also reported and one dealer stated that small-motor business was never better.

Shortage of labor is still a factor but should improve soon.

MOTORS.—Cancellations for motors of the larger type have taken place in considerable volume, and demand the past week has fallen off noticeably. Fractional motors, on the other hand, show a very marked increase in demand, and sales the past few days have been very brisk. The growing popularity of the washing machine has greatly stimulated sales of small motors. Supplies on hand are good and shipments prompt.

VARNISHED CAMBRIC.—Prices remain stationary, and supplies on hand are in better volume owing to the release of large amounts of cotton cloth which was to be used by the Red Cross. Export demand, particularly for Japan, is increasing and deliveries are good.

MICA.—Supplies on hand are good and show a tendency to increase owing to South American imports. Prices are softening.

LAMPS.—Following the removal of the lighting restrictions by the Fuel Administration the lamp market is showing increased demand. Supplies on hand are adequate.

LAMP CORD.—Demand is very firm, and supplies on hand are limited. As the holiday season approaches large sales of portable lamps are expected which may be considerably curtailed if the necessary lamp cord cannot be obtained.

RADIATORS.—Cold weather has at last set in, and the demand for electric radiators is insistent. The market is practically bare of supplies, with no immediate hope of much betterment. As an example of the situation one distributer has sold during the past year 9000 radiators and expressed the opinion that he could have disposed of 20,000 had he been able to obtain them. It is also reported that a manufacturer of a well-known brand has unfilled orders on his books for 70,000 radiators.

HEATER CORD.—It is practically impossible to get any quantity of heater cord in the market to-day. Supplies on hand are most limited and deliveries for the near future doubtful. One well-known supplier voiced the opinion that he did not think the market for heater cord would be back in its normal condition for ten months, the underlying reason being the great shortage of rubber and asbestos yarns.

CHICAGO

The general business situation in the Middle West can best be summed up in the two words "watchful waiting." There is plenty of evidence that business is all ready to go ahead in many different directions, but there seems to be some hesitancy on the part of controlling factors here and there in actually getting into action. There are a number of contributing causes. Business men appear to be awaiting the outcome of the meeting of the United States Chamber of Commerce at Atlantic City on Dec. 4, 5 and 6. A definite solution of the government contract situation will also assist in clearing up the outlook. Removing all restrictions from business in essential material has assisted to some extent, but the demand thus created is not so great that it cannot be easily supplied. The holiday outlook for electrical devices at the present moment does not seem to be especially bright. Jobbers report that small dealers are buying from hand to mouth to supply the early Christmas trade and have given no indication of making an intensive effort to go after business. Jobbers are of the opinion that their business for December will be of somewhat meager volume; nevertheless, the whole year of 1918 as compared with 1917 will be entirely satisfactory.

The falling off of central-station loads is now beginning to be apparent in some centers. It is altogether probable that many central stations which have large industrial power loads will find that they passed their peak on or about Nov. 30. This is a rather peculiar circumstance, as the peak loads of these stations usually came a few days just before Christmas. The entire load curve of such central stations for the fall months has been different from what it is in normal years on account of the shift in the clocks and the signing of the armistice. Central stations which were normally producing about 15 per cent more energy than they had turned out last year found that just before the clocks were shifted their load was less than it had been on the same days of the previous year. Immediately the clocks were shifted, however, the peak loads began to mount higher and higher, attaining a maximum on or about Nov. 30. Following the signing of the armistice there has been a drop that ranges from 10 to 15 per cent in the peak load. It is expected that there will be a still further decline, but this has not presented an annoying situation, for central-station men believe that in February and March they will pick up all of the loads they formerly had and probably some other additional business held back by the war.

The building situation continues promising, particularly in connection with municipal improvements.

WIRE.—The market on small sizes of wire appears to be easing up gradually, it being possible for some, not all, manufacturers to supply their distributers with No. 12 and No. 14. It is the belief that this situation will gradually improve.

CONDUIT.—Jobbers are now shipping to all classes of trade without asking any questions. It is the belief that, in spite of the contracts for the navy which are holding up the producers to some extent, conduit will be back on a normal basis within about one month.

ELECTRIC HEATERS.—There is still a shortage of electric heaters. Complaints are heard in the trade that the manufacturers of these devices are driving business away by retaining in effect their ruling that all orders are placed subject to the price in effect on the date of shipment. Such an arrangement was all right under abnormal conditions, but the manufacturers now can contract for material, and the distributers feel therefore that the ruling should be annulled.

INCANDESCENT LAMPS.—Jobbers' stocks are reported to be in excellent shape.

ELECTRIC TOOLS.—One manufacturer is getting ready to announce a full line of electric tools such as portable drills and grinders which he intends to market through the electrical trade.

FUSES.—It is reported that there is some falling off in demand.

INSULATING VARNISHES.—Three concerns have recently signified their intention of going after this class of business more intensively in the electrical field.

WASHING MACHINES.—Manufacturers report that the demand for washing machines is expected to remain at high level for at least one to one and a half years, and at present prices, since producers during that period will have small chance of reducing their costs.

BOSTON

Business continues exceedingly brisk, despite progress in cancellation of war orders, which tends to slow down industrial activity for the time being. Manufacturers are devoting close attention to readjustment questions, and so far little has been heard as to labor disturbance. Well-informed opinion, however, urges caution in the rate of cancellations, holding that even at the cost of some waste of raw material and labor it is better to allow plenty of time for the transition from war to a peace basis. Jobbers report substantial stocks in most lines, and at present the larger houses are buying comparatively little material, preferring to dispose of present accumulations instead of going into the market actively for new supplies. Deliveries are improving a little. Collections are in reasonably good shape and show no material change over last week. Prices hold firm, and it is rumored that some appliances will be still higher later on. Central-station sales departments are beginning to receive holiday trade, and the opinion is expressed that unless manufacturing interests attempt to profiteer by raising prices without adequate grounds a fine winter's business will be enjoyed.

CONDUIT.—The larger houses are in better shape to meet new business demands than for some time. The removal of restrictions by the government means a better flow of pipe into New England, and jobbers who have ordered far ahead are now reaping the reward of their foresight. Stocks are still spotty, and a large movement of conduit is expected later.

ELECTRIC RANGES.—Stocks are fair and expansion of business is anticipated after Jan. 1. Central stations have many prospects on their books. Sales are still held back by the lack of labor, material and money for line extensions.

MOTORS.—The demand appears to be slackening somewhat, and many cancellations are being received. Stocks are gradually increasing, though now and then a particular size and speed cannot be secured. Up to 50 hp. rating, the supply of motors is now fairly large. There are many motors likely to be turned over to the second-hand market as war contract work dies down.

TRANSFORMERS.—Deliveries are improving. A large supply is expected by the second-hand market.

MOLDED INSULATION.—Some reduction in the volume of business is noted. The producers are looking toward the domestic market to absorb the future output. Price tendencies are still upward, but may not go much higher.

CHRISTMAS-TREE OUTFITS.—Stocks are fairly well in hand now to meet the trade of the holidays. The retail demand has begun for these equipments.

PORTABLE LAMPS.—An increasing demand is noted, and the price situation is not expected to have much effect on the holiday trade. Electrical gifts are likely to be in great demand this year, and while the lower and medium-priced portables are in greatest demand so far, a good trade is looked for in all grades.

SMALL STEAM TURBINES.—Makers of these units for auxiliary service will be busy for some time. The naval program of the country accounts for a large percentage of orders, and while the central stations are not as yet making inquiries, a loosening up of expansion restrictions may be expected before long. This is likely to mean a little more commercial business for the turbine makers, especially in connection with betterment work in plants. There is not much prospect now of any real boom in the electrical utility market for turbine sets of small size, however.

ATLANTA

A rough survey of the electrical field indicates that buyers are becoming more cautious while awaiting the results of readjustment in the near future. A large volume of business has been recorded during the last eighteen months on a rising market, and it is only natural that jobbers should exercise proper care when they anticipate a sagging market, even if a material decline is recorded over a comparatively long period.

Stocks are in almost normal condition, or in quantities to cover sixty-day turnover periods. As the quantity of stocks has varied so much in the last two years, there is really no other way to compare stocks than on the turnover basis. The tendency is to clean out present stocks of heating appliances before the first of the year and gradually build up stocks in the early part of 1919. On the whole, business is excellent and the much-talked-of slump in sales has not materialized up to this writing. All sources report deliveries as improving.

INCANDESCENT LAMPS.—The usual December demand for lamps of all types is now in full swing, and the volume of business is well up to that recorded during the same period a year ago when government requirements for cantonments were especially heavy. Stocks are well distributed throughout the Southeast, and jobbers are supplying the trade with little difficulty. For six to eight months past the insistent and steady call for government account kept the stock of 75-watt and 100-watt lamps at a low level, but buying from this quarter has been steadily slowing up and stocks are being replenished.

FIXTURES.—Dealers report that business has been big up to this time. A large quantity of this class of goods has been shipped to the smaller towns for distribution to rural points where numbers of farm-lighting outfits have been installed. Although this type of consumer has prospered during the war, the greater portion of sales was for the moderate-priced three-shower and four-shower fixtures. This market in itself has helped to fill in the valley caused by the slump in general building. On the other hand, the completion of buildings has tended to help out the situation, but as it will take some time for the new work to reach the point where the fixture demand will again become normal, many dealers will push the farm-lighting fixture business to the limit and get rid of their present stocks, anticipating a decline in metals.

PORTABLES.—A substantial business is being transacted in these and especially in the higher-priced lamps. One large dealer reports that he expects to sell out his entire stock during the holidays, but he is not going to order replacements extensively at this time. Individual shades are popular and moving faster as the holidays approach. Prices covering the entire line are steady.

SEATTLE—PORTLAND

The recent slump in price of copper is causing considerable alarm among Northwest jobbers, those in Seattle particularly, where stocks of wire of some proportions are held owing to heavy demand for this commodity from shipbuilding sources and the inability to secure satisfactory deliveries. Several of the larger firms were carrying stocks in excess of requirements. Another thing which is causing worry, to jobbing houses especially, is the threatened strike of the labor unions protesting against the Mooney decision and the strike of shipyard workers on the Pacific Coast because of the Macey board award. Electrical business undoubtedly will be hard hit if the strike set for Dec. 9 materializes as the larger portion of electrical jobbing business is with shipyards and allied industrials.

Jobbers as a whole in Seattle report business during the past week exceptionally good in spite of the Thanksgiving holiday. Sales are well sustained to industrials, and retailers report quickened movement along domestic-appliance lines with indications that Christmas trade will be far better than originally predicted. Jobbers have fair stocks of electric household lines, and small dealers are making purchases. The Morrison Mill Company, Bellingham, Wash., is making arrangements to install new electrical equipment, including a large dynamo and thirteen motors, etc. Portland electrical contractors report the usual amount of business for the past week. Some have more than they can handle. This condition, however, does not extend to the supply houses. Electrical manufacturers' representatives report business very slow during the past week, with very few sales of generators, motors and like equipment. Buyers are apparently holding off until conditions are more settled. From present indications there should be ample stocks of motors and transformers on hand for some time to come. The very unexpected order of the government canceling all wooden-ship contracts, twenty-nine in all, valued at approximately $20,000,000, except in cases where ships are actually under construction, created a decided feeling of depression in business circles and has caused a decidedly conservative attitude to be taken by all who are contemplating any extension of new work at this time. Sudden and drastic cancellation of government contracts for woolens in the Portland district placed this industry also in serious condition temporarily. Contracts calling for the construction of 2000 railroad cars are held up, and the largest car-manufacturing plant of the Northwest has been idle for a week as the result of a strike at the plant of the Pacific Car & Foundry Company. The Foundation Shipbuilding Company, Tacoma, is seriously considering converting its large wooden plant into a steel yard equipped with eight ways. The present plant covers fifty-five acres and has ten ways.

SAN FRANCISCO

The prospect of the immediate return of troops, particularly the drafted men taken last, is making a difference in the labor situation in California, and material improvement in general conditions is expected to result. Plans of reconstruction for returned wounded soldiers are claiming popular attention, and indications are that California will enjoy a good share of activity in that line. The lifting of the ban on development work is being felt first in extensions and additions which power companies and other public utilities have deferred for some time. The development of more water power in California is regarded as a certainty as soon as there has been time to study the situation in the light of the peace basis and to arrange the financing. The influenza epidemic is past in San Francisco. Public gatherings, etc., were resumed Nov. 16. Business had entirely regained its normal level by the last week in November. Los Angeles on the other hand, had a longer siege, and December business was still depressed.

Orders for electrical equipment and material in the central valleys of California have been increasing, particularly for next year's irrigation work with orders for pumping installations up to 200 hp. or 300 hp. Freight shipments between Eastern factories and San Francisco are now averaging about twenty-eight days, no noticeable effect of peace conditions having yet become manifest on transcontinental freight.

Transformer stocks are in excellent shape now, and orders for practically all sizes can be filled immediately. Small motors are being ordered on a three to four month basis now instead of the eight to twelve month basis necessary until recently. This condition relieves the necessity for carrying large stocks on the Pacific Coast, and orders to the factories are being adjusted accordingly. Effort is being made to return promptly to a stock condition such as will balance the difference between demand and present delivery rates.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61 00
No. 12 solid	71 00
No. 10 solid	90 00
No. 8 solid	106 00
No. 6 solid	145 00
No. 10 stranded	95 00
No. 8 stranded	115 00
No. 6 stranded	160 00
No. 4 stranded	205 00
No. 2 stranded	266 00
No. 1 stranded	315 00

Twin-Conductor

No. 14 solid	104 00
No. 12 solid	135 00
No. 10 solid	185 00
No. 8 stranded	235 00
No. 6 stranded	370 00
No. 4 stranded	575 00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

Twin-Conductor

	No. 14 Solid
Less than coil.	List
Coil to 1000 ft	6%–10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	6%–10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+30% to $73 20
Coil to 1000 ft	List

	No. 12 Solid
Less than coil	+30% to $85 20
Coil to 1000 ft....	List

Twin-Conductor

	No. 14 Solid
Less than coil	$115.00
Coil to 1000 ft	100.00

	No. 12 Solid
Less than coil	+20% to $162 00
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0 22 to $0.30 each.
Standard packages from 100 to 250

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std pkg	+30% to 12%
1/5 to std. pkg	+5% to 20%
Std. pkg	18% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 45—$0 46	$0 45—$0 47
12 to 50	40	.40— 41
50 to barrel	35— .36	.36— 37
Barrel lots	32— 329	33— 339

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.	$0 40 to $0 45	$0 40 to $0 45
12 to 50....	.35 to 39	35 to .39
50 to barrel	319 to .362	329 to 382
Barrel lots..	.289 to 332	299 to 342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5 00
3/8	250	7 50
1/2	100	10 00
3/4	50	13 00
1	50	21 00
1¼	50	26 00
1½	25–50	35 00
2	25–50	45 00
2½	25–50	52 00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
3/8-in. single.trip.	$75.00	$63.75— 69 75
3/8-in. double strip	75.00— 82 50	72 00— 75 00
1/2-in. single strip	100 00	85 00— 93 00
1/2-in. double strip	100.00—110 00	96 00—100 00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75 00	$63 25 to $63 75
3/8-in. double strip	78 25 to $90 00	71.25 to 75 00
1/2-in. single strip	100 00	75 00 to 85 00
1/2-in. double strip	105.00 to 120 00	93.00 to 100 00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0 05½	1	$0.25
1/4	06	1¼	.33
3/8	.09	1½	40
1/2	.12	1¾	47
5/8	15	2	55
3/4	18	2¼	65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$25 00–51 70	$24 00–35 20	$23 00–30 25
1/4-in.—	30 00–56 40	28 00–38 40	26 00–33 00

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$44 00–60 00	$30 00–33 00	$26 50–29 15
1/4-in —	48 00–65 00	33 50–36 00	29 00–31 80

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
1/4	$0 08½
3/8	08½
1/2	.08½
3/4	11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	.76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
1/4	$0 05	$0 19
3/8	06	.19
1/2	07	.19
3/4	10	.25
1	13	37
1¼	17	45
1½	21	.50
2	28	1 10
2½	40	1 80
3	60	4 80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in	3/4 in. to 3 in.
Less than 2500 lb..	7% to 7 1%	9% to 9 1%
2500 to 5000 lb...	10% to 10 1%	12% to 12 1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 to 1/2 In.	3/4 to 3 In.
Less than 2500 lb..	+5.5% to 3.5%	+3.5% to +1.5%
2500 to 5000 lb.....	+2.5% to +0.5%	+5% to 1.5%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price.	$6 00 to $7 00
Discount..	20% to 30%

CHICAGO

List price.	$6 00 to $7 00
Discount.	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	Lis
3-amp. to 30-amp	100	$0 25
35-amp. to 60-amp	100	35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp	25	2 00
225-amp. to 400-amp.	25	3 60
450-amp. to 600-amp	10	5 50
600-Volt		
3-amp. to 30-amp	100	$0 40
35-amp. to 60-amp.	100	60
65-amp. to 100-amp.	50	1 50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5 50
450-amp. to 600-amp.	10	8 00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41% to 45%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	30%
1/5 to std pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6 00 to $9 37
1/5 to std. pkg	5 25 to 7 00

Standard packages, 500. List, each, $0 07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8 00
1/5 to std pkg	7 00

Standard packages, 500 List, each, $0 07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

Regular, Clear:	Std. Pkg	List, Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	85
75-watt—C	50	70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3 25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25	50	60
25-watt—G 25	50	.60
40-watt—G 25	50	.64
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4⅜-in., Frosted:		
100-watt—G 35	24	1 15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30 47—$40 77
Coil to 1000 ft	27 42— 30 22

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$38 00
Coil to 1000 ft	28 00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24 00

CHICAGO

Net per 100	$23 93 to $30 00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30 00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30 00
103—C.A., 9, 4R, B 1½	25 00
106—F.A., 7, C.S., 1½, 3 R	20 00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%	20%
$10.00 to $50.00 list	36%	31%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20%	10%
$10.00 to $50.00 list	30%	20%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	5%
1/5 to std. pkg	15%
Std pkg	25%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$21 00 to $34 00
1/5 to std. pkg	17.85 to 28 90

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$21 00–24 15
1/5 to std. pkg	17 85–21 00

Standard package, 2200. List per 1000, $20.00–21 00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500 5½ N C.—Solid Nail-it	Std. Pkg. 4000 —N.C.
Less than 1/5 std. pkg	$16 00 to $22 00	$32 00
1/5 to std. pkg	13 60 to 18 70	27 20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500. 5½ N C.—Solid Nail-it	Std. Pkg. 4000 —N.C.
Less than 1/5 std. pkg	$13 00–$18 40	$32 00 $36 80
1/5 to std. pkg	11 50– 16 00	27 20– 32 00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets.	500	$0 33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List
1/5 std. pkg	10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0 80
60-amp. S. P. S. T.	1 20
100-amp. S. P. S. T	2 25
200-amp. S. P. S. T.	3 48
300-amp. S. P. S. T	5 34
30-amp. D. P. S. T.	1 20
60-amp. D. P. S. T.	1 78
100-amp. D. P. S. T.	3 38
200-amp. D. P. S. T	5.20
300-amp. D. P. S. T	8 00
30-amp. 3 P. S. T	1 80
60-amp. 3 P. S. T	2.68
100-amp. 3 P. S. T	5 08
200-amp. 3 P. S. T	7 80
300-amp. 3 P. S. T	12 00
Low Grade:	
30-amp. S. P. S. T	$0.42
60-amp. S. P. S. T.	74
100-amp. S. P. S. T	1 50
200-amp. S. P. S. T	2 70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T	1 22
100-amp. D. P. S. T.	2 50
200-amp. D. P. S. T	4 50
30-amp. 3 P. S. T	1.02
60-amp. 3 P. S. T	1 84
100-amp. 3 P. S. T.	3 76
200-amp. 3 P. S. T	6 76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15% to +10%
$10 to $25 list	+10% to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5% to list
$10 to $25 list	List to 8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 15%
$10 to $25 list	List to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15% to 16%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0 28
5-amp single-pole, ind	250	32
10-amp. single-pole	100	.48
10-amp. single-pole, ind	100	.54
5-amp. three-point	100	54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P	100	66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List to 10%
1/5 to std. pkg	10% to 16⅔%
Std. pkg	18% to 25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0 34
No. 160	60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list.	Net to 30%	Net
$2.00 to $10 00 list.	10% to 35%	5%
$10.00 to $50.00 list.	20% to 37%	10%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list..	25% to 40%	20% to 30%
$2.00 to $10.00 list...	25% to 50%	20% to 40%
$10.00 to $50 00 list.	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price.	$6 00 to 6 50
Discount	20% to 30%

CHICAGO

List price	$6 00 to $7 00
Discount	20% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0 54–$0 66
No. 18, full spools.	52– 56

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0 65 to $0 71
No. 18, full spools	.55 to 595

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft	500 to 1000 Ft.	1000 to 5000 Ft.
14	$20 00–$25 00	$15 00–$17 00	$15 00–$15 75
12.	23 58– 27 09	21 62– 29 09	17 68– 23 22
10..	30 20– 37 80	27 45– 32 40	23 47– 32 40
8..	42 74– 53 34	38 85– 45 72	33.21– 45 72
6	61.50– 84 42	55 35– 72 36	52 58– 55 48

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14..	$25 00	$18 00–$25 00	$15 50
12..	$29 46– 31 44	29 46– 31 44	$25 54– 31 44
10..	41 10– 43 84	41 10– 43 84	34 62– 38 36
8..	57 00– 61 76	57 00– 61 76	50 18– 54 04
6...	85 31– 97.68	85 31– 85 47	77 21– 85 47

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4 0 to 3 Inc

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$39 75 to $44 00
25 to 50 lb.	39 75 to 42 00
50 to 100 lb.	38 75 to 40 00

CHICAGO

	Per 100 Lb. Net
Less than 25 lb.	$41 00 to $41 76
25 to 50 lb	39 75 to 40 76
50 to 100 lb	38 75 to 39 76

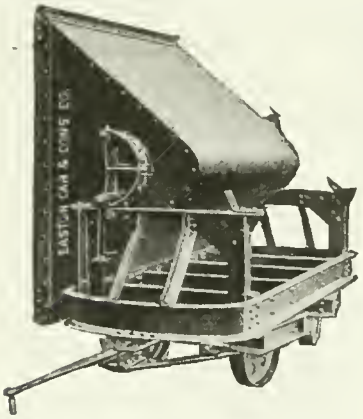
NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Trackless Trailer with Dump-Car Body

With the increasing use of industrial electric tractors has come the need of trailers for specialized service. With this in mind the Easton Car & Construction Company, Easton, Pa., is manufacturing a trackless trailer mounting a dump body to speed up the loading and unloading of loose materials such as coal, ashes, sand, ore and slag.

Four extra large wheels furnished with roller bearings and either rubber or composition tires assist the trailer in running smoothly over all types of flooring and even quite rough ground. Close tracking in trains of these cars is said to be accomplished with comparative ease since both front and rear tracks of the trailers are fitted with swivels.



DUMPS LOAD AT ANGLE OF 45 DEG.

Among the important features claimed for the car body are a special latch for locking it in a half-dumped position, thus giving a low height for hand loading; heavy construction of the body, which dumps clear of the wheel at an angle of 45 deg.; cast-steel wheels, sturdy underframes and automatic safety latches.

One-Piece Porcelain Refillable Fuse Plug

A simply constructed 125-volt service refillable fuse plug for 3-30 amp. is the latest product of A. F. Daum, 1157 Hodgkiss Street, Pittsburgh, Pa. The body of the plug is a single piece of porcelain with threads for socket insertion and slits through which the metal fuse strip is passed. A transparent mica cover completes the plug.

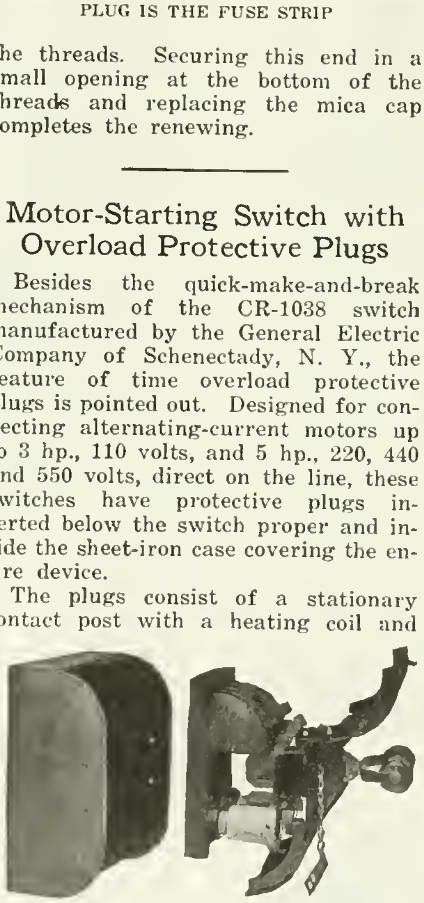
Simplicity in renewing the fuse strip is a feature claimed by the maker, the operation consisting of passing ends of the new strip up through the two bottom slits in the porcelain and bending one end down into a groove cut in the threads. Securing this end in a small opening at the bottom of the threads and replacing the mica cap completes the renewing.

THE ONLY METAL PART OF THIS FUSE PLUG IS THE FUSE STRIP

Motor-Starting Switch with Overload Protective Plugs

Besides the quick-make-and-break mechanism of the CR-1038 switch manufactured by the General Electric Company of Schenectady, N. Y., the feature of time overload protective plugs is pointed out. Designed for connecting alternating-current motors up to 3 hp., 110 volts, and 5 hp., 220, 440 and 550 volts, direct on the line, these switches have protective plugs inserted below the switch proper and inside the sheet-iron case covering the entire device.

The plugs consist of a stationary contact post with a heating coil and a fusible link which binds a spring contact to the stationary post. The motor circuit is completed through the heating coil, post, fusible link and spring contact arm, so that in case of an overload the current passing through the coil will heat the post sufficiently to melt the fusible link. This releases the contact arm, which springs out of touch with the stationary post and breaks the circuit. The manufacturers state that the links are both inexpensive and easily renewed.



SWITCH MOVEMENT REMOVED FROM CASE, SHOWING PROTECTIVE PLUGS

By reason of the time-lag feature the momentary increase of starting current is said not to cause the plug to open the circuit, only acting to protect the motor when overload conditions are maintained for periods long enough to overheat the motor. Under these conditions the plugs open the circuit in time to prevent the motor carrying too heavy a load from attempts to start stalled motors and multiphase motors running single-phase.

Non-Water-Tight Push and Pull Switches

Side or rear entrance styles may be secured in the non-water-tight push and pull switches for marine service, rated at 5 amp., 125 volts, and are being marketed by the Benjamin Electric Manufacturing Company, 806 West Washington Boulevard, Chicago. The mechanism is said to be heavy and sturdy in construction with plunger control, and the connectors, of the binder screw type, are easily accessible. High-heat-molded insulating material composes the base. Tappings may be furnished for ½-in. (1.27-cm.) pipe connection one-way, and two of the models will be tapped ¾ in. (1.9 cm.) one-way, or ½-in. (1.27 cm.) or ¾ in. (1.9 cm.) two-way, if desired. The boxes for these switches are brass or iron while the cover is of brass threaded for connection to the box. Standard marine black finish is used.

SUBSTANTIAL MARINE SWITCH

Trade Notes

EXTENSION OF PERIOD OF VALIDITY OF IMPORT LICENSES.—In W. T. B. R. 315, issued Nov. 11, the War Trade Board announced that all import licenses would be valid to permit shipment of the commodities referred to therein within a period of ninety days from the date of the issuance of the license. The War Trade Board now announces that henceforth all import licenses which have been issued, or of which extensions have been issued, on or after Aug. 25, 1918, or which may hereafter be issued or extended, will be valid indefinitely unless revoked, provided that it is not otherwise expressly stated in the license. The provision printed on the import license forms which have been and are still in use, that the license is valid for ninety days only, will therefore be disregarded.

COURSE OF WAGES.—In drawing some analogies between the respective periods immediately following the civil war and the late world war, the Guaranty Trust Company of New York makes the following instructive remarks regarding the course of wages: Wages lagged very much behind prices in both the upward and the downward movements after 1860; they increased more than prices and sustained the gains for a longer time. Specifically, according to Professor Mitchell's tabulations, the high peak in prices came in January, 1865, and there was an almost uninterrupted decline thereafter, the index number for 1880 standing at only 4 per cent above the level for 1860. Wages, on the other hand, rose much more slowly during the war period, but continued to rise generally until July, 1872, seven years after prices had begun the long decline. The margin of gain for the workers, the net increase in real wages, maintained at the close of the twenty-year period, is roughly measured by the indices. They show a gross gain of 38 per cent in wages in 1880 over the 1860 level, against a net increase of 4 per cent in wholesale prices.

SHORTENING THE CONSERVATION LIST.—The changed situation arising out of the signing of the armistice makes it possible for the War Trade Board to alter many of its regulations governing the exportation of certain commodities which the continuance of the war has heretofore made it necessary to conserve much more strictly than present circumstances require. For the war needs of the United States and the Allies the War Trade Board has limited the exportation of many commodities which may now be spared for general export trade, as they are no longer needed for war purposes. In pursuance of this policy, the War Trade Board is now revising as rapidly as possible its rules of conservation, and in conformity with such revision the conservation list will be materially abbreviated. The War Trade Board is now in a position to grant many export licenses which heretofore have been refused for reasons of conservation. There are now, and for some time to come there will be, certain commodities the exportation of which must be carefully controlled because of the general world shortage, but even for the exportation of these commodities licenses will be granted as freely as possible. The issuance of licenses will be greatly facilitated if exporters will state on their applications whether the licenses are required for business which is actually in hand, subject to export license, together with the dates of their orders. In connection with the foregoing exporters should be advised that, while it is no longer necessary to conserve commodities for war purposes, it may become necessary to regulate the exportation of certain commodities essential to the rehabilitation of Europe and Siberia, and exporters should be further advised that it may become necessary to place restrictions upon the exportation of bulky commodities by reason of the scarcity of tonnage available. The return of troops, the carriage of supplies for troops not yet returned and the carriage of commodities required for the relief and reconstruction abroad make demands upon the world's tonnage of such magnitude that it is impossible as yet to determine when there will be an increase in the tonnage engaged in unregulated trade. Tonnage continues to be the controlling factor, and when reconstruction is well under way it may become necessary to subject certain raw materials to rationing. The War Trade Board also calls attention of exporters to the fact that the trading with the enemy act still remains in full force and effect.

THE H. W. JOHNS-MANVILLE COMPANY has purchased 255 acres as a factory site in Chicago. It is said to be the intention of the company to erect as soon as conditions will permit a duplicate of its large plant at Manville, N. J. It will cover 1,250,000 sq.ft. of floor space at a cost of approximately $3,000,000.

SIBLEY & PITMAN, electrical supplies, formerly located for six years at 19 West Thirty-sixth Street, New York, moved last month to very much larger quarters at the corner of Thirteenth Street and Sixth Avenue. Greatly increased business necessitated larger space, and the new store, sub-basement and cellar contain over 20,000 sq.ft.

BENJAMIN I. FULLER has resigned as superintendent of foundries of the Westinghouse Electric & Manufacturing Company to become vice-president and general manager of the following companies at Niagara Falls, N. Y.: Niagara Electric Furnace Company, Defiance Paper Company and Niagara Wall Paper Company. Mr. Fuller was connected with Westinghouse interests for twenty-eight years.

THE W. E. DAVIS ADVERTISING SERVICE, 1203-4 Plymouth Building, Minneapolis, Minn., will hereafter be known as Davis & Armstrong, Inc. This new arrangement includes the services of J. C. Armstrong as well as those of W. E. Davis. This firm is well known in the Northwest as one which gives special attention to technical advertising accounts, including that of the cedar pole associations.

I. H. MILLS, who has been associated with the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., for the past twenty-three years, has resigned to become superintendent of the Sperry Gyroscope Company of Brooklyn, N. Y. Mr. Mills began his career with the Westinghouse company as a machine operator and finally became superintendent of the small industrial motor department.

THE EDISON ELECTRIC APPLIANCE COMPANY, INC., Hotpoint Division, Chicago, has announced to its distributers and customers that in order to assist the government further, because of the urgent requests to save paper, it will not distribute this season the special Christmas window decorations or line of coöperative materials. The company states that it will, however, supply its standard line of helps in limited quantities.

THE BOOTH-HALL COMPANY, manufacturer of electric furnaces, Chicago, has placed in successful operation during the past few months the following steel melting furnaces: West Michigan Steel Foundry Company, Muskegon, Mich., 3-ton basic-steel castings for naval gun carriages; Monroe Steel Castings Company, Monroe, Mich., 1½-ton acid-steel castings; Queen City Foundry, Denver, Col., ¾-ton basic-steel castings for the Emergency Fleet Corporation; New England Steel Castings Company, East Longmeadow, Mass., 1½-ton acid-steel castings. In addition to these furnaces, there is also a ¾-ton acid-lined furnace in operation at the plant of the Duriron Castings Company, Dayton, Ohio, used for experimental work in the manufacture of duriron, and a 1½-ton furnace at the Avery plant, Peoria, Ill., basic, used for the manufacture of tractor castings.

DWIGHT P. ROBINSON & COMPANY, INC., constructing and consulting engineers, New York City, is the name of a firm just formed by Dwight P. Robinson, a former partner of Stone & Webster in charge of their construction and engineering business. The associates of Mr. Robinson will be R. M. Henderson, in charge of construction; C. W. E. Clarke, mechanical engineer; R. A. Philip and D. L. Galusha, electrical engineers, and M. E. Thomas, structural engineer, together with a nucleus of a strong purchasing, accounting and steel construction organization. All of these men for many years have been engaged in large undertakings under Mr. Robinson's direction. In the past they have specialized in the economical and rapid execution of difficult projects and in the new work are prepared to construct, either from their own designs or from the designs of others, hydroelectric developments, steam-power plants, transmission systems, industrial plants, housing developments, steel and reinforced-concrete structures, electrification of steam-railway systems, and similar work in this general field. They will also carry on a general practice as consulting engineers, including the making of engineering and financial reports and appraisals.

Trade Publications

FUSE TESTER.—The Blake illuminated fuse tester is pictured and described in a recently issued leaflet of R. S. Blake, 230 South La Salle Street, Chicago.

COAL-STORAGE SYSTEM.—Catalog 38, from the R. H. Beaumont Company, Philadelphia, has for its subject the Beaumont drag scraper system used in the ground storage of coal.

TOOLS AND HANDLES.—Illustrated general catalog 25 of the Columbus Handle & Tool Company, Columbus, Ind., gives prices and brief descriptions of construction tools, linemen's tools and equipment, handles for various uses as well as tools for other purposes.

INSULATION MAINTENANCE.—The relation between renewing insulating varnishes and keeping motors out of repair shops is dealt with in a recent leaflet from the Dolph Manufacturing Corporation, 95 Liberty Street, New York City. The firm makes insulating compounds and varnishes.

CUTTING AND WELDING.—"Oxwelding and Cutting" is the title of a book from the Oxweld Acetylene Company, New York City, and is a manual of instruction for welding and cutting, giving the principles of electric welding and cutting and explaining fifty-four problems which an efficient operator should master.

ENGINES.—Belliss & Morcom, Ltd., of Birmingham, England, have issued through their Canadian representatives, Laurie & Lamb, 211 Board of Trade Building, Montreal, a pamphlet showing some of the Canadian installations of the Belliss double-acting self-lubricating engines for generator drive as well as citing advantages of these engines and giving tables of the revolutions, kilowatts and horsepowers of the two-crank compound and non-compound and the three-crank triple-expansion and compound types. The horsepower of the former ranges from 32 to 720, while the latter type of engines develop from 260 hp. to 2500 hp.

New Incorporations

THE BELYEA COMPANY of New York, N. Y., has been incorporated by W. P. Berryman, B. M. and T. S. Belyea, 48 East Eighth Street, New York City. The company is capitalized at $10,000 and proposes to manufacture electric and gas-operated machinery.

THE FULLER ELECTRIC COMPANY of New York, N. Y., has been incorporated by C. L. Thompson, W. A. Walling and E. L. Dolder, 315 East Seventh Street, New York City. The company is capitalized at $10,000, and proposes to manufacture electric vehicles.

THE CRAWFORD ELECTRICAL CONSTRUCTION COMPANY of New York, N. Y., has been incorporated with a capital stock of $5,000 to do a general electrical contracting business. The incorporators are J. Wolf, S. Berlinger and J. L. Diamond, 1789 Broadway, New York City.

THE FEDERAL STORAGE BATTERY COMPANY of Washington, D. C., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $100,000 to manufacture storage batteries. The incorporators are M. E. Jones Rudolph Uramboug and Richard Bowen of Washington, D. C.

THE UNIVERSAL PRODUCTS COMPANY of Madison, Wis., has been chartered by John L. Bourke, John L. Newman and E. Lee, all of Madison. The company is capitalized at $50,000, and proposes to manufacture motor vehicles, tractors, machinery and install lighting and heating plants.

THE GERLINGER ELECTRIC STEEL FOUNDRY COMPANY of Milwaukee, Wis., has been incorporated with a capital stock of $99,000 by the owners of the Gerlinger Electric Steel Foundry Company, to control and operate the new electric steel foundry now being completed at Fifty-ninth and National Avenues, West Allis. The officers of the company are: William E. Gerlinger, president; George P. Gerlinger, vice-president, and C. A. Gerlinger, secretary and treasurer

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

BOSTON, MASS.—Work has been resumed on the eight-story addition, 74 ft. by 167 ft., to the plant of the Gillette Safety Razor Company. The cost is estimated at about $500,000.

WATERTOWN, MASS.—Plans are being prepared by the Aetna Mills Company of Watertown for an addition to its plant, to cost about $50,000.

WORCESTER, MASS.—The Worcester Electric Light Company has applied to the City Council for permission to lay a conduit in South Crystal Street.

PHILLIPSDALE, R. I.—Plans have been prepared for the erection of a pumping station, 20 ft. by 20 ft., with an intake of 300 ft. 30-in. pipe line at the plant of the American Electrical Works.

NEW HAVEN, CONN.—The New York, New Haven & Hartford Railroad Company is planning to erect a new engine house at Hopewell, to cost about $50,000.

WATERBURY, CONN.—The Public Utilities Commission has given its approval of the construction of a transmission line of the Connecticut Light & Power Company from its substation at Bunker Hill in the town of Waterbury through the towns of Waterbury and Oxford to its hydroelectric power station on the Housatonic River.

Middle Atlantic States

AMSTERDAM, N. Y.—The Adirondack Electric Power Corporation has filed a petition with the Public Service Commission asking for approval of operation of a high-tension transmission line between its substation at Amsterdam and Utica and one between Little Falls and Herkimer. Franchises have been received from the towns of Amsterdam, Johnstown, Ephratah, Oppenheim, Manheim and Little Falls. The company has a contract to furnish electricity to the Utica & Mohawk Valley Railroad.

BUFFALO, N. Y.—The City Council is considering replacing the gas lamps in maoy of the streets with electric lamps.

BUFFALO, N. Y.—The capital stock of the Clemens Electrical Corporation, 725 Main Street, has been increased from $10,000 to $100,000. The company manufactures electrical machinery and equipment.

NEW YORK, N. Y.—Plans are under consideration by the Public Service Commission foı the early award of the remaining contracts on the dual rapid transit system, including the construction of four or more shop buildings for repair and general work. The cost of the work is estimated at about $25,000,000.

NEW YORK, N. Y.—Contract has been awarded by the New York Municipal Railway Company to the General Railway Signal Company of Rochester for the installation of alternating-current block signals and interlocking on its proposed underground line to be built in Sixtieth Street, New York City.

NIAGARA FALLS, N. Y.—Plans have been prepared by the Cliff Electric Distributing Company, Canal Basin, for the erection of four-story buildings, 20 ft. by 75 ft., at Echota, near Niagara Falls. The buildings, it is understood, will be used for substation work.

NIAGARA FALLS, N. Y.—Plans for the construction of a hydroelectric plant to develop approximately 200,000 hp. additional power, it is reported, have been submitted to the United States government by Dr. T. Kenard Thomson, 50 Church Street, New York City. The plans provide for the construction of a new dam across the Niagara River, 4 miles below the falls. The cost is estimated at $50,000,000. It will require about two years to carry out the project.

OGDENSBURG, N. Y.—Plans have been prepared by the New York Central Railroad Company for the erection of a mechanical coal-handling plant at Ogdensburg, to cost about $30,000. G. W. Kittredge, Grand Central Terminal, New York City, is chief engineer.

BOONTON, N. J.—The Morris & Somerset Company of Morristown has acquired the local plant of the Boonton Electric Company, including water rights along the Rockaway River in Boonton. Extensions and improvements, it is understood, will be made to the property.

JERSEY CITY, N. J.—The City Commission has appropriated more than $200,000 to provide funds for the construction of a new power plant at the Lincoln High School, the installation of new boilers and auxiliary equipment at the Coles Street bathhouse and new boiler equipment at the City Hospital, in connection with the bond issue for $3,985,000, arranged to provide for various extensions and improvements at municipal properties.

BUTLER, PA.—The proposed new power plant of the Imbria Coal Company of Butler will be located at Nichola instead of Etnaria, as previously announced. The building will be about 40 ft. by 65 ft. and will cost about $10,000.

CARLISLE, PA.—Plans, it is understood, have been prepared by the Western Union Telegraph Company for the installation of a new underground conduit system to replace the present overhead lines.

CONNELLSVILLE, PA. — The Capson Glass Company has started work on the construction of a new gas-producer plant at its works, to cost about $100,000.

NICETOWN, PA.—Plans have been prepared by the Midvale Steel & Ordnance Corporation, Widener Building, Philadelphia, for the installation of new reinforced concrete oil and switch cells at its local plant.

PHILADELPHIA, PA.—Plans are under consideration by the Philadelphia Electric Company for extensive improvements and additions to its plant at Chester, including the installation of a new 30,000-kw. generating unit for the purpose of furnishing electricity to the shipbuilding works of the American International Corporation at Hog Island and in the Eddystone district. The directors of the company have authorized an issue of $4,997,550 in capital stock to provide funds for extensions to its system.

PITTSBURGH, PA.—Notice has been filed by the Electric Appliance Company of Pittsburgh of an increase in capital stock from $25,000 to $40,000, to provide for general business extensions.

SCOTDALE, PA.—The Electric Water Sterilizer & Ozone Company has filed a notice of an increase in capital stock from $250,000 to $350,000, to provide for extensions.

STATE COLLEGE, PA.—The light, heat and power plant of the Pennsylvania State College was recently damaged by fire, causing a loss of about $300,000. The entire engineering school with equipment was totally destroyed.

ALEXANDRIA, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 16, under Specification 3627, for furnishing and installing electric traveling cranes in the torpedo assembly building plant at Alexandria. The cost is estimated at about $30,000.

NORFOLK, VA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 9, under Specification 3483, for elevators for laundry and power house at Norfolk, Va.

WHEELING, W. VA.—The Wheeling Electric Company, it is reported, is considering the construction of a new steam-driven power plant, to cost about $2,000,000, in the vicinity of Windsor. The Foundation Company of New York, N. Y., has charge of building operations.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Various, Schedule 3527—miscellaneous flexible brush-holder cable, miscellaneous single-conductor ignition cable; Schedule 3534—miscellaneous lighting and power cable, miscellaneous ship-lighting cable, miscellaneous telephone cable, miscellaneous lighting and power wire, miscellaneous telephone wire, miscellaneous weatherproof wire; Schedule 3524—miscellaneous incandescent cord; Schedule 3519—miscellaneous brass wire, miscellaneous hard and soft copper wire, miscellaneous bronze phosphor wire; Schedule 3526—miscellaneous fuse wire, miscellaneous nickel steel bare resistance wire; Schedule 3523—miscellaneous underwriters' wire. Brooklyn, N. Y., Schedule 3534—25,000 ft. lead-sheathed cable; Schedule 3534—miscellaneous rubber-covered wire. Boston, Mass., Schedule 3527—500 ft. searchlight cable. Mare Island, Schedule 3534—250 lb. annunciator wire. Norfolk, Va., Schedule 3523—8000 ft. pot-head wire. Charleston, S. C., Schedule 3526—miscellaneous resistance ribbon wire. Application for proposal blanks should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Eastern and Western yards, until Dec. 9, Schedule 7253½—connectors and outlet box for cable; Schedule 7261½—50 resistance devices. Boston and Brooklyn, Schedule 7275½—270 6-volt buzzers and 750 6-volt 3-in. bells. Gloucester, Schedule 7267½—six 3-hp. motors, one motor-generator set and one motor-generator. Puget Sound, Wash., until Dec. 13, Schedule 7255½—one switchboard. Bids will also be received as follows: Washington, Schedule 7268½—3450 transformers; Schedule 7350½—20 motor buzzer sets; Schedule 7356½—switchboard panels. Puget Sound, Schedule 7274½—two transformers; Schedule 7307½—miscellaneous soft lead wire; Schedule 7340½—two motors; Schedule 7346½—one 28-hp. motor; 7348½—one 50-hp. motor; Schedule 7349½—fuses and fuse elements. Brooklyn, Schedule 7305½—miscellaneous extension sockets. Eastern and Western yards, Schedule 7311½—miscellaneous storage batteries. Boston, Schedule 7333½—gasoline blowers and a number of 250-hp. motors. Fort Worth, Tex., Schedule 7339½—miscellaneous cable, 196 ft. busbar copper, miscellaneous busbar insulators and supports, six oil circuit breakers, four transformers, three switches and one lightning arrester. Pensacola, Fla., Schedule 7347½—miscellaneous receptacles, plugs, cable and connectors. Norfolk, Va., Schedule 7345½—switchboard. Application for proposal blanks should designate the schedule desired by number.

North Central States

DETROIT, MICH. — Contract has been awarded by the Detroit Copper & Brass Rolling Mills, Clark Avenue, Detroit, to A. A. Albrecht, Penobscot Building, for an addition to its plant, to cost about $400,000.

CLEVELAND, OHIO.—The Reflex Ignition Company has acquired a site on West 106th Street, on which it proposes to erect a plant. The company manufactures spark plugs, etc.

CLEVELAND, OHIO.—The City Council is planning to erect a power house at East Fifty-third Street. The proposed plant will have an output of 10,000 kw., and will cost about $300,000. A bond issue has been approved by the Capital Issues Commission to finance this project.

CLEVELAND, OHIO.—Bids will be received at the office of purchase and supplies, City Hall, Cleveland, Ohio, until Dec. 13, for the forced-draft air ducts for the division of light and heat. Bids will also be received on the same date for high-pressure steam separators. Specifications may be obtained upon application to the office of the division of light and heat.

MASSILLON, OHIO.—A permit has been granted the Massillon Electric & Gas Company for rebuilding its plant, which was destroyed by an explosion last spring. The cost is estimated at $30,000.

NAPOLEON, OHIO.—The Detroit, Toledo & Ironton Railway Company has awarded contract to the Crowell-Lundoff-Little Company of Cleveland for the construction of an eight-stall engine house and machine shop at Napoleon, to cost about $80,000.

NEW LEXINGTON, OHIO.—The capital stock of the Perry County Telephone Company has been increased from $75,000 to $125,000. Extensive improvements are contemplated by the company.

ST. MARYS, OHIO.—Contract for excavation and concrete work for the new electric light plant has been awarded by the Board of Control to the Joseph Skeldon Engineering Company of Toledo. The contract for piping, wiring, installing machinery, etc., will not be awarded until the $20,000 bond issue has been sold, which may not be until the first of the new year.

GENEVA, IND.—Work has begun on the construction of the new power plant to be erected at the local factory of the Powers National Oil Company of Detroit.

INDIANAPOLIS, IND.—The Big Four Railway Company is planning extensions to its local roundhouse, to cost about $90,000.

SHOALS, IND. — The Shoals Light & Power Company, it is reported, is installing steam engines, replacing oil engines in its plant.

CHICAGO, ILL.—The Packard Motor Company, East Grand Boulevard and Belt Line, is planning to erect a service station on Twenty-fourth Street and Prairie Avenue, to cost about $750,000.

CHICAGO, ILL.—Plans are under consideration by the W. F. Hall Printing Company, 466 West Superior Street, for an addition to its plant on Superior and Kingsbury Streets, to cost about $675,000. Graver & Dinkelburg, 80 East Jackson Boulevard, are architects.

DIVERNON, ILL.—The municipal electric light plant was recently destroyed by fire, causing a loss of about $50,000.

EAST ST. LOUIS, ILL.—Armour & Company, Union Stock Yards, Chicago, are contemplating the construction of a power house in East St. Louis, to cost about $60,000.

FARMINGTON, ILL.—The Central Illinois Light Company is contemplating the erection of an electric transmission line from Farmington to Gilchrist, where it will connect with the transmission system of the Canton (Ill.) Gas & Electric Company. E. E. Corken of Peoria is secretary.

LINCOLN, ILL.—The City Commission has decided to build an extension of the Lincoln Municipal Railway to the North Mine.

MALTA, ILL.—The installation of a larger engine in the future in the municipal electric light plant is under consideration. S. S. Plapp is manager.

EAU CLAIRE, WIS.—The Wisconsin-Minnesota Light & Power Company, it is reported, is considering the construction of a power dam. It will probably be located at Chippewa Falls, Holcombe or Dunnville.

GRAFTON, WIS.—The Badger Rolling Mills, it is reported, are contemplating utilizing electric power.

STURGEON BAY, WIS.—The Sturgeon Bay Fruit Package Company is planning to erect an addition, 52 ft. by 90 ft., three stories, and extension to boiler and engine house, 26 ft. by 30 ft.

AUSTIN, MINN.—Contracts will soon be awarded by the city of Austin for coal-handling equipment, to cost about $12,000. The C. L. Pillsbury Company, Metropolitan Life Building, Minneapolis, is engineer.

MANKATO, MINN.—Three 400-kva. transformers are being installed at the local substation of the Northern States Power Company to provide for the increasing demands on the Kasota-St. Peter transmission line.

MINNEAPOLIS, MINN.—Plans are under consideration by the Minneapolis & St. Louis Railroad Company for the construction of a new terminal plant at Fort Dodge, including an engine house, machine shop, boiler plant and power house. Coal hoisting and handling machinery, turntable and other equipment will be installed. The company is also planning to remodel a shop in Marshalltown, at a cost of about $10,000.

HOLDEN, MO.—The Island Creek Coal Company is planning to install two 400-hp. boilers in its power plant.

KANSAS CITY, MO.—Contract has been awarded by the Kansas City Light & Power Company to the E. L. Winn Construction Company of Kansas City, for the construction of a substation, 50 ft. by 100 ft., to cost about $35,000. Sargent & Lundy, 72 Adams Street, Chicago, Ill., are engineers.

MARSHFIELD, MO. — Bonds to the amount of $15,000 have been voted for the purchase of the local electric light plant.

ST. LOUIS, MO.—The city of St. Louis is considering doubling the capacity of the new municipal dock. The cost of the work is estimated at $350,000, and will include the installation of mechanical loading and unloading equipment.

ST. LOUIS, MO.—The Board of Public Service is considering plans for repairing two wings of the old college building, recently damaged by fire, and to erect an additional building for the city infirmary, to cost about $100,000. E. R. Kinsey is president of the board.

WESTON, MO.—Improvements are contemplated to the municipal waterworks system, including the installation of new pumping equipment and other machinery. C. E. McCrae, Republic Building, Kansas City, Mo., is engineer in charge.

PRATT, KAN.—Bids will be received by the Board of Education of Pratt until Dec. 19, for construction of high-school building, including heating, electric wiring, plumbing, fan ventilating, etc. The cost of the building is estimated at $100,000. W. E. Hulse & Company of Hutchinson are architects.

Southern States

FREMONT, N. C.—Bonds to the amount of $25,000 have been authorized, the proceeds to be used for electric lighting and street improvements.

MURPHY, N. C.—The City Council is considering the construction of a hydroelectric plant. The cost is estimated at about $25,000.

ELLOREE, S. C.—Preparations are being made by the Elloree Electric Light Company for rebuilding its electric light plant, recently destroyed by fire. Machinery, it is understood, has been purchased D. T. Evans is president.

SARASOTA, FLA.—Plans are under consideration by the City Council for the purchase of the electric plant of the Sarasota Ice & Electric Company. If taken over by the city, the system will be enlarged and improved.

TARPON SPRINGS, FLA.—Preparations are being made by the Florida Glass Company of Tampa for the erection of a new plant near Tarpon Springs. The cost of the plant, including equipment, is estimated at $150,000, and will include a main building, 150 ft. by 300 ft.; machine shop, 40 ft. by 75 ft., a forge and blacksmith shop, mixing department and other buildings.

TUTWILER, MISS. — Bonds to the amount of $8,000 have been authorized for the installation of a municipal electric light plant.

COTTER, ARK.—The Dixie Power Company is contemplating the construction of a hydroelectric power plant on the White River, to cost about $5,000,000. The plans include the construction of a dam, 2000 ft. long and 150 ft. high, across the White River, to develop about 60,000 hp., to be used locally for smelting and manufacturing purposes. The project is awaiting Congressional action.

CUSHMAN, ARK.—The White River Manganese Company, recently incorporated, is planning to develop 120 acres of manganese land. Mining equipment to be installed will cost about $55,000. Electric power will be used. B. B. McHam of Joplin, Mo., is superintendent.

ROGERS, ARK.—The Ozark Cider & Vinegar Company is planning to remodel its vinegar plant to be equipped with a complete bottling outfit, etc. It may install a power plant. The cost is estimated at $20,000. O. B. Phillips is manager.

MOORINGSPORT, LA.—The Oil City (La.) Electric Light & Power Company is planning extensions to its service in Mooringsport.

NEW ORLEANS, LA.—The Machinery Exchange Company, 4201 Bienville and David Streets, it is reported, would like to receive prices on two turbine-driven generators of 1000-kw. to 1500-kw. capacity.

NEW ORLEANS, LA.—Plans have been completed by the city of New Orleans for the construction of a coal-handling plant for loading steamships with cargo coal. A large storage bin connected by a system of conveyors with railroad and river barges and steamship wharf is included in the project. The United States Fuel Administration has given its approval of the work.

DUNCAN, OKLA.—Plans are being prepared for improvements to the electric light plant, waterworks and sewer system. A bond issue of $95,000, to provide funds for the proposed work, has been approved by the Attorney-General. The Benham Engineering Company, Colcord Building, Oklahoma City, has charge of the engineering work.

KINGFISHER, OKLA.—Preparations are being made for improvements to the municipal electric light plant and waterworks system, to cost about $50,000. Bids, it is understood, will soon be asked for material for transmission system. Black & Veatch, Inter-State Building, Kansas City, Mo., are engineers.

PONCA CITY, OKLA.—All bids submitted Oct. 23 for construction and equipment for waterworks and electric light plant for the city of Ponca have been rejected.

TULSA, OKLA.—New equipment, including engines, boilers, etc., will be installed in the refrigerating plant of the Independent Packing Company, 25 East Twelfth Street, Tulsa.

BAY CITY, TEX.—Preparations, it is reported, are being made by the Texas Gulf Sulphur Company for the development of sulphur mines, involving an expenditure of about $4,000,000. George Stockham Hessenbruch of Matagorda is manager.

CLIFTON, TEX.—The Clifton Ice & Cold Storage Company, it is reported, contemplates the construction of an ice and cold storage plant, to cost about $10,500.

DALLAS, TEX.—Steps, it is stated, have been taken by the City Commission for carrying out of the provisions of the new franchise granted the Dallas Railway Company for making important improvements and extensions to its street-railway system and for the construction of interurban railways. The proposed improvements for the street-railway system will involve an expenditure of about $500,000. Under the franchise the company must start the construction of two interurban railways, each to be not less than 30 miles in length, and make other expenditures amounting to $1,000,000. The carrying out of these provisions of the franchise were deferred on account of the war.

DONNA, TEX.—Additional bonds to the amount of $500,000 have been voted by the Donna Irrigation District for extensions of canals and ditches and the installation of additional machinery in pumping plant.

MARFA, TEX.—The Capote Nitrate Company, recently incorporated, is planning to mine and manufacture nitrate of potassium and sodium of nitrate. Alfred Dueller, G. C. Simpson and J. B. Berff, all of San Antonio, are interested in the company.

MARLIN, TEX.—The Marlin Grocery Company is reported to be contemplating the installation of a pumping plant on the Brazos River in Fall County to irrigate about 100 acres.

RANGER, TEX.—Plans are under consideration by the Chamber of Commerce for establishing an electric lighting system in Ranger.

UVALDE, TEX.—Arrangements are being made by the Uvalde Electric Light & Ice Company for extensions and improvements to its system. Contract for machinery, it is understood, have been placed.

WEATHERFORD, TEX.—Plans are under way for rebuilding the municipal electric light plant, recently damaged by fire.

Pacific and Mountain States

ANACORTES, WASH.—The City Council recently passed an ordinance providing for the purchase of the entire waterworks system of the Washington Power Light & Water Company.

MOLSON, WASH.—Plans are under consideration by Ward Brothers, owners of the local electric light plant, for the purchase of an electric generator and a gasoline engine, to be used as an auxiliary to the present steam plant.

PE ELL, WASH.—Work will begin at once on the erection of an electric transmission line connecting the property of the Central Light & Manufacturing Company at Pe Ell with the transmission lines of the North Coast Power Company at Meskill. The towns of Doty and Dryad will be benefited by the extensions as well as Pe Ell.

PILOT ROCK, ORE.—The local electric light plant was recently destroyed by fire. The plant was connected with a flour mill and furnished energy for the municipal lighting system.

GLENDALE, CAL.—The Southern California Edison Company has applied to the State Railroad Commission for permission to sell part of its local system to the city of Glendale.

LOS ANGELES, CAL.—Plans have been prepared by the Pacific Electric Railway Company for the erection of a substation, 30 ft. by 50 ft., at Maple Avenue and Seventh Street.

Canada

PORT ALBERNI, B. C.—The Town Council is considering the installation of an electric system, to cost about $60,000.

COBALT, ONT.—The Northern Ontario Light & Power Company is contemplating extending its transmission system to supply electricity in the Boston Creek mining district.

LONDON, ONT.—Plans are under consideration by the City Council for an addition to the municipal power station, to cost about $15,000. H. A. Brazier is engineer.

PORT ARTHUR, ONT.—The Electrical Manufacturing Company of Vancouver, B. C., has been awarded the contract for the power panels and cabinets for the complete equipment of the grain elevators under construction by the Saskatchewan Coöperative Elevator Company at Port Arthur.

MONTREAL, QUE. — A section of the plant of the Patterson Manufacturing Company, including the entire boiler room, was recently destroyed by fire, causing a loss of about $10,000.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until Dec. 11, for copper, brass, bronze, tin, boilers, rope, cable, wire, watt-hour meters, electric fans, connectors, condulets and conduit, etc. Blanks and information relating to this circular (circular 1241) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

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AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West Fortieth St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. University of Pennsylvania, Philadelphia, Pa.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, W. J. Tharp, Little Rock, Ark. Annual meeting, Fort Smith, Ark.

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ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

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FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla. Annual meeting, Jacksonville, Jan. 5, 1919.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, Springfield, Ill.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C le Maistre, 28 Victoria St., Westminster, London, S. W., England.

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MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 721 Locust St., St. Louis, Mo.

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NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, 33 West 39th St., New York City.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NEBRASKA SECTION, N. E. L. A Secretary-treasurer, R. W. McGinnis, O'Neil Light & Creamery Co., O'Neil, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass. Annual meeting, Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. A. Burslel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M. Annual meeting, Albuquerque, N. M., Feb. 17-19, 1919.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, Franz Neilson, 120 Broadway, New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York City.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION. Affiliated with N. E. L. A. Secretary, George L. Myers, Pacific Power & Light Co., Portland, Ore.

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OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OKLAHOMA UTILITIES ASSOCIATION. Secretary H. A. Lane, 611 State National Bank Building, Oklahoma City. Annual meeting, Feb. 13, 14 and 15, 1919, Oklahoma City.

PACIFIC COAST SECTION, N. E. L. A. Secretary, A. H. Halloran, 618 Mission St., San Francisco, Cal.

PENNSYLVANIA ELECTRIC ASSOCIATION. State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

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RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 152 Beach St., Yonkers, N. Y.

ROCKY MOUNTAIN ASSOCIATION OF MUNICIPAL ELECTRICIANS. President, Lawrence Stone, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York City.

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SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 703 First National Bank Building, El Paso, Tex.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Rutland, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill. Annual meeting, Chicago, Jan. 28-30, 1919.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill. Annual meeting, Chicago, January, 1919.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, J. P. Pulliam, 1408 First National Bank Building, Milwaukee, Wis.

Record of Electrical Patents

Notes on United States Patents

1,282,295. Fire-Alarm System; Wilton S. Schuyler, Savannah, Mo. App. filed March 26, 1917. Especially designed for smaller towns and villages in which a fire bell is sounded.

1,282,493. Outlet-Box Fitting; George B. Thomas, Bridgeport, Conn. App. filed April 26, 1918. Pertains particularly to connection block to be associated with any one of a series of outlet fittings.

1,282,497. Electrical Measuring Instrument; Harold E. Trent, Wilkinsburg, Pa. App. filed Nov. 19, 1914. Indicating or integrating wattmeter operating with permanent magnet and movable coil.

1,282,502. Electric Welding Machine; Robert E. Wagner and Wesley E. Laid, Pittsfield, Mass. App. filed April 20, 1918. Particularly adapted for welding together metal sheets along an extended seam or line.

1,282,521. Process of and Apparatus for Extracting Metals from Ores; Frank L. Antisell, Perth Amboy, N. J. App. filed Jan. 7, 1915. For leaching copper ore and electrolytically depositing its metal.

1,282,525. Binding Terminal; Reuben B. Benjamin, Chicago, Ill. App. filed Feb. 20, 1916. Wiring can be quickly accomplished.

1,282,555. Flashlamp with Extension; William A. Ericksen, Brooklyn, N. Y. App. filed April 24, 1918. Bulb is also adapted for use at some distance from battery.

1,282,565. Electric Switch or Socket Key; Frederick P. Gates, Hartford, Conn. App. filed Jan. 22, 1917. Having a shank of special form struck from sheet metal and formed to shape.

1,282,566. Fuse Plug; Henry F. Goetz, Waterbury, Conn. App. filed May 6, 1918. Sheet-metal contacts of special construction employed whereby their correct seating in the plug body is assured.

1,282,578. Electric Time Switch; Edmund G. Hoffmann, Burksville, Ill. App. filed Feb. 19, 1916. Capable of closing and breaking circuit at varying intervals to correspond with varying lengths of night during different seasons of year.

1,282,594. Lamp Stand; Max Kossmann, Brooklyn, N. Y. App. filed Feb. 18, 1918. Bulb can be adjusted to various positions.

1,282,606. Refillable Fuse Cartridge; Herbert Lutz, Hamilton, Ontario, Canada. App. filed April 23, 1918. Having contacts at outer or cap ends of casing.

1,282,615. Flashlight and Battery; Moz Mizrahi, New York, N. Y. App. filed June 5, 1918. Casing made of cheap material such as strawboard or the like.

1,282,621. Graphic Meter and the Like; John A. Obermaier, Chicago, Ill. App. filed Oct. 13, 1917. Relates particularly to pen construction.

1,282,630. Electrical Connector; Thomas Rhodus, Chicago, Ill. App. filed July 9, 1917. For permanent attachment to line wire for connection in readily detachable manner to terminal posts of primary batteries of different makes.

1,282,653. Connecting Pole; William W. Thompson, Chicago, Ill. App. filed July 16, 1917. To make contact with an aërial wire.

1,282,660. Manufacture of Steel; Samuel S. Wales, Pittsburgh, Pa. App. filed Aug. 3, 1917. Has particular relation to manufacture of steel in electric furnaces at small or isolated plants where molten metal is not available for use.

1,282,676. Lamp Support; William J. Carlin, Roxbury, Mass. App. filed Sept. 21, 1917. Rays from lamp may be thrown in every possible direction.

1,282,684. Core Construction for Electrical Apparatus; Edgar C. George, Norwood, Ohio. App. filed Feb. 19, 1917. For promoting efficient ventilation of cores while maintaining strong and durable construction.

1,282,691. Automobile Signal; Sam Illingworth, Dallas, Tex. App. filed July 6, 1917. For indicating proposed movements of automobile.

1,282,760. Testing Apparatus for Spark Coils, Plugs, etc.; Charles T. Cole Roundup, Mont. App. filed Feb. 24, 1917. Apparatus contained within carrying case and so easily transportable.

1,282,803. Signaling System; William A. Fricke, Chicago, Ill. App. filed Aug. 25, 1914. Used in connection with ordinary telegraph line circuit, so that if station signaled cannot be raised by regular code call, special device will be operated to signal desired station.

1,282,815. Electric Snap Switch; Monroe Guett, Hartford, Conn. App. filed Sept. 12, 1916. Binding preventing snap movements is eliminated.

1,282,816. Electric Snap Switch; Monroe Guett, Hartford, Conn. App. filed Jan. 24, 1918. To assure adequate insulation between parts on supporting body and face plate.

1,282,828. Automatic Slow-Down Controller; Clark T. Henderson, Milwaukee, Wis. App. filed April 29, 1914. For variable-speed motors.

1,282,835. Automatic Cut-Off; John G. Homan, Steubenville, Ohio. App. filed July 18, 1917. If thermostat connected to the apparatus fails to break circuit at rise in temperature, the cut-off will be freed.

1,282,836. Motor Controller; Albert J. Horton, White Plains, N. Y. App. filed Jan. 2, 1918. For both field-regulating and stopping purposes and to obviate using either special stopping switch or special current-reducing means.

1,282,842. Starting Box; Robert A. Ilg, Chicago, Ill. App. filed July 22, 1916. Has reference to relation between starting arm and release member.

1,282,855. Motor-Control System; Walter C. Kennedy, Milwaukee, Wis. App. filed March 7, 1916. Means responsive to current variations in motor circuit for selectively regulating field of generator and field of motor in accordance with action of motor, i. e., as motor or as generator.

1,282,876. Line-Conductor Support; William D. Kyle, Milwaukee, Wis. App. filed Oct. 23, 1916. Combined insulator and supporting bracket with universal joint.

1,282,891. Rotary Field Magnet with Parallel Grooves for the Windings; Fredrik Ljungstrom, Finspong, Sweden. App. filed April 16, 1915. In Lamme type rotator centrifugal strain is lessened.

1,282,892. Treatment of Copper Ores; Alfred A. Lockwood, Forest Hill, England. App. filed Jan. 20, 1917. Copper may be precipitated directly from pulped ore without filtration.

1,282,933. Electric Oven; Leroy K. Pontius, Chicago, Ill. App. filed Dec. 13, 1915. Heating unit includes a core which surrounds oven proper.

1,282,954. Steering-Column Switch Unit; Richard C. Scaife, Cleveland, Ohio. App. filed Aug. 27, 1914. Controlling apparatus for starting and lighting system of motor vehicle.

1,282,956. Manufacture of Windings for Electrical Machines; Gustav Schongut, Budapest, Hungary. App. filed March 11, 1915. Machine draws wire into windings.

1,282,965. Telephone System; Frank M. Slough, Elyria, Ohio. App. filed Nov. 12, 1914. To produce cut-off device which will under no circumstances respond to ringing current until subscriber has responded to bell ringing.

1,282,966. Telephone System; Frank M. Slough, Elyria, Ohio. App. filed Nov. 12, 1914. Relates to systems where ringing of subscriber is automatically continued until he responds.

1,282,969. Electrical Starting System for Internal-Combustion Engines; Cyril A. Soans, Chicago, Ill. App. filed Nov. 7, 1913. To form part of power system of motor vehicle.

1,283,002. Signal; Albert M. Ward, Rochester, N. Y. App. filed March 6, 1918. All signaling elements are mounted upon a single base, and one electromagnet is employed for operating plurality of signaling elements.

1,283,005. Battery and Method of Making Same; Henry Wilhelm and Harold Olaneta, Brooklyn, N. Y. App. filed Aug. 10, 1917. Paste surrounding the cartridge of dry battery is cooked prior to being placed in cup.

1,283,046. Starting Device for Explosion and Other Engines; William J. E. Beere, London, England. App. filed Sept. 21, 1915. To provide against motor being revolved before it is in driving engagement with the engine.

1,283,054. Carburetor-Heating Device; William J. Biegel, New York, N. Y. App. filed Feb. 18, 1918. To be applied to any type of bowl without altering or modifying latter.

1,283,077. Electrolytic Production of Zinc; Galen H. Clevenger, Palo Alto, Cal. App. filed May 7, 1917. Accomplished by leaching or extracting zinc ores, concentrates or other zinc-containing materials from zinc-sulphate solutions.

1,283,078. Electrolytic Recovery of Zinc; Galen H. Clevenger, Palo Alto, Cal. App. filed May 7, 1917. Relates to recovery of zinc from ores and electrolytes containing small amounts of cobalt.

1,283,137. Electric Heating Device; Elbert Fowler, Atlanta, Ga. App. filed Dec. 10, 1915. Generates and reflects heat upon small objects contained therein and can be held in the hand for observation.

1,283,147. Typewriting-Telegraph System; Frederick Ghio, Bristol, Conn. App. filed March 9, 1918. Only two line wires used to connect sending and receiving stations.

1,283,176. Control System; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Oct. 6, 1915. To vary automatically regulating effect of phase advancer in accordance with slip of induction motor to be governed.

1,283,182. Automatic District Telephone System; Harry E. Hershey, Whitewater, Kan. App. filed Aug. 8, 1914. To provide improved trunking apparatus for establishing connection between lines.

1,283,200. Water-Level Alarm for Drop Plans; Charles C. Johnson, Newburgh, N. Y. App. filed July 20, 1917. May be attached to refrigerator without interfering with removal of pan.

1,283,206. Electric Sign Flasher; Joseph A. Karpel, New York, N. Y. App. filed May 14, 1917. To prevent burning out of contacts by arcing.

1,283,226. Circuit Controller; Richard C. Leake, Rochester, N. Y. App. filed May 29, 1916. Relates to circuit controllers having intermediate position and two operating positions.

1,283,236. Obtainment of Gold and Silver from Their Ores; Alfred A. Lockwood, Forest Hill, England. App. filed March 8, 1918. Gold and silver to be precipitated directly from a pulped ore without filtration.

1,283,260. Thermostat; Herbert D. Montgomery, Brooklyn, N. Y. App. filed Feb. 21, 1917. For use in automatic fire-alarm systems.

1,283,285. Laboratory Furnace; Carl A. Pfanstiehl, Highland Park, Ill. App. filed July 17, 1916. Equipped with heating, cooling, electrical and mechanical devices.

1,283,292. Dry-Cell Battery; Isaiah Pletcher, Iuka, Ill. App. filed March 13, 1918. Impregnating solution for recharging dry-cell batteries.

1,283,300. Vehicle Signal; Fritz G. Rantzau, Spokane, Wash. App. filed July 30, 1917. Oscillating arm for use on front portion of automobile.

1,283,304. Telephone Receiver; Thomas Rhodus, Chicago, Ill. App. filed Dec. 16. 1916. Sectional formation of parts permits lighter construction.

1,283,311. Automobile Traffic Signal; William Rosen, Middletown, Conn. App. filed Dec. 22, 1917. Audible means provided for calling attention to visual direction signal.

1,283,320. Telegraphic Sending Machine; Ferdinand S. Ruttmann, New York, N. Y. App. filed June 2, 1914. Line circuit is automatically opened and closed through a manually operative keyboard mechanism.

1,283,329. Electromagnetic Apparatus; William M. Scott, Tredyffrin Township, Chester County, Pa. App. filed Nov. 4, 1914. Differentiates between fluctuating or alternating currents of different frequencies, or between fluctuating or alternating current and continuous or direct current.

1,283,339. Electrical Connection and Box; Frederick F. Skeel, Chicago, Ill. App. filed July 27, 1914. For use with conduit outlet boxes and in connection with meters.

1,283,340. Electrical Connection and Box; Frederick F. Skeel, Chicago, Ill. App. filed Aug. 7, 1914. Particularly applicable for use with meters.

1,283,353. Control System; Norman W. Storer, Pittsburgh, Pa. App. filed Sept.

10, 1915. For four-motor equipment on electric railway cars or locomotives.

1,283,370. Selective Direction Indicator for Vehicles; Paul W. Vanderhoff, Topeka, Kan. App. filed Feb. 27, 1917. Indicators mounted in front and rear.

1,283,373. Casing for Flywheel Magnetos; Harry R. Van Deventer, Sumter, S. C. App. filed April 21, 1917. Is stationary and also dustproof and waterproof.

1,283,380. Car-Lighting System; Leonard A. Watson, New York, N. Y. App. filed June 14, 1916. Electric controlling means to govern automatically charging current delivered to battery.

1,283,388. Electric Bell; Daniel G. Williams, Taunton, Mass. App. filed July 20, 1917. Tapper of bell has an isochronal movement to produce even and uniform resonance of gong.

1,283,400. Trunk Circuit; Hiram D. Currier, Chicago, Ill. App. filed June 11, 1915. Relates to telephone systems in which calls are extended from calling substation through operator's cord and trunk circuits to called substation.

1,283,413. Telephone-Exchange System; Alexander E. Keith, Chicago, Ill. App. filed Jan. 22, 1907. Relates particularly to automatic systems operated on the district system principle.

1,283,418. Trolley Harp and Shoe; John Miller, Jr., Amesbury, Mass. App. filed Aug. 14, 1916. Sliding trolley shoes equally efficient in forward or rearward travel on wire.

1,283,430. Apparatus for Converting Reciprocating Motion into Continuous Rotary Motion; Henry E. Warren, Ashland, Mass. App. filed Nov. 30, 1914. For directly transferring motion.

1,283,431. Electric Clock System; Henry E. Warren, Ashland, Mass. App. filed Aug. 21, 1916. Time indication may be distributed by means of alternating-current system.

1,283,433. Self-Starting Synchronous Motor; Henry E. Warren, Ashland, Mass. App. filed Feb. 5, 1917. Synchronizing element is removed from maximum influence of magnetic field when rotor is at rest and is brought under maximum influence when rotor element substantially reaches synchronous speed.

1,283,434. Timing Device; Henry E. Warren, Ashland, Mass. App. filed Feb. 26, 1917. Directly and continuously driven by self-starting synchronous motor capable of starting and stopping substantially in an instant and of running continuously at a uniform speed.

1,283,435. Self-Starting Synchronous Motor; Henry E. Warren, Ashland, Mass. App. filed Sept. 19, 1918. To be produced and operated at a minimum expense.

1,283,440. Heating Appliance; E[illegible] Lightfoot, New York, N. Y. App. [illegible] Nov. 15, 1915. Electric soldering iron is free from soldered joints.

1,283,445. High-Crossing Bell for Railroad Service; Eugene W. Vogel, Oak Park, Ill. App. filed May 27, 1914. Solenoid-type operating mechanism is protected against injury from rain, dust and the like.

1,283,466. Electromechanical Switch; Clarence N. Cahusac, Jersey City, N. J. App. filed April 2, 1917. For use with recorder for machines.

1,283,491. Combination Porcelain Socket; Edgar H. Freeman, Trenton, N. J. App. filed April 11, 1917. Key socket may also be tapped for supplemental uses.

1,283,492. Electrostatic Machine; Walter S. Frost, Homerton, London, England. App. filed March 8, 1918. For use in electrical ignition systems of gas, petrol and internal-combustion engines.

1,283,507. Thermostatic Temperature-Controlling Device for Electric Ovens; Frederic T. Harding, St. Paul, Minn. App. filed Jan. 13, 1917. To cut out and cut in an electric circuit automatically and to change the operating temperature as desired.

1,283,531. Dynamo; Henry Leitner, Tunbridge Wells, England. App. filed Jan. 22, 1915. For regulating the output of dynamo machines designed to be driven at variable speeds.

1,283,563. Contact Bank; John G. Roberts, Dobbs Ferry, N. Y. App. filed Nov. 3, 1917. For electric switches having brushes movable in two directions at right angles to each other.

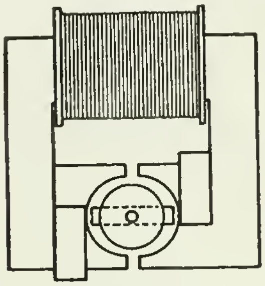
1,283,566. Pocket Flashlight; Francis M. Rosenfeld, New York, N. Y. App. filed Jan. 6, 1916. Circuit-closing device will operate equally well irrespective of way in which battery has been inserted in casing.

1,283,574. Conduit Terminal; August G. F. Schuster and Iver R. Johnson, Chicago, Ill. App. filed Dec. 11, 1915. More particularly adapted for use upon upper end of upright wire or cable conduit pipes such as are usually attached to upright supporting poles used in current-conducting system.

1,283,598. Process of Concentrating Nitric Acid; Bruno Thomas, Seattle, Wash. App. filed July 24, 1917. Absorption of gases is increased by use of pressure and concentration and purification is increased by electrolysis.

1,283,603. Telephone System; Richard I. Utter, Chicago, Ill. App. filed June 18, 1914. To provide a universal cord circuit and trunk circuit which may be used interchangeably with telephone systems of automatic or manual type.

1,283,645. Electric Switch; Carl Bramming, Chicago, Ill. App. filed Oct. 20, 1916. Of push-button type and primarily intended for automobile service.



1,283,433.—Self-Starting Synchronous Motor

1,283,651. Lightning Arrester; Sutton R. Buchanan, New Bremen, Ohio. App. filed April 22, 1918. Particularly for use as a protection for low-potential telephone lines against lightning or other destructive high-potential currents.

1,283,660. Thermostatic Fire Alarm; Harry H. Camp, Spencer, W. Va. App. filed Jan. 4, 1918. Relates particularly to thermostatic member for use with electrical alarms of fire and other types.

1,283,669. Hood-Locking Device for Automobiles; Herbert H. Chrisman and Frank W. Adsit, Minneapolis, Minn. App. filed April 7, 1918. To prevent any unauthorized person from obtaining access to the engine.

1,283,670. Storage-Battery Vent; Christian A. Christiansen, Cleveland, Ohio. App. filed May 3, 1916. Will permit use of maximum amount of electrolyte in jar without trapping gases.

1,283,682. Electric Switch; Herbert W. Crane, Chicago, Ill. App. filed Aug. 16, 1917. Three-way solenoid switch which may be operated by successive movements of switch blade in same direction.

1,283,687. Signaling System; Leo H. Darrow, New York, N. Y. App. filed Oct. 30, 1917. Relates to equipment for private branch exchange switchboards with which are associated both long-distance and local lines.

1,283,715. Electric Welding; Charles H. Florandin and Alan M. Bennett, Westfield, N. J. App. filed Jan. 10, 1917. Means for regulating the voltage in accordance with the current and voltage conditions of the wire.

1,283,748. Automatic Contact-Making Device for an Electric Circuit; Robert C. Harris, Indianapolis, Ind. App. filed July 27, 1917. To use a separate insulated circuit of wires, instead of the present track circuit used in railroad signaling.

1,283,754. Process of Making a Heat-Insulating Composition; Frank A. Headson, Milwaukee, Wis. App. filed Jan. 22, 1917. Consists in calcining finely divided diatomaceous earth and finely divided asbestos, intermixing and moistening the ingredients.

1,283,779. Storage Battery; Miller R. Hutchison and Charles W. Norton, West Orange, N. J. App. filed May 23, 1914. To provide improved battery structure of simple arrangement and construction especially designed for batteries having a great capacity and a high rate of discharge.

1,283,789. Indicating and Recording Mechanism; Austin C. Johnson, Chicago, Ill. App. filed May 18, 1914. For giving a visual indication and, if desired, making a permanent record of the performance of one or more machines.

1,283,801. Headlight Cut-out; Horace L. Kincaid, Athens, Ala. App. filed July 28, 1917. For use upon automobiles having electric lamps supplied in series with electrical energy derived from a magneto or generator driven by engine operating the automobile.

1,283,804. Outlet-Box Cover; Philip Klein, Brooklyn, N. Y. App. filed Dec. 13, 1917. Having reliable means for securing cover to box.

1,283,806. Illuminated Name Plate; Joseph F. Kreger, Erie, Pa. App. filed Jan. 15, 1918. For use in hallway and having electric means for illuminating the plate when it is desired to read the name thereon.

1,283,825. Magnetic Clutch; Albion D. T. Libby, East Orange, N. J. App. filed April 12, 1913. Particularly adapted for clutching driving mechanism to driven mechanism after the former has been started and has obtained a certain momentum.

1,283,827. Elevator; David L. Lindquist, Yonkers, N. Y. App. filed Dec. 1, 1915. Automatic means for effecting exact landing at a predetermined point or points regardless of the load and speed of the device.

1,283,831. Selecting Switch; Frank A. Lindquist, New York, N. Y. App. filed Aug. 2, 1916. Single operating magnet controls both rotary and longitudinal movements of brush-carrying element and a slow releasing magnet to control sequence of these movements.

1,283,845. Electric Combination Lock; Harry A. Marchant, Stoneham, Mass. App. filed Sept. 17, 1917. Electric circuits controlling lock must be opened, closed or modified in a predetermined manner in order to operate or permit the operation of the lock.

1,283,848. Incandescent Electric Lamp; Victorino Martinez, Havana, Cuba. App. filed June 4, 1917. Only metallic part of device is that of the two contacts required for the passage of the electric current to the filament.

1,283,894. Automatic Switch; Osvald E. Rasmusen, West Hoboken, N. J. App. filed Sept. 22, 1916. Mechanical means permit the construction of an automatic switch having but a single operating magnet.

1,283,936. Illuminable Darning Last; Edna C. Smith, Clifton Forge, Va. App. filed April 11, 1918. Constructed of translucent or transparent material detachably secured to handle, which has a source of electric energy.

1,283,946. Trolley; Herman L. Stanley, Derby, Conn. App. filed June 29, 1917. Having contact bar for sliding engagement with the wire.

1,283,973. Method of Electroplating; William Thum and John J. Mulligan, East Chicago, Ind. App. filed July 31, 1918. Relates to electroplating surfaces of base metals belonging to the more electro-positive series of metals with metals belonging to the more electronegative series.

1,283,979. Regenerative Brake Device; Walter V. Turner, Wilkinsburg, Pa. App. filed June 30, 1917. Means operated upon apply brakes by fluid under pressure for cutting regenerative brake out of action.

1,283,981. Electropneumatic Brake; Walter V. Turner, Wilkinsburg, Pa. App. filed Sept. 11, 1917. Magneto having rotating armature employed.

1,283,983. Signal for Vehicles; Joseph C. Udell, Flint, Mich. App. filed April 18, 1917. To indicate intended change, such as turning in either direction or stopping.

1,283,989. Rain Signal; August F. W. Viehweger, Hoboken, N. J. App. filed Oct. 25, 1916. Casing formed of a single piece of sheet metal.

1,284,025. Spark-Plug Connector; Walter Zielinski, Bay City, Mich. App. filed April 9, 1918. To provide a firm yet readily detachable connector.

1,284,026. Relay; Conrad H. Zierdt, Edgewood Borough, Pa. App. filed Feb. 20, 1917. Is selective as to frequency for contact operation, such selection being obtained by a single core and a single vane.

Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

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Alas, Poor Yorick!

THE water-power resolution passed by the Reconstruction Conference of War Service Committees at Atlantic City last week is sadly reminiscent of a somewhat similar resolution passed by the Chamber of Commerce of the United States at its convention in Chicago last April. Indeed, we recall many utterances, some our own, to the effect "that it is important in the public interest that federal legislation on this subject should be enacted without further delay." However, so far as the Congress of the United States is concerned, these resolutions apparently might just as well remain unwritten. "Imperious Cæsar, dead and turned to clay, might stop a hole to keep the wind away;" but neither resolution nor presidential message, coal shortage or lack of power can move the present Congress to use the nation's natural resources. We may hope to the end that something will yet be done, but let us not pitch our expectations too high. The obsequies of the administration water-power bill will soon be said.

The sudden termination of the war finds many electrical supply jobbers with abundant stocks on hand. As business men they know exactly what that means but do not fear it. How they prepared for it is not now of concern; it is enough that they took precautions, whatever the manner. If electrical contractors could glean from the field of their experiences the same lessons of financial preparedness, how much better off they would be!

The Peerless American Navy

SECRETARY DANIELS' report on the navy's part in the war is a story of brilliant achievement of which every American may be justly proud. The mighty accomplishment of transporting two million men to France and the gallant behavior of our marines at Belleau Wood will ever be remembered in American history. But for electrical engineers what the Secretary says about the battleship New Mexico is not one whit less interesting and encouraging. This electrically propelled ship represents, he says, "one of the biggest achievements of this generation in engineering." And, as though that were not enough, the report also states that "in this unique vessel the United States Navy has a battleship which has no peer in the world's navies." This is both a tribute to and a vindication of American electrical genius, which despite the storm of protest over the driving equipment of the New Mexico, never lost faith in the ultimate triumph of electricity. Had the system of electric propulsion been perfected and standardized a year or two earlier, without doubt our entire new merchant marine would have been equipped with it.

The history of the war is yet to be written. If there is no distortion of facts and every incident, encounter and contribution is given its just measure, we shall find other heroes besides those that fought in Flanders. Among them will be numbered those civilians who served their country ardently and faithfully for an honorarium of one dollar a year.

Getting a New Angle on the Labor Problem

NO PROPHETIC sign of the times that are to come is more encouraging than the new way in which the old labor problem is being discussed by men of vast business responsibilities. For lecturers and publicists and social workers to talk of coöperation between employers and employed, of the representation of workmen in the management of great industries, and of the community as a third party concerned, is no novel thing. But when men who have derived enormous fortunes from business skill and energy, and who are thus able to turn theory into practice, proclaim, as one of them did the other day, that capital and labor are partners, and even, as did another, that they are synonymous terms, and when their point of view receives the indorsement of a great and representative business gathering, surely it may be said that "the old order changeth, yielding place to new." It would be hard to exaggerate the importance of such pronouncements. They will make their influence felt in every industry, not excepting the electrical; for, though it is one of the wonders of electricity that so tremendous a force can be controlled with the minimum of human exertion, and therefore the labor problem is nowhere smaller than in the central stations, it is none the less a vital one with manufacturers of electrical machines and appliances, with the electrical contractors, who depend on labor for the execution of their undertakings, and with the jobbers, who rely upon it in the disposal of their stock.

Among the most useful lessons which the war has taught, said one of the American capitalists just referred to, is the value of coöperation. This has indeed been exemplified not only in the marvelous military achievements of this and other nations but also in such industrial triumphs as the erection in thirteen months of the greatest shipyard in the world, with two hundred and fifty buildings, fifty shipways and many miles of streets and railways, where previously the mosquito had been in undisputed possession.

Another lesson the war has taught deserves emphasis in connection with the labor situation. It is summed in the terse old saying "Extremes meet," which never before perhaps in the world's history had so startling a demonstration. When in full view of mankind the Junkers and the Bolsheviki embraced, only the blind could help perceiving that as surely as a traveler who persistently moves west will wind up in the farthest East, so a revolutionist who advances from one heresy to another will find himself at last in the arms of his deadliest foe, though the latter has never stirred. The spectacle has not been lost on American labor, which save for exotic elements has never been a revolutionary force. The detestable imported jargon of "proletariat" and "class consciousness" has fallen on deaf ears. Proud of their American citizenship, the workmen of the nation have eschewed rebellion and sought to better their condition through organization and contract. They have often been badly led, sometimes unreasonable and occasionally violent; which is to say that, like their employers, they have been entirely human. If now the latter, under the lead of the nation's financial magnates are to meet them bearing the offering of coöperation and representation "built from the bottom up," a new industrial era may dawn indeed.

If, like Wilkins Micawber, we merely "wait for something to turn up," our competitors, foreign and domestic, will reap the reward of their superior foresight and "two-o'clock-in-the-morning courage." Four years of military destruction and civilian self-denial have created a new market for our products. Let us, in the words of good old Dr. Hale, "look up, not down; out, not in, and forward, not back!"

A Study of Arc Welders

THE use of electric welding has been so greatly increased of late that a comprehensive knowledge of the performance of various types of welding apparatus is highly desirable. In a brief article in our current issue J. F. Lincoln goes into the working characteristics of various arrangements for arc welding with respect not only to their convenience and economy but to the character of the welds produced. A large amount of such welding is done by direct-current machines either with special rheostatic regulation or by being made approximately self-regulating. Both types do good work, and their particular advantages depend perhaps more on the amount and character of the work to be done than upon their inherent properties.

The other class of welders operate with an alternating-current arc, and it is to these in particular that Mr. Lincoln devotes his attention, pointing out the great simplicity and convenience as well as the low cost of such apparatus on the one hand, and on the other the somewhat obvious inconveniences that come from short arc, extremely low power factor and troubles connected with instability of the arc in the hands of the ordinary user. Mr. Lincoln lays particular stress on the danger of imperfect welds from this last-named cause, though the power factor is not to be forgotten. As to the danger of making bad welds, this is obviously in theory a little more likely to occur with a somewhat unstable arc than with a long arc of high stability. The practical bearing on the matter, however, is somewhat different. The situation will necessarily vary with the character of the work to be performed, and in the last resort the vital point is whether in actual practice the alternating-current arc welder does or does not get into trouble in the quality of its welds. We earnestly hope that the raising of this question will bring to the front practical tests made with direct-current and alternating-current welders on similar work with the object of determining the strength of the resulting welds and the relative facility with which they can be made.

Very alluring are the prospects of American export trade, but let us not forget that all that glitters is not gold. Much of it is tinsel.

Forecasting Interconnection Results

IN ORDER that the interconnection of electric power plants and transmission systems may be developed along successful lines financially, it is important to forecast accurately the minimum savings which such a program will permit. If the realized economies in operating expense or in the utilization of the plant investment exceed the minimum which justifies the tying together of separated systems or stations, the scheme is so much to the good, and no one need be exercised because the estimates of benefit to be derived have been exceeded. To assure the project of a certain rock-bottom saving, however, is absolutely essential.

There are many phases of interconnection which may be investigated to advantage, but, after all, the fundamentals are relatively simple. The working out of interchange agreements presents a much larger problem than does the determination of probable minimum savings. The principal items of importance in the latter are the existing generating capacities involved, the maximum loads, energy outputs during the period under consideration, and the average fuel consumption. Taking an analysis of interconnection benefits for a group of twenty-five plants recently made, we find that the following general data apply: Total generating station capacity, 113,074 kw.; sum of peak loads on above stations, 69,928 kw.; yearly output, 201,039,754 kw.-hr.; coal consumption per kilowatt-hour, average, 2.62 lb. What can be done with this information?

Neglecting the fact that the peaks are non-coincident, and thus taking the situation at its worst, we find that there is available 43,146 kw. in total spare capacity in this group of stations. We can overlook the non-coincidence of the peaks because for the preliminary survey the minimum saving to be accomplished is the object of the inquiry. Based on the operating results of the more efficient plants in the group, it may be safely assumed that under interconnection these stations can be handled with a yearly fuel consumption averaging 2 lb. of coal a kilowatt-hour. This will be accomplished by shutting down all the inefficient stations except when the peak load on the system as a whole demands their operation for short periods. The load factors of the economical plants tied into the network will be greatly improved under skillful operation, and we can count upon 2 lb. a kilowatt-hour as a year-around figure.

Applying this saving of 0.62 lb. a kilowatt-hour to the combined output of the interconnected stations, we have a probable minimum fuel saving of 124,644,647 lb. of coal a year, representing a yearly saving in money of $445,160 with coal at $8 a ton. It remains only to make a rough estimate of the cost of tying the plants together in this particular case, because the fuel economies promised are so great that they will permit an investment of certainly from $2,000,000 to $3,000,000 to realize the program, wholly apart from the savings in labor and supplies which would be effected.

This estimated total investment cost cannot, of course, be determined with accuracy in a few moments' consideration of the problem, but it is surprising how useful a general estimate can be made for the minimum purposes outlined above by merely assembling the fundamental plant statistics and roughing out tie-line routes on a map of the territory concerned. There may be cases in practice where the immediately apparent fuel savings do not at once justify the carrying through of the project, and these close cases must naturally be figured in much greater detail if a sound decision is to be attained. That rough forecasts may be made exceedingly useful in pointing the way toward interconnection developments is clearly established, and a more fascinating subject for investigation could hardly be named at the present time.

Willful waste was treasonable with the war at its height. Unintentional waste was reduced by electric service to a point which will be the pride of the central-station industry when the story is told. In the reconstruction period still further gains in efficiency will be realized by scientifically applied light, heat and power. Better work and larger outputs per unit of total cost signalize the dawning new era of coördinated coöperation in electrical development.

Operating for Maximum Efficiency

ALTHOUGH the coal situation is at the present time somewhat relieved, it will be long before the price of fuel falls considerably, and every effort must be made by operating companies to work at the highest feasible thermal efficiency in order to keep down the serious effect of the fuel costs. A paper in the current issue by Lieut.-Col. Hirshfeld and C. L. Karr takes up in an exceedingly practical way the operating side of this problem in economy.

The vital points in operation are the distribution of load between the generating units, the handling of the steam-producing units and the method of driving auxiliaries. As regards the first item, Colonel Hirshfeld and Mr. Karr hold very strongly that the only thing to do is actually to obtain from the generating units their steam characteristics under varying load. The economy curves of modern turbo-generators, while adhering commonly to one accepted type, still present some sharp variations, and in the long run the best evidence regarding steam characteristics must be obtained by practical tests at a comparatively few equally spaced loadings. Such tests are not difficult to make if the plant be properly equipped and can be carried out by the staff already available. In point of fact it is better to have these repeated at comparatively short intervals, perhaps a couple of months or so, in order to keep track of any changes in conditions either due to variations in steam production or to changes in the turbines themselves, which, although not very frequent, sometimes rise to rather astonishing magnitudes. There seems to be little doubt that the costs of thus testing the necessary equipment are more than recouped by the saving in fuel.

Once the steam characteristics of the generating units are ascertained, it becomes possible to distribute the load so as to take advantage of these characteristics. Obviously the most economical results so far as steam consumption are concerned will be attained by having in use at each station load the generator or generators which will furnish this particular output with the least steam consumption. The simplest method of examining this situation is suggested by the authors to be a graphical cut-and-try test made on the steam curves with a parallel ruler. In this way the efficient operating range of each unit can be determined with very little trouble. Then for any given station load the most efficient machine or combination of machines can be picked out. The chief difficulty of operating on this scheme is that imposed by suddenly varying loads and the consequent necessity of keeping ample generating capacity available even at the expense of a relatively uneconomical load distribution.

Much that has here been said of the generators applies as well to boiler-room operation. In general, boiler efficiency falls off much less at overloads than at underloads, so that on the whole pushing the boilers pays. It is easy to determine by periodical tests what the boilers are actually doing in the way of efficient evaporation and what combination of boilers will for each station load give the necessary steam with the highest efficiency. The problem here is somewhat simplified because of the fact that as a rule the boilers when kept in good condition have rather similar characteristics.

As regards the operation of auxiliaries there is a very wide variety of practice. Indeed, the key to the situation is found in the use which can be made of exhaust steam from steam-driven auxiliaries. If all this can be employed for heating feed water, the practical thermal efficiency of an auxiliary steam set, even if not large, is rather high. Steam driving is less simple and convenient than electrical driving, but the figures here given indicate that, provided the waste steam can be fully utilized, the steam-driven auxiliaries have a very considerable advantage in sheer economy. A number of interesting modifications of schemes for driving auxiliaries are in use involving the use of electric and steam drive in various proportions and in various relations. In so far as the comments of the authors can be summarized they practically amount to this, that the efficiency of any combined system turns on the extent to which the waste heat can be utilized; that is, upon the extent to which the steam used for driving the auxiliaries can be turned into useful heat. Their final word on the subject is that as much as possible of the auxiliary power should be obtained in such a manner that the resultant exhaust steam can be absorbed by the feed water, and the rest should be derived from the most efficient electric units available.

Reconstruction Outlook in the Industry

Views of Officials of Companies on the Conditions in the Industry and the Opportunities in Wise Solution of the Problems Affecting Cost and Service to the Consumer

As THE electrical industry feels its way into the matters of reconstruction which touch its particular interests it is helped by the views of those who are giving special thought to the subject. The following opinions and suggestive counsel have been given to the ELECTRICAL WORLD:

HARTFORD MAN SEES PROMISING FUTURE

"The future of the central station looks good to us," said Samuel Ferguson, vice-president of the Hartford (Conn.) Electric Light Company, to a representative of the ELECTRICAL WORLD. "As yet there is no appreciable reduction in power sales, but a temporary reduction is to be expected as plants are converted from a war basis to a peace basis. I look for an increase in lighting sales which will to a certain degree offset this temporary reduction in power output, now that the restrictions imposed on lighting have been removed by the Fuel Administration.

"As a matter of fact, the war has increased the power load so much on central-station systems through the greatly augmented use of motor-driven labor-saving machinery that the central station will gain in the long run. More power is being used in proportion to the total manufactured output of our industries than ever before, and the stabilizing effect of this situation should be appreciated.

"As yet there has been no widespread cancellation of war contracts in Hartford, with the exception of contracts upon which work had not been started. It seems to me that it is too early to consider the possibilities of rate reduction and that it would be unsafe to take steps in this direction before conditions become steadier. With the elimination of lighting restrictions we are announcing that we are restoring free renewals of 40-watt and upward type B tungsten lamps and 300-watt and upward type C lamps. The curtailment of service by representative customers on our system during the period of daylight saving and lightless nights amounted to much more than was generally realized. When the full tide of these restrictions was reached, some of our larger mercantile customers used 25 to 40 per cent less energy than in the corresponding part of 1917.

"We have coöperated with the Fuel Administration in coal saving and in the first twenty days of this month (November) produced 1,400,000 kw.-hr. more than in the same period in 1917 and with a total coal consumption of 1000 tons less than in that period. We are looking forward to the winter with the knowledge that our coal supply is in better shape both as to quantity and quality than last year. Some applications for employment are being received by us now, and while we expect to pursue a conservative policy for the present regarding extensions, we intend to go ahead with such new business as we can see our way clear to take up, and to do everything in our power to increase our usefulness to the communities which we serve."

A thoughtful observer in the industry expresses the following views to the ELECTRICAL WORLD:

CONDITIONS INFLUENCING THE RECONSTRUCTION ERA

In the face of developments in the international situation so unexpected as those of recent months, it is unsafe to predict future conditions. Until very recently the policy of the government in dealing with war material contracts and in war industries generally has indicated an expectation of five years more of war. In fact, it has been the general feeling that if any one asked the administration at Washington for advice in laying business plans the opinion would have been rendered that planning on five years more of war would be wise. Until the eleventh hour conditions seemed to preclude the possibility of a political collapse in Germany. Men who knew that nation intimately felt confident on this score. But the unexpected has happened, and we suddenly find ourselves at peace with much less warning than that preceding the declaration of war.

Some elements of the situation can already be analyzed. It is certain that the high-speed industrial effort of war times must give way to a basis more nearly normal. Sunday and overtime work has already been stopped, and in many of the war industry plants a cut in labor forces of 15 to 30 per cent, retaining only the more efficient men, can be expected soon. It is practically certain that the government will cancel many contracts for war-making equipment. On many of these it would be economy for the government to cancel the orders even if the work has been 75 per cent completed, so that a large percentage of the total cost will have to be paid to the contractor by way of settlement. Some of our industries may shut down entirely. It has been suggested that the wooden shipbuilding plants are in this class. Thus large numbers of men will be thrown back into the industry and the wage scale will be reduced. It is always difficult to reduce the wage scale—almost impossible until labor itself paves the way by flooding the labor market so that the law of supply and demand forces a readjustment of the rate. When wages decrease the cost of raw materials goes down and living costs of course follow.

The War Industries Board has lifted the ban on expansion and development of public utilities and natural resources generally, and the resultant activity will, of course, absorb some of the labor released from war industries. Moreover, there may very well be large developments such as could not have been considered during the period of the war—for example, the electrification of the mountain divisions of the three trunk railroads in California. Such a project would keep the two great electric manufacturing concerns of this country busy for a number of years.

But these are uncertain factors yet to be determined. One change in the fundamentals of industrial activity on which we can count definitely is the increased rate of earning; that is, the greater production per unit of labor or capital because of increased efficiency and improved methods or equipment. The histories of previous wars are all parallel in this particular.

On the whole, unforeseen if not unprecedented conditions may be expected, and whether a business be small or large, success in the reconstruction era will call for close observation and study of developments with a readiness to make adjustment to changes promptly.

ENCOURAGEMENT FROM MASSACHUSETTS

Walter L. Mulligan, general manager of the United Electric Light Company, Springfield, Mass., informed the ELECTRICAL WORLD that so far no reduction in load had been noted on account of curtailment of industrial-plant production work. "The outlook for the central-station industry appears most encouraging," said Mr. Mulligan. "The abolition of restrictions by the Fuel Administration on ornamental and display lighting will help us materially. While the eight-hour day is coming into vogue among Springfield plants, with the abolition of overtime and Sunday work, no general release of labor has as yet been seen in this district. Gradually, it looks, the labor supply will become more plentiful with the return of troops from the cantonments and from overseas. We are planning to open the door wide to all our employees who entered our country's service, and we were fortunate in losing but two men in the war. Men of mature years whom we have used as meter readers will be retained as a rule.

"It was necessary during the war to increase our lighting rate from 9 to 10 cents per kilowatt-hour, and our power rates had to be raised 5 mills per kilowatt-hour. Our coal supply costs us $1 per ton for haulage from our storage field at Indian Orchard to our main generating plant, and there is practically no sign of any reduction in operating expenses, whether labor or material. An example of the high cost of construction is afforded by our switch house at our State Street station, now under way. This when completed will represent an outlay of about $600,000 in equipment and building, and yet it was absolutely necessary for us to provide this in maintaining our plant upon the most modern basis of operation. No extended program of expansion is at present planned in our company, but when the building trade begins to show life once more we expect to be able to devote some of our reserve generating capacity to supplying the new establishments.

"We were able to meet all the demands upon us for electrical service during the war, and were especially pleased that one of these—a request for the immediate supply of about 1000 hp. to the United States Armory—was at once complied with. We have purchased hydro-electric energy from the Turners Falls Power & Electric Company so far as available and have made the most of our own water-power stations, notably in the remodeling of our Indian Orchard station for increased production. The central-station industry demonstrated its usefulness during the war as never before, and I believe it will be an important economic factor in the reconstruction period upon which we are entering."

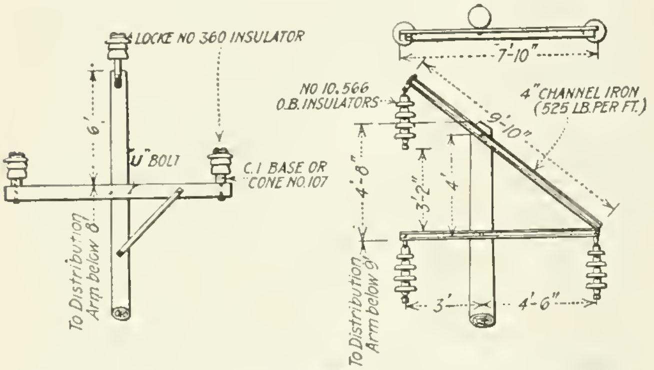
THE GREAT WHITE WAY COMES INTO ITS OWN AGAIN

WISHBONE CROSS-ARMS FAVORED IN CALIFORNIA

Prevent Pole-Top Fires Caused by Leakage Between Wires—Cost of Construction Is Also Reasonable

BY L. J. MOORE
Electrical Engineer San Joaquin Light & Power Company, Fresno, Cal.

IN THE spring of 1911 the San Joaquin Light & Power Corporation of Fresno, Cal., began to construct a 70,000-volt transmission network which was ultimately to replace the 30,000-volt lines that had formed the company's transmission system up to that time. The standard of construction adopted involved the use of pin-type insulators and wood cross-arms on wooden poles, as shown in Fig. 1. The actual voltage used was approximately 69,500, being obtained by connecting the high sides of the transformers, rated at 40,100 volts, in star with the neutral grounded.


LOCKE NO 360 INSULATOR
6'
"U" BOLT
C.I. BASE OR CONE NO.107
To Distribution Arm below 8'
7'-10"
NO 10,566 O.B. INSULATORS
4" CHANNEL IRON (525 LB.PER FT.)
9'-10"
4'-8"
3'-2"
4'
3'
4'-6"
To Distribution Arm below 9'

FIGS. 1 AND 2—WOOD CROSS-ARMS WITH PIN INSULATORS, AND CHANNEL-IRON CROSS-ARMS WITH SUSPENSION INSULATORS

With this construction trouble was experienced from leakage currents, or static, flowing from the wires to the neutral, or in this case to the ground, via pins, cross-arms and poles. During the summer months, when the poles and insulators were perfectly dry, owing to the long California dry season, no serious results occurred. However, a heavy coating of dust would collect on the insulators, and with the first gentle rains in the fall this coating became wet, causing a great decrease in the insulator resistance. As a result a number of pole-top fires occurred due to the increased leakage currents setting fire to the poles or arms at the points of contact between the pins and bolts and the wood. When the rains became heavy enough to wash the insulators thoroughly and wet the poles and arms, the trouble was practically eliminated, but not before a number of severe cases of failure had occurred.

Other California companies experienced similar troubles, and in line with their experience the San Joaquin corporation adopted a systematic campaign of "bonding" the hardware on all transmission-line poles. This involved connecting together all pins, cones and bolts on the poles and stapling the wire used for this purpose to the pole. This may be said to provide a direct connection from the pins on each of the phases to the neutral, or, in other words, to make the pins the neutral. The wire is not carried to the ground, because that is unnecessary, the neutral potential being practically ground potential, provided, of course, that the insulator resistances on the three phases are equal. After a line has been bonded very few cases of pole-top fires occur. In fact, practically all pole-top fires occurring on the transmission lines of the company now occur on sections of line which so far have not been bonded.

In order to increase the amount of insulation on the lines it was decided early in 1916 to adopt suspension insulators, and a steel "wishbone" type arm was designed for use in this type of construction. The wishbone arm, on account of supporting all three phases of the transmission line, automatically takes care of the hardware bonding and forms a neutral for the leakage currents from the three phases on each pole. The first line built using the wishbone arms was provided with an angle-iron type of arm, of a design similar to that shown in Fig. 2, except that the upper piece of angle iron was bent above the attaching bolt so that it became horizontal. Further study of the matter showed that a channel-iron section would offer much greater strength for the same weight of metal; therefore the arm shown in Fig. 2 was developed. In this case the upper piece of channel is left straight, no bends whatever being made in the construction of the arm. This makes a cheaper construction, and probably a stronger one. The transmission conductors used on this design of arm are No. 2 solid copper, and the spans are 352 ft. (119 m.). In the California inland valleys it is not necessary to design transmission lines for any snow or ice load, dead weight and windage alone forming the load.

Different sizes of plates are used for supporting the insulators and bolting the two pieces of channel together. A long plate is used to support the insulator of the upper phase rather than a smaller one in order to give more clearance between the string of suspension insulators and the channel iron.

The prices of the transmission-line material for a single pole of each type of construction are:

SUSPENSION CONSTRUCTION — TRANSMISSION-LINE MATERIAL	
Channel iron cross-arm	$6.03
Two ⅝-in. by 10-in. bolts, at $0.07	.14
Seven ⅝-in. by 1¼-in. bolts and washers, at $0.05	.35
Twelve No. 10,566 O. B. insulators, at $1.54	18 48
Three No. 10,756 O. B. suspension hooks, at $0.24	.72
Three No. 11,539 O. B. suspension clamps, at $0.85	2 55
Total	$28.27

PIN-TYPE CONSTRUCTION—TRANSMISSION-LINE MATERIAL	
One 6-in. by 10-in. cross-arm	$1.83
One pole-top pin	.62
Two cross-arm pins, at $0.11	.22
Two castr-ion cones, at $0 33	.66
Two ⅝-in. by 10-in. bolts, at $0.07	.14
Tne ¾-in. U-bolt	.25
One 48-in cross-arm brace	.58
Two ⅝-in by 4-in. lag screws, at $0.03	.06
Three No 360 insulators, at $2.35	7.05
Total	$11 41

It will be noted that the suspension-type construction with the wishbone arm is considerably more expensive than the old pin-type construction. However, the pin-type insulator used was very close to the limit of voltage for that type of insulator, whereas the suspension construction provides approximately double the amount of insulation given by the use of pin-type insulators. Moreover, the longer life of the steel cross-arm and the reduced amount of trouble experienced will be advantageous for this type of construction. The cost of the channel-iron cross-arm is for the present high price of steel. If before-the-war prices for steel were used and one-half the amount of suspension insulators were installed, costs of the two construction types would differ less.

Comparative Characteristics of Arc Welders

Discussion Designed to Bring Out the Comparative Advantages and Costs of Alternating-Current and Direct-Current Welders—Opportunity for Improvement of First Type Is Considerable—Practical Cost Data from Large Shipbuilding Plant

BY J. F. LINCOLN
Vice-President Lincoln Electric Company

THE characteristics of the different types of direct-current welders are so well known because of their years of use that there is not much use in going into their characteristics except in a very general way. The direct-current machines are of two general classes —those which get their regulating properties from resistance and those which have the regulating properties inherent in the machine. Both are successful when properly designed and both are in use in large numbers. The machine which eliminates resistance is somewhat simpler as far as control is concerned and uses considerably less power. It has the feature, however, that it is impossible to get more than one arc off each machine, and where a multiplicity of operators is required the first cost of the apparatus is larger than with the resistance type. Which one is best suited to the work depends entirely on conditions, and for that reason both are used to a very considerable extent.

CHARACTERISTICS OF ALTERNATING-CURRENT ARC WELDER

The alternating-current arc welder, however, is of more recent development and its characteristics are not so well known. It might therefore be well to discuss the claims made by the sellers of this type of apparatus and then discuss the other facts in connection with them. As is the case with all apparatus, this type of welder has some points which are very valuable and other points which are not. A consideration of the facts in the case as applied to each job will generally decide for the buyer which type should be used. The claims made for the alternating-current machine are the following: (1) No moving parts; (2) no commutator with its consequent trouble; (3) possible portability by hand; (4) high efficiency, and (5) low cost.

The first two claims are borne out except for the fact that in order to reduce the size of the welder a fan is sometimes used for cooling. A machine suitable for delivering 150 amp. for welding weighs approximately 400 lb. (181 kg.); thus it is obvious that two men may carry it around to some extent, although if it is to be widely portable as is required in most places where portability is necessary at all, a truck must be used either for this type of welder or for any of the previous types of direct-current welders.

Since there is no loss in resistance and since the transformation is done by a transformer, it is a fact that the efficiency is very high compared with that of any direct-current apparatus. However, for protective reasons, it is necessary to have very large leakages in the transformer, which results in an over-all efficiency considerably less than that of a standard constant-voltage transformer. The cost also is low.

Among operating characteristics of the alternating-current welder which are emphasized by the manufacturers is the short arc obtained, which gives less chance of burning the weld. However, arcs greater than ½ in. (1.2 cm.) in length have been established by the writer with a covered electrode, although it is a fact that with the bare electrode a short arc only can be maintained. Furthermore, the welds obtained were not so perfect as the manufacturers claim should be produced regularly with this type of apparatus.

Some of the difficulties, as seen by the users of these machines, follow: (1) Heat is equal at both electrodes; (2) alternating-current welders cannot be used for carbon electrode work; (3) power factor is low; (4) considerable skill is necessary to hold the arc at all with bare electrode; (5) speed of operation is relatively low; (6) the weld is liable to be poor when using bare electrodes because of the frequent breaking of the arc, and (7) the arc tends to sputter considerably, using more electrode than if this did not occur.

In discussing these points it is self-evident that the heat at each electrode must be the same. With the direct-current welder the heat at the point where the most heat is required can be secured by making that electrode positive. This is very essential where heavy plate is being welded.

The alternating-current arc is not suitable for carbon-electrode work because when the electrode is positive carbon is carried across the work, thus very greatly changing the characteristics of the weld.

A power factor of approximately 10 per cent is necessary in order to maintain the arc at all, and a power factor of 5 per cent gives considerably better operation. This means that for an outfit which would normally deliver 3 kw. to the arc transformer connections the power-house capacity and line capacity necessary to serve it must be 30 kw. at 10 per cent power factor.

The speed of operation is low because it is more difficult to hold the arc; it is practically impossible under normal operating conditions for any man to hold the alternating-current arc continuously during a ten-hour day.

Any arc welder is good or bad, depending upon the amount of oxide included in the metal. Each time that the arc is broken there is very apt to be a little pocket of oxide formed; consequently there is very great possibility that each time the alternating-current arc breaks a defect in the weld will be occasioned. Because of the difficulty of holding the arc the weld is less reliable.

COST OF OPERATION

The sputtering of the electrode is something that cannot be explained positively. It probably comes from very wide variation in heat being liberated at the arc during different parts of the cycle. The fact still remains that the arc sputters very considerably more with alternating current than with direct current.

Considering the cost of operation, there are three important items: (1) Cost of equipment; (2) cost of equipment supplying the power, and (3) cost of labor in doing the welding. All three of these can be determined with fair accuracy.

The first cost of a 150-amp. alternating-current welder is about $150 and that of a direct-current equipment about $1,000. The relative cost of generating and line equipment for the alternating-current welder is about $170 per kva., and for the direct-current set about $225 per kw., or $5,100 and $680 respectively for 3-kw. sets. The comparative labor costs are approximately 100 per cent for direct current and 125 per cent to 150 per cent for alternating current. Where power is purchased the cost of energy for the two types should be considered in place of the second item above. If the rate is not based on power factor or kva. input (compared with kw. input), the cost may be less for alternating-current equipment because of its higher efficiency. However, based on the making of a certain weld, this advantage for alternating-current apparatus would probably be offset. At any rate, many central stations are now penalizing for low power factor, so the cost of power will most likely be higher for alternating-current welders.

Comparative labor costs in one of the large shipbuilding plants have been ascertained. The best operator on alternating-current apparatus could do about two-thirds as much work as the best operator on direct current. With an operator of less skill the direct current could be operated in a fairly satisfactory way, but the alternating-current outfit could not be operated.

There are no doubt improvements which will be made over the present type of alternating-current welding apparatus both as regards operating characteristics and cost which will improve both. For instance, one of these is to use, instead of a transformer, a reactance with a variable magnetic circuit. This will improve the characteristics and at the same time reduce the cost.

Operating Methods That Increase Economy*

The Methods of Operation Here Outlined Apply to Plants Having Turbo-Generators—Distribution of Loads on Boilers and Turbines and Economical Operation of Auxiliaries Discussed

BY LIEUT.-COL. C. F. HIRSHFELD AND C. L. KARR

LARGE central-power plants offer special opportunities for practical application of fuel-saving methods, because the increase of economy can be had by making changes that are practicable within a reasonable time and do not call for the employment of higher engineering supervision than is already available. The present paper discusses the economies to be effected through changes in operating methods at large power plants having turbo-generators.

The actual working economy is determined by the fuel used, by the temperature of available circulating water, by the character of the load to be carried, and by the operating methods adopted.

Under normal conditions that fuel should be used which gives the minimum figure for the sum of the following items:

1. Cost of coal delivered to storage.
2. Cost of preparing coal for use, as by crushing or screening.
3. Cost of transferring coal from storage to bunkers.
4. Cost of transferring coal from bunkers to furnaces.
5. Cost of removing refuse.
6. Cost of rehandling and other labor caused by spontaneous combustion.
7. Maintenance of coal-handling, preparing and burning equipment.
8. Capital charges on equipment required to generate the required amount of steam.

In the present state of knowledge there is no method of determining, by reasoning or by analysis, the coal that will give this minimum. In general, each variety available in a given district must be given a trial thorough enough to enable the operating engineer to obtain actual cost figures. As a rule a medium-price coal gives the best results. Occasionally the coal that is most expensive on a ton basis really gives the minimum total of all costs concerned.

The temperature of the circulating water is, in general, entirely dependent on the characteristics of the supply and on the effect of seasonal changes and is thus a matter beyond the control of the operating engineer.

The character of the load to be carried is also, in general, beyond the control of the operating engineer. He must accept that load which the industry or community that he serves gives him at any particular instant. His job is to carry that load throughout all of its variations in such a manner as to attain as nearly as he can the minimum production cost possible with the equipment available, but he must always carry this load in such a way as to obtain the degree of continuity of service demanded or desired.

Methods giving the smallest fuel charges are not necessarily the most economical methods; true economy comes only from a realization of the complete problem and the use of an operating method which represents the best possible compromise between the many conflicting interests outlined above.

In a single plant with a given load curve the fuel economy is dependent upon three distinctly different things. These are:

1. The method used in distributing the load between the main units available;
2. The methods used in the boiler room for producing the steam required; and

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*For more complete discussion see "Bureau of Mines Technical Paper No. 204" on "Economic Operation of Steam Turbo-electric Stations."

3. The method used for obtaining auxiliary power or house service.

These three branches of the problem will be considered separately in what follows.

Distribution of Load Between Main Units

Most steam-driven turbo-generators built in this country have steam characteristics of the general type shown in Fig. 1. Some turbines built recently possess steam characteristics giving more complicated graphs when plotted, but attention will be confined to the type shown in the figure because of the greater simplicity and because the same sort of reasoning can be used to evolve proper operating methods for units with more complicated characteristics.

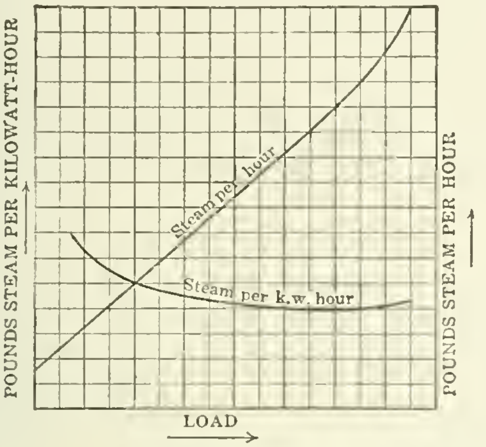

FIG. 1—TYPICAL WATER-RATE CURVE FOR STEAM TURBINE

Water-Rate Curves.—Any logical method of operating turbo-generators in such a way as to cause them to make minimum steam demands for given loads must obviously depend upon a fairly complete knowledge of the shape and location of their water-rate curves. These can be obtained only by water-rate tests, and it therefore follows that for best operation routine testing of units at definite intervals is necessary.

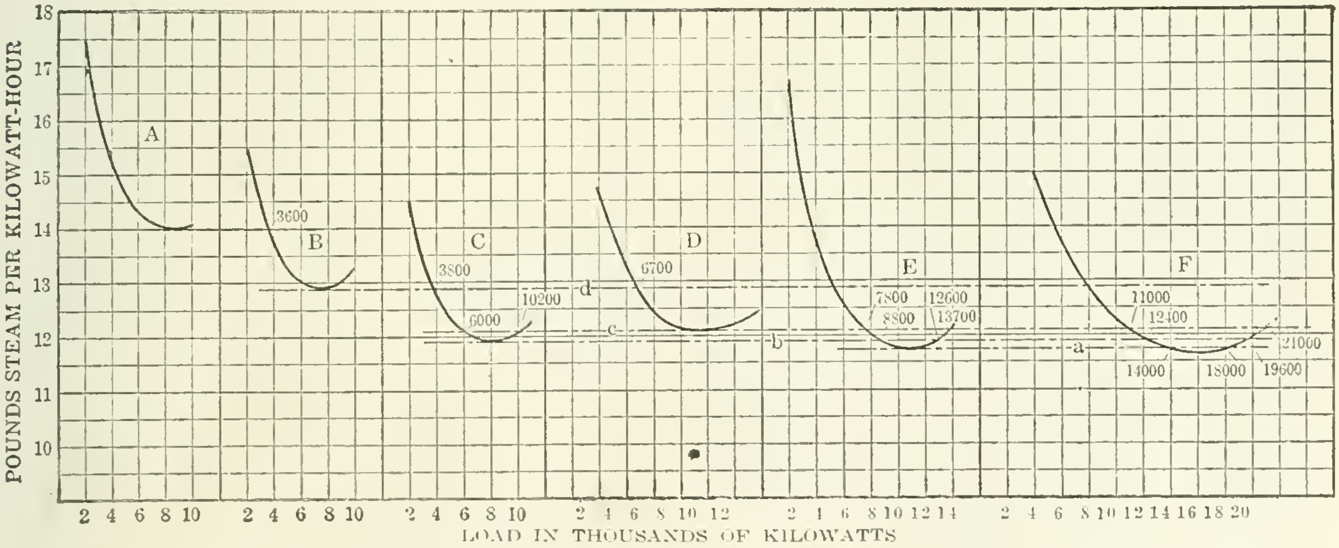

FIG. 2—WATER-RATE CURVES LAID OUT FOR STUDYING ECONOMICAL DISTRIBUTION OF LOAD

Experience has shown that it is necessary to test each machine through its entire range of load once in every eight weeks at stations operating continuously if a fairly exact knowledge of conditions is to be maintained. Tests made at about five or six equally spaced loadings generally suffice to determine the curves with the required degree of accuracy.

Such a suggestion is apt to be discarded by many operating engineers on the ground of difficulty or expense. As a matter of fact, neither of the arguments can be maintained in the face of figures that are easily obtainable. The cost of the testing equipment and the testing are more than paid by the savings effected through operating on the basis of known water rates.

At plants having surface condensers that were constructed without provision for tests of water rate by weighing it is often possible to install the necessary equipment at moderate expense. Particularly when all hot-well pumps discharge into one header it is usually a comparatively cheap and simple matter to install a parallel header with valves so arranged that any hot-well pump can discharge into weighing tanks while the discharge of the other pumps travels the customary route.

In surface condenser plants in which weighing apparatus cannot be installed or in which water-jet air pumps are used, and in plants fitted with jet condensers, recourse must be had to steam meters of some sort.

Method of Determining Load Distribution.—It is possible to determine mathematically the distribution of load between units so as to yield the minimum water rate for any given station load, but this method has not yet been reduced to a form easily understood and applied. An alternative cut-and-try method is therefore given here.

If a straight-edge be placed across the Fig. 2 horizontally at a height representing 14.5 lb. of steam per hour and be gradually moved downward while kept parallel to the horizontal axis it will cut all curves at equal water rates. Comparison of loads at different equal water rates on the several curves shows that machine C can carry any load from 2000 kw. up to about 9000 kw. more economically than any other machine. Beyond this point machine E should be given the load. It can carry loads from 9000 kw. to 12,500 kw. more economically than any other machine. Beyond that point the load should be given to F, and it is obvious from the figure that this machine is fitted to carry from 12,500 kw. up to 18,000 kw. more economically than any other.

Next, it is necessary to decide whether a load above 18,000 kw. can be carried more economically on F alone or on some combination of machines. Actual numerical trial will show that the greatest economy will be obtained by carrying load on F up to some point above 18,000 kw., but that somewhere between 18,000 kw. and 19,000 kw. the load should be shifted to C and E, giving about 8000 kw. to C and about 11,000 kw. to E. Such a combination would yield a water rate of about 11.8 at 19,000 kw. as against about 11.85 for the same load on F alone. The point of change may be assumed at about 18,500 kw.

It is next necessary to discover how far to carry the load on the combination C and E. Inspection of the curves indicates that 8000 kw. on C. and 12,600 kw. on E will give a load of 20,600 kw. with a water rate corresponding to the height of the line *b*. Inspection also shows that 8800 kw. on E and 12,400 kw. on F will give a total load of 21,200 kw. with the same water rate. Obviously the load would be carried on C and E from a total of 18,500 kw. to about 21,000 kw., after which it would be carried on E and F to a total of 12,600 + 19,600 = 33,200 kw. The best distribution between E and F at each different load between 21,000 kw. and 33,200 kw. must be found by cutting and trying, but it is obvious from the curves that at loads between 11,000 + 14,000 = 25,000 kw. and 11,000 + 18,000 = 29,000 kw. the load will be held constant at 11,000 kw. on E and the remainder will be taken on F.

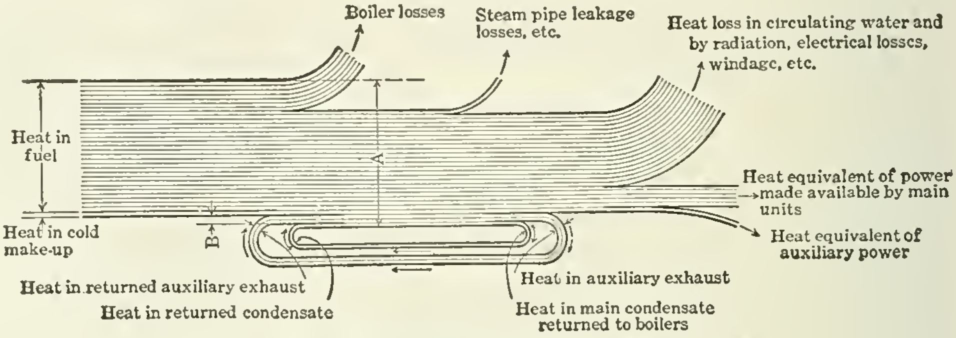
Boiler losses
Steam pipe leakage losses, etc.
Heat loss in circulating water and by radiation, electrical losses, windage, etc.
Heat in fuel
Heat equivalent of power made available by main units
Heat equivalent of auxiliary power
Heat in cold make-up
Heat in returned auxiliary exhaust
Heat in returned condensate
Heat in auxiliary exhaust
Heat in main condensate returned to boilers

FIG. 3—SCHEMATIC REPRESENTATION OF THERMAL ECONOMY OF STEAM-DRIVEN AUXILIARIES

Beyond a load of 33,200 kw. the possibility of using machine C must be considered because the water rate when carrying that load on E and F in parallel is the same as the best water rate on C. As a matter of fact the load would have to be increased beyond 33,200 kw. before C could be utilized because this unit cannot be utilized with the water rate in question at a load less or greater than about 8000 kw.

This sort of analysis can be carried through in the way outlined until a loading schedule has been developed for all loads between 2000 kw. and the maximum of which the station is capable. It is laborious and slightly confusing when more than three machines are being considered, but the fuel savings that can be effected by operating on schedules developed in this way are so great as amply to justify much more labor than can possibly be involved in utilizing this method.

In the analysis carried out attention was given to one point only, namely, that of obtaining minimum water rates at each load. In practice other considerations must be borne in mind. Thus operating requirements do not permit the frequent starting and stopping of machines to meet a violently swinging load, nor would such frequent starting and stopping give the results desired because of the necessary incidental waste of heat.

Again, in the analysis, one machine was assumed to operate alone at the smaller loads and to be used if necessary well up toward its maximum capacity. It is possible that some stations might be willing to operate in this way, but if assured continuity of service was desired such operation would not be permissible. It is generally most convenient to prepare an operating schedule and then to modify this as necessary.

It is also essential to bear in mind the fact that in normal cases schedules of this sort are good for about two months only. After that they must be revised, on the basis of experimentally determined curves, to meet the new individual water rates produced by changes in the temperature of the circulating water and by changes in the conditions of the turbines themselves.

The most advantageous distribution of load between stations can be determined in the same way as has been suggested for the distribution of load between the machines of one station.

Boiler-Room Operation

Boiler-room operation, like turbine-room operation, should be based upon the characteristic curves of the apparatus available. Here the characteristic curve of importance is one showing the values of the combined efficiency of the boiler unit at all different loads within its operating range. Tests made under best operating conditions are interesting as showing results toward which to aim, but they have not the same utilitarian value as tests made under conditions that represent the average that can be reasonably expected.

By examining combined efficiency curves for stoker-fired boilers it may be noted that the efficiency falls off much less rapidly at loads above that giving the greatest efficiency than it does at loads below that point. Moreover, the dome is relatively flat, and fairly large variations of load near the best point can be obtained without very great variations in thermal efficiency.

The most economical thermal results are obviously obtainable when such a number of boilers is operated as will require those operating to carry loads near that giving the best point on the curve. It is equally evident that when swinging loads are considered it is best to have the average load on a boiler fall above rather than below the best point, because of the less rapid drop of the right-hand side of the curve. Economic considerations other than those involving the cost of fuel also dictate average operation at a point above that giving the highest thermal efficiency.

Two further modifying conditions must also be noted in this connection. First, it may be necessary to operate in such a way that peak loads of large size can be picked up quickly on boilers already in operation. This may dictate operation at a point lower on the curve than would otherwise be chosen. Second, the character of the station load may be such that very light loads must be carried during many hours out of the twenty-four. This may dictate average operation at a higher point on the curve than would otherwise be chosen, in order that all of the boilers operating may follow the load downward for a considerable distance before banking of any boilers is required.

Banking of boilers should be carefully studied in every case. A certain definite quantity of coal is consumed during every banking period, and this quantity can be determined by experiment. It is, therefore, actually possible to determine at what point in the characteristic curve it is more economical to bank one or more boilers than to carry all at a lower rating.

OPERATION OF AUXILIARIES

Before the various methods available for running power-plant auxiliaries are considered it is desirable to call attention to several impressions that are widely held, although they are only partly true. Thus it is often assumed that steam-driven auxiliaries are thermally the most economical because the steam exhausted from auxiliary drives can be used in heating the feed water. Again, others hold that electric drive is thermally the most economical arrangement because the power used by the auxiliaries is generated in the main units of the station and these are unquestionably far more efficient than the scattered small units that would be used for direct steam drive. As a matter of fact, no broad statements of the type indicated above can be true in general.

Certain fundamentals can be laid down, however, and may be used as guiding principles for making a choice between possible methods in planning a new installation, or as indications of the best methods of operating stations already constructed. Often a study of operating conditions in the light of these fundamentals will show that it would pay handsomely to alter the auxiliary machinery in existing plants.

"Straight" Steam Drive.—What may be designated as the unmodified or "straight" steam method of auxiliary drive is illustrated diagrammatically in Fig. 3. The width of the stream as shown by the dimension *A* represents the total amount of heat supplied the boiler. Of this, a part is lost at the boiler, a part is lost in steam lines and traps, and a part enters the main unit. The remainder finally arrives at the auxilliary machinery, where it is split into three parts—(*a*) the auxiliary power sought, (*b*) losses by radiation, friction, windage, etc., and (*c*) heat in the exhaust steam. The heat in the exhaust steam is returned to the boiler by being absorbed in the feed water, and thus it forms part of the width of the stream as indicated by *A*. If it were not returned in this way the part of the stream representing heat in fuel would have to be wider by the amount indicated by *B* in the figure. As a rough approximation, auxiliary power obtained in this way may be said to take about 4500 B.t.u. per kilowatt-hour of auxiliary power.

It must be noted that this figure holds only for conditions under which the steam exhausted from auxiliaries can be absorbed by the feed water. If a condition arises in which auxiliary exhaust must be discharged to the atmosphere, the auxiliary power must be charged with the heat in its exhaust steam, and a kilowatt-hour of auxiliary power under these conditions involves an expenditure of 50,000 to 200,000 B.t.u.

In plants of modern proportions the amount of auxiliary power required per kilowatt capacity of main units is such that at light and moderate loads much more auxiliary steam would be made than could be absorbed by the feed water. It therefore follows that if a straight steam-driven auxiliary system is adopted, the greatest thermal efficiency will result when the most efficient engines or turbines are used for driving auxiliaries. Whether the use of such efficient, and therefore costly, auxiliary drives would result in the greatest economic efficiency would depend entirely upon the costs of fuel and capital. Ordinarily, the fuel saving would be such as to balance a very considerable increase in first cost.

"Straight" Electrical Drive.—In this method all auxiliaries are motor-driven and the power is taken from the main units served or from the station bus. Turbine plants of modern design should produce a kilowatt-hour with an expenditure of 19,000 to 25,000 B.t.u. in coal. Therefore every kilowatt-hour taken for the driving of auxiliaries represents a thermal cost of the order of 23,000 to 30,000 B.t.u., after allowing for the various efficiencies involved.

The unmodified electrical method possesses many advantages, such as reliability, simplicity, flexibility, cleanliness, etc., but it is unquestionably thermally expensive as compared to the other method under conditions that permit total absorption of the exhaust. On the other hand, the thermal cost of auxiliary power generated without reclamation of the heat in the exhaust is two to eight times as large as that characteristic of the "straight" electrical method.

Dual System.—In some of the stations installed a decade or more ago the auxiliary problem was solved by the use of both steam and electrically driven units. This may be designated as the dual system. A sufficient number of steam-driven auxiliaries were operated to give that quantity of exhaust steam which could be absorbed by the station feed, and all of the remaining auxiliary power was obtained electrically with energy taken from the main units. Many systems of this sort are in successful operation.

Obviously, the correct apportionment between the two different methods in the dual system varies with the station load. With high loads and large quantities of feed water the greater part of the auxiliary power is obtained with steam, and with light loads a large part is obtained electrically. Consequently the thermal cost of auxiliary power varies with the load. At high loads this cost tends to approach the 4500 to 5000 B.t.u. characteristic of steam drive with utilization of exhaust, and at light loads it tends to approach a figure nearer 20,000 to 30,000 B.t.u.

Other Systems for Driving Auxiliaries.—One such system drives the auxiliaries electrically with power taken from the main units and heats the feed water with steam drawn from the medium or low-pressure stages of the main turbines. This system is capable of many variations, but in all of its forms it amounts, thermally, to the generation of auxiliary power with steam up to the ability of the feed water to absorb the exhaust and the use of electrical energy generated in the main unit for auxiliary power in excess of this quantity. However, as the main units are the source of the steam-generated part of the auxiliary power, the steam drives of the auxiliaries are very economical and a larger proportion of auxiliaries can be driven in this way than could be done if many small steam-driven units were used. Moreover, all advantages of "straight" electrical drive are obtained, and the operation of the system is delightfully simple. The different demands made by the feed water at different loads can be met by merely controlling the steam bled from lower stages of the turbine. By placing the bleeder valves under thermostatic control the operation can be made entirely automatic.

The thermal cost of auxiliary power with this arrangement is similar to that of the dual system, but with normal load curves it should be lower through the greater thermal efficiency of the apparatus used for furnishing the "steam-driven" part of the auxiliary power. Because of the greater thermal efficiency a smaller number of pounds of "exhaust" steam will be made per unit of auxiliary power generated, and a greater part of the total can therefore be generated in this way without exceeding the ability of the feed water to absorb "exhaust" steam.

Another system that has been used extensively is almost the opposite of that last described. The auxiliary apparatus is driven by numerous small steam-operated units. As much as possible of the steam exhausted by these units is absorbed in the feed water and the remainder is fed to the low-pressure stages of the main turbines. By the use of an automatic valve on the exhaust the apportionment of exhaust steam can be made automatic in operation; in this respect the system behaves similarly to that last described.

It is obvious that whatever part of the auxiliary power is derived from steam that is later absorbed by the feed water is obtained at the thermal cost characteristic of a "straight" steam system. As the steam drives of the auxiliaries are bound to be of small capacity they are commonly characterized by low thermal efficiency and therefore use a relatively large quantity of steam per kilowatt-hour developed. In this respect the system is less economical than that previously described, because with absorption of exhaust steam by the feed water a smaller part of the total auxiliary demand can be supplied. With this method the auxiliary power would cost about 27,500 B.t.u. per kilowatt-hour. With more efficient auxiliary drives this figure would be lowered and with less efficient auxiliary drives it would be raised.

Effect of Economizers.—The increasing price of fuel is leading more central stations to the use of economizers. With these the greatest saving is effected when the water supplied them is at the lowest permissible temperature. This value is probably somewhere between 120 deg. and 150 deg. Fahr., depending upon the type of economizer used and the care with which it is operated. When these items are taken into account they point toward another solution of the auxiliary power problem which has been found both thermally efficient and very practical.

With the system referred to all, or practically all, of the auxiliaries are electrically driven, but as much as possible of the electric power used is taken from an auxiliary steam-driven generator of fairly large size. The remainder is taken from the main unit. Steam exhausted by the auxiliary turbo-generator unit is passed into a feed-water heater as in the "straight" steam method, but the feed-water heater is arranged so that it can be operated at a pressure below atmospheric if desired.

This system is thermally the exact counterpart of the dual method previously described. It is, however, thermally superior in that the greater efficiency of the large auxiliary unit makes possible the absorption of the steam made from the generation of a larger part of the total auxiliary power. It is also superior in that a control of the auxiliary steam made is available, for with any given load the quantity of steam demanded depends entirely on the back pressure. These points of superiority can be utilized in two ways. The auxiliary unit may be operated with atmospheric-exhaust pressure, when the advantage gained is merely that of being able to carry a greater part of the total auxiliary load on the steam-driven auxiliary apparatus, or the auxiliary unit may be operated with low back pressures, so low as to give feed-water temperatures as low as 140 deg. Fahr.; in this case economizers can be used to full advantage and a greater part of the auxiliary power can be carried on steam-driven machinery than would be permissible with a number of small steam-driven units exhausting at a corresponding temperature.

Thermally, the cost of auxiliary power is approximately 4500 to 5000 B.t.u. for all that power obtained from the auxiliary generator, and all power in excess of this is obtained from the main generator at a thermal cost of 23,000 to 30,000 B.t.u.

In conclusion, as much as possible of the auxiliary power should be obtained in such a way that resultant exhaust steam can be absorbed by the feed water. The remainder of the necessary auxiliary power should be obtained in electrical form from the most efficient units available. The observance of these two rules leads to maximum thermal economy.

THERE are those who fear a business depression. The surest way to bring on a depression of business is to nurture fears and act hesitatingly. We now have a national financial system which is capable of meeting practically any situation that can arise, and we do not need to fear difficulties from that quarter. Our farmers have harvested an enormous crop, and the assurance of good prices, together with more plentiful labor, makes certain a heavy planting next year. The only thing needed to insure a year of great prosperity is a determination on the part of every business man, big and little, to go ahead with absolute confidence in the future.—*Thomas A. Edison.*

Location for Power-Factor Corrective Apparatus

Experience with Static Condensers—Dissimilarities of Synchronous Machines—Using Idle Alternators as Condensers—Best Motor Rating for Correction—Effect of Condenser Location on Results

BY WILL BROWN
Electric Machinery Company

In previous articles* in the ELECTRICAL WORLD the writer called attention to the urgent necessity of power producers and users coöperating to improve power factor, pointing out that unless this is done adequate power to meet essential needs may not be available this winter. This is particularly true not only because there is a natural growth in loads for which little margin in generating capacity is left but also because lighting loads are overlapping the power load more and more. Causes of poor power factor were outlined; methods of locating them were explained and the proper remedies to apply were discussed. All of the suggestions point toward means for getting the maximum use out of equipment, and most of them involve preventing poor power factor rather than correcting it. In some cases, however, preventive measures alone are not sufficient and more expedient means have to be adopted. For such cases the writer suggests the use of synchronous motors, synchronous condensers and static condensers. Four objections that have frequently been raised to synchronous motors were discussed, and it was shown how conditions have changed. In this article the use of synchronous motors and condensers and static condensers will be considered.

As POINTED out in previous articles, recourse may be had to the use of static condensers and synchronous motors and condensers for power-factor correction where preventive measures are not sufficient or cannot be considered because of the time available for changes. By this it is not meant that the use of the apparatus named is merely an expedient, although the remedy can be applied quickly. In many cases it is advisable to consider installing synchronous motors in the first place.

The use of synchronous motors, synchronous condensers and static condensers involves many interesting phases which will be discussed more in detail here. For instance, attention will be given to the field for and experience with static condensers, provisions made to secure high starting torque and carry fluctuating loads with synchronous motors, distinction between synchronous machines for voltage regulation, power-factor correction, and carrying load, use of idle alternators as condensers, sensitiveness of different machines to low power factor, most economical rating of synchronous condensers for power-factor correction and relative benefits from locating condensers in different places.

STATIC CONDENSERS

There has not been any intensive use of the static condenser in this country up to date, although it is receiving increased attention now. However, it has been in use for some time in Europe. Flexibility of power-factor control is not permitted by static condensers as is the case with synchronous condensers.

There are at the present time a few installations of static condensers for power-factor correction on central-station lines. These are restricted to comparatively small units, but their operation seems to have been reasonably successful. They have the advantage of not requiring any source of excitation and operate at very high efficiency with slight losses. They require very little attention and supply a fixed amount of reactive kva. at all time.

A static condenser consists of numerous condenser sections connected in parallel. Some method of damping out the high frequencies produced by condenser discharge must be used, and for this reason they are always supplied with reactors in series with each line conductor. Condenser terminals are short-circuited through resistance in order to allow the set to discharge itself when disconnected from the line in a charged condition. Each condenser section is protected by a fuse in series.

A 300-kva. unit at Camden, N. J., is the largest static condenser the writer knows of as being used at the present time. Standard-size units can be added from time to time so that any required amount of kva. capacity can be secured. Whether these will become practical for general use is a question depending largely upon their price per kva. and their satisfactory operation. Other installations have been referred to before.

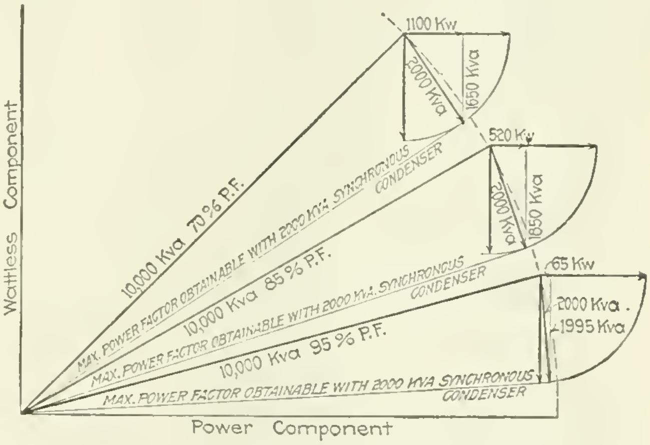
1100 Kw
2000 Kva
1650 Kva
520 Kw
2000 Kva
1850 Kva
65 Kw
2000 Kva
1995 Kva
10,000 Kva 70% P.F.
MAX. POWER FACTOR OBTAINABLE WITH 2000 KVA SYNCHRONOUS CONDENSER
10,000 Kva 85% P.F.
MAX. POWER FACTOR OBTAINABLE WITH 2000 KVA. SYNCHRONOUS CONDENSER
10,000 Kva 95% P.F.
MAX. POWER FACTOR OBTAINABLE WITH 2000 KVA SYNCHRONOUS CONDENSER
Wattless Component
Power Component

FIG. 1—POWER FACTOR IMPROVED BY CARRYING PART POWER LOAD AND PART WATTLESS LOAD

Note that with condenser rating equal to 20 per cent of system load 0.63 kw. increase in useful power is made available per kva. of condenser rating at 70 per cent power factor; 0.38 kw. is made available per kva. at 85 per cent power factor, and 0.2 kw. per kva. at 95 per cent power factor. The condenser should also be credited for carrying relatively larger power loads when correcting the lower power factors. With condenser rating a larger proportion of system load the increase in useful power made available per kva. becomes less.

SYNCHRONOUS MACHINE DISSIMILARITIES

Before discussing the most economical rating of synchronous motor to install for power-factor correction some of the dissimilarities of synchronous motors and condensers will be considered. The difference between the field windings and pole faces of unity-power-factor synchronous motors and power-factor-correcting synchronous motors was pointed out in the article by the author in the Nov. 23 issue of the ELECTRICAL WORLD.

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*Oct. 26, Nov. 2, Nov. 23, 1918.

Straight synchronous condensers also differ from synchronous motors in some respects. For instance, since power-factor correction alone is desired, there are no particular speed limitations to meet. The cost per kva. being smaller for higher-speed machines, it is the usual practice to design condensers for fairly high speeds. Of course, there is a safe limit to the operating speed, and the point is reached where additional speed would actually increase the cost of construction rather than decrease it. The large stresses due to centrifugal force necessitate what is known as boiler-plate construction of the rotor. The field poles are solidly anchored with dovetail joints to a spider built up with segments of sheet steel solidly bolted together. Since it is not necessary for the condenser to drive a mechanical load, the shaft and bearings are smaller than those used on load-driving synchronous motors of similar rating. They also lack all mechanical connections such as pulleys or couplings.

Phase Modifiers.—It is necessary to make a clear distinction between the use of synchronous motors to maintain constant voltage and the use of such motors strictly for power-factor correction. When used for the former purpose they are generally termed phase modifiers. Thus a power company might have a large kva. capacity in condensers installed at the receiving substations of its transmission lines, but they would be operated almost exclusively as phase modifiers for maintaining constant voltage. They would, of course, produce high power factor at the substations, on the transmission lines and at the generating station, but they would have no corrective effect on the lagging power factor of the feeders and motor circuit. For voltage regulation the synchronous condensers are equipped with hand or automatic field-current regulators.

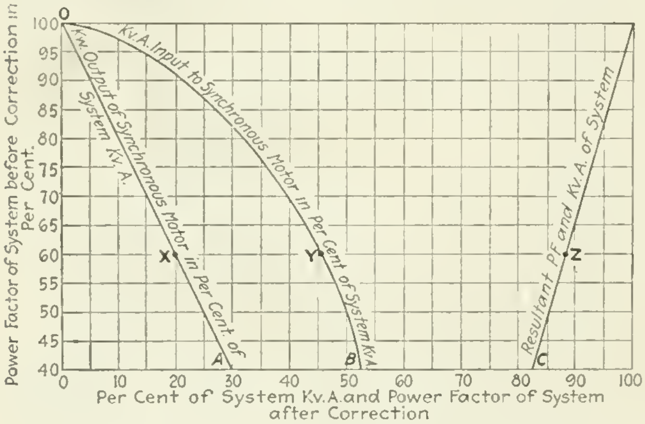

FIG. 2—HIGHEST POWER FACTOR THAT CAN BE OBTAINED ECONOMICALLY; ALSO CONDENSER RATING AND LOAD

For example, suppose the line rating is 1000 kva. and the system power factor is 60 per cent. Follow the horizontal line marked 60 per cent to the right, indicating the intersections *X*, *Y* and *Z* with the three curves. Below these points on the bottom scale are the kw. load (200) which the synchronous motor should carry, the kva. rating (455) of the motor and the most economical power factor (88.5 per cent) which may be obtained respectively. The intersection *Z* also indicates that the system kva. has been reduced to 885, making the kw. load 800 instead of 600 as before correction. The I^2R losses, voltage drop, etc., would therefore be less.

The West Penn Power Company makes it a practice to place Tirrill regulators on all synchronous apparatus of 100 kw. or over and thus regulate the line for voltage. Transformers are connected in such a manner that under normal conditions synchronous motors will be running at approximately normal load, but when the voltage drops they take a considerable overload. When the voltage rises again the load is reduced and the reactive component is allowed to lower the voltage of the line. This company has also persuaded many of its consumers to equip their synchronous apparatus with Tirrill regulators, giving an additional 5 per cent discount for such service. As a result of this policy the company is able to maintain the power factor at the main station within two points of unity—that is, 98 per cent lagging—under maximum load conditions when it has all of the synchronous apparatus on the system boosting heavily. The voltage at the principal load consumers on the transmission system is maintained at its normal value because of the very excellent regulation.

Caution.—When the field of a synchronous motor is automatically regulated by a Tirrill regulator the excitation must not be allowed to fall to a point where the motor would drop out of step.

Auto-Synchronous Motors.—On loads requiring very high starting torque or where it is necessary to provide for heavy load fluctuation with a comparatively low exciting current the auto-synchronous motor is used to some extent. This motor differs from the ordinary type of synchronous motor in that it is not of definite pole construction. The rotor is wound in much the same fashion as a slip-ring induction motor, the windings being designed to form definite poles when direct current is applied. A three-phase motor is equipped with three slip rings, and the operation of starting is exactly analogous to the starting of a slip-ring motor. The rotor circuit is connected in series with an auxiliary resistance through the slip rings. When the motor reaches its pull-in point the full line voltage is automatically applied and direct current is allowed to flow from the exciter through the slip rings into the rotor circuit. Two of the slip rings are connected in parallel through conductors leading to one exciter terminal; the other slip ring is connected to the other terminal of the exciter. This motor has the advantage of being able to drop out of step under heavy load and operate continuously as an induction motor, then pull itself automatically back into step again as the load is reduced. There are a number of auto-synchronous motors of this type operating on lines of the Hydro-Electric Power Commission of Ontario, driving direct-current generators. It does not appear likely that there will be any great field for this type of motor because its efficiency is relatively lower than that of the ordinary synchronous motor, especially at low speed.

USE OF IDLE ALTERNATORS AS CONDENSERS

Many plants make use of idle alternators on the system to correct power factor, running them as synchronous condensers. This can be done in one of two ways—either as a synchronous condenser at approximately zero power factor, or the alternator may deliver a percentage of its load in kw. and be operated to its full kva. capacity at leading power factor. This latter method is not be to recommended, but it is used sometimes in an emergency.

For instance, at Minneapolis and St. Paul during the summer months practically all the power is supplied by waterwheel-driven generators. In addition to these the

Northern States Power Company has about 30,000 kva. of turbo-alternators installed in the downtown stations. These turbo-alternators are run as condensers to their full capacity with just enough steam in the stages to maintain proper temperatures.

Another interesting case was related in the ELECTRICAL WORLD of May 4, 1918. Duplicate transmission lines from the generator station were paralleled at the distant ends so that any alternator that was not carrying a load at the time could be connected to this reserve line and run as a synchronous condenser to compensate for low power factor at the delivery end of the line. This arrangement has an advantage over merely connecting the condensers to the generator bus in that it benefits the transmission line as well as the generators. It is probable this plan could be used in a number of cases where there are duplicate lines.

Some alternators are extremely sensitive to low power factor. This is generally due to faulty design permitting excessive field leakage, etc. There may be other alternators in the same station which can stand low-power-factor operation more satisfactorily. In such cases it is advisable to run the sensitive alternators as close to unity as possible and correct the power factor on the other alternators by overexciting the fields.

Alternators at Leading Power Factor.—It must be borne in mind that the operation of an alternator on lines of low power factor is exactly the opposite to that of a synchronous motor. Suppose it was desired to operate an alternator to its full kw. capacity at unity power factor on a line of lagging power factor. This could be done by underexciting the field. In this case, however, the wattless component of the line would be still further increased, and it would be necessary to take care of it on the other alternators of the system. This fact should be remembered by central stations buying power from isolated plants. It may be possible that the alternators at the isolated plant are causing increased reactive component on the lines and thus adding to the burdens of the alternators at the company's own generating station.

The Edison Electric Illuminating Company of Boston cites an interesting point about power factor that came up recently in connection with interchange of power between two alternating-current systems, as follows: "We are planning to supply power to another network, and apparently the power factor on the connecting line will not depend on the power factor of the other system

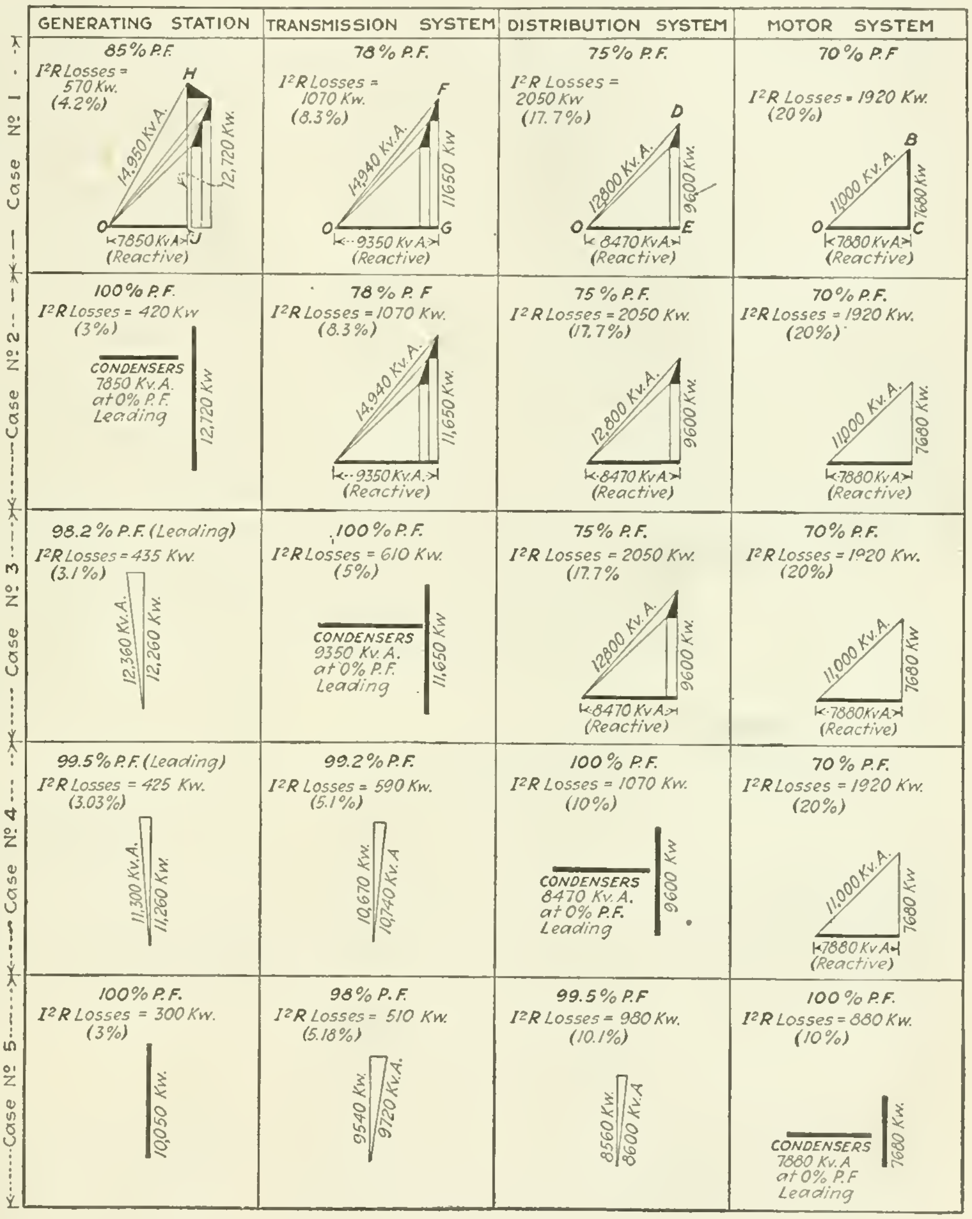

FIG. 3—EFFECT OF PLACING CONDENSERS AT VARIOUS POINTS

The system is delivering 7680 kw. to motors, the average power factor of which is 70 per cent. This is indicated by triangle *OBC* (case 1). Owing to the I^2R loss and reactive power obtained in the motor circuits, vectors representing these amounts must be added to the kva. delivered to the motors to obtain the kva. (vector *OD*, case 1) delivered by the distribution circuit. In a similar manner, the kva. delivered by each part of the system can be obtained. The upper triangle of the transmission system vector diagram represents losses in the distribution system, and the upper triangle for the generating station represents the losses in the transmission line. There is no triangle to represent the 570 kw. I^2R losses in the generating station, since this would be taken into account in the total horsepower delivered by the prime movers. Note that the capacity effect of the transmission lines introduces a leading reactive kva. at the generating station.

Case 1 refers to conditions with no condensers installed, whereas cases 2, 3, 4 and 5 refer to conditions with condensers installed in generating station, at receiving end of transmission line, at distribution centers and at motors respectively. Note how the I^2R losses are affected in each case, those between the generator and condenser being considerably reduced. In the last case (5), which is the ideal condition, by placing 7880 kva. of condensers at motors the I^2R losses have been reduced as follows: Motor system, 20 to 10 per cent; distribution system, 17.7 to 10.1 per cent; transmission system, 8.3 to 5.2 per cent; generating station, 4.2 to 3 per cent. The total I^2R losses have been reduced from 42 per cent with no condensers to 26 per cent with condensers at motors. Furthermore, the kva. load on the generators is reduced about 33 per cent.

considered by itself, but can be controlled by the ratios of the transformers and also by the voltages of the two systems and by the amount of current that is being sent over the line, the latter being controlled by the frequency rather than by the voltage. The sending company, without changing its own voltage, can be tending to increase its frequency and force more current over the line at an improved power factor unless the receiving company raises its voltage, which would interfere with its distribution voltage, or else in turn tries to raise its frequency so that the two companies are bucking against each other."

When two companies with a connecting link are making power the question of power factor is more for operating than rate consideration. It is very much like driving a pair of horses. Unless the horses pull equally the wagon slews around and gets into trouble. Unless the operating engineers of the two companies work together their system slews around.

A contract for the interchange of power between the Boston Edison company and another large system was recently made. It is a long-term contract with a provision for arbitration of the price, and their solution of the power factor difficulty is to put in the contract that the two companies agree to operate their systems, so far as practicable, so as to put a given percentage of power factor on the line. Further in the contract is a statement that the present prices are considered to be fair for that same percentage of power factor, the idea being, of course, that if they find later that it is necessary to operate at a different power factor, then an equitable adjustment in the price of energy will be made.

Best Synchronous Motor Rating for Correction

Having presented some of peculiarities of synchronous apparatus as it is related to power-factor correction and having related some methods of using generators to improve power factor, the writer will now consider the synchronous rating which is most economical for power-factor correction. It is a fact not universally understood that a synchronous motor carrying a certain proportion of kw. load will actually raise the power factor of the system to a higher point than a condenser of equal rating operating at zero per cent leading power factor. This is readily understood by studying or making diagrams similar to Fig. 1.

Just what the proportion of this kw. load should be to the total kva. rating of the motor depends upon several conditions, among them the total load in kva. and power factor before correction. With these factors given, the highest point to which the power factor can be economically raised, the kva. rating of the synchronous motor required and the kw. load which the motor can carry allowing the maximum correction for the system can be readily obtained from Fig. 2.

Best Location for Condensers

Apparatus which supplies leading reactive kva. should be placed as near as possible to the apparatus which is causing the lagging reactive kva. Since the greatest amount of lagging kva. on any system is furnished by the induction motors, it is evident that the best place to put condensers is near the induction motors. In this way the reactive component of current would circulate only between the armatures of the induction motors and the armatures of the synchronous motors. The rest of the circuit would then be relieved of all the reactive component except a comparatively small amount caused by transformers, etc., on the distributing system and transmission system and at the generating station.

An ideal condition for any system would be to have sufficient condenser capacity at the points where induction motor loads are carried to raise the power factor at all these points to unity. Then a comparatively small installation of synchronous condensers at the distributing stations and at the generating station could serve to keep the whole system at unity-power-factor operation. In actual practice this ideal condition can very seldom be achieved, although there are systems where just such conditions exist at the present time.

The Peninsular Power Company, at Iron River, Mich., makes this statement: "Our power output is sold almost exclusively to mining companies. Although we do not specify, we advise that all compressor motors be synchronous. As this is adhered to in almost all cases, we have an ideal power factor on the entire system."

On any system of lagging power factor there is a certain definite amount of reactive leading kva. which must be supplied in order to bring the system up to unity. Now it is possible to supply this whole amount to the generating station itself, but if this is done the whole system outside, beginning with the high-voltage side of the step-up transformers, will still remain of the same power factor as before and all the losses due to low power factor will also remain unaltered. The diagrams in Fig. 3 show graphically some results brought about on one system by locating condensers at different points.

In the article entitled "For and Against Synchronous Motors," which appeared in the Electrical World for Nov. 23, a serious typographical error appeared on page 982, where the statement is made that "Synchronous motors can now be designed to start and pull into step a load amounting to from 30 to 50 per cent of full load with kva. input not to exceed 25 per cent of normal rating." This should have read "250 per cent of normal rating."

With the ending of the war we find ourselves with the familiar constitutional privileges and restrictions, and it behooves officers of government to realize that to make a pretense of military exigency for ulterior purposes when military necessity has ceased is simply an abuse of power which will not be permitted to escape censure. . . . The immediate purpose should be to readjust as soon as may be, not to use war powers to control peace conditions, a proceeding essentially vicious and constituting the most serious offense against our institutions. Peace policies must be prosecuted with the authority and distribution of powers and according to the methods which pertain to peace.—*Charles E. Hughes.*

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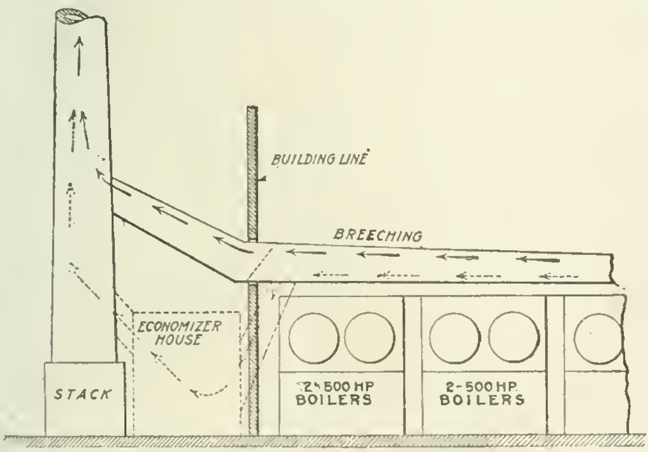
DEMAND METERS SHIFTED FROM CUSTOMER TO CUSTOMER

Impossibility of Getting Enough Instruments Promptly Causes Company to Move the Existing Meters Repeatedly to Increase Billing Accuracy

A company serving a large industrial district had never thought it necessary to use demand meters on every large customer's installation before the war boom came. Loads were fairly steady and demand meters were expensive, so demands were checked up occasionally, using as few instruments as possible. Now that the industrial loads are growing rapidly on every side, the management sees that a demand meter on each power customer's installation would pay for itself in a few months. At present, however, demand meters are not to be had except on long delivery quotations. An order for a large number of them has been placed, but in the meantime the meter department is endeavoring to keep pace with the changing loads by moving the existing meters from customer to customer as rapidly as an approximately correct demand for each consumer can be found.

STATION PLANNED WITH A VIEW TO FUTURE ECONOMIZER

Layout That Takes Into Account Probable Higher Coal Prices in Coming Years and Provides Method of Meeting Them



IF COAL PRICES RISE, ECONOMIZERS CAN BE EASILY INSTALLED IN THIS PLANT

Provision for installing economizers has been made in several power stations which have been built or rebuilt recently in the Middle West. Notable among these are some properties of the Illinois Traction System. When a station is being planned the engineers calculate the increased economy that could be gained by installing economizers and also calculate the increased cost of including economizers in the design. It is then a simple matter to see how high the price of coal would have to go to make the economizers a paying investment. In some cases it has seemed inadvisable to include the economizers in the station at the time of building, but it was at the same time clear that probable future coal prices might dictate their installation.

Accordingly layouts have been selected which make later inclusion of economizers easily possible. A cross-section through a station which is typical of this group is shown in the sketch here published. The layout as it is now is shown in solid lines, and the future layout with economizers is shown in dotted lines. The stack stands outside the power house, and the space under the breeching between the power house and the stack is ample for an economizer house. It is planned that dampers shall be included to direct the gases either through the original breeching or through the economizer.

SPARK RECORDER USED IN TESTING APPARATUS

Simultaneous Readings of Testing Instruments Are Recorded on Endless Tape in Form of Curves Traced by Spark Discharges

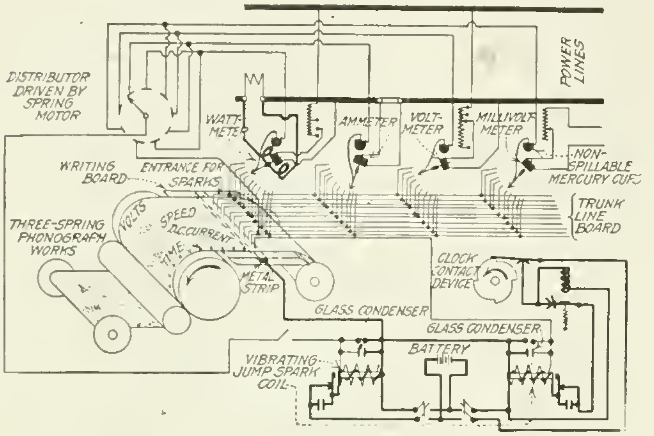
BY F. W. SPRINGER

The portable recording instrument shown in the accompanying illustration was designed and built in the electrical engineering department of the University of Minnesota some time ago for recording the readings of any indicating instrument. Its principal use is in testing electric cars, elevators and starters or controllers used with various types of alternating-current and direct-current motors. An earlier model of spark recorder arranged to rectify and superimpose three sets of direct-current instrument readings was described in the ELECTRICAL WORLD for July 21, 1906.

Edison three-spring phonograph works operate the paper reels and drums and the spark distributer. A laminated board holds eighty bare copper wires uniformly spaced and laid in suitable slots. The distributer *Y* is driven by one of the shafts of the spring motor, although it could be driven by a special electric motor connected with a storage battery if desired. An H-slot gear-shift is provided, which, together with the centrifugal governor on the spring motor, allows a paper speed of from 2 in. to 4 ft. (5 cm. to 1.2 m. per minute. The slow speed is used for railway work and the high speed for testing alternating-current motor starters and the like.

A common two-cell automobile lighting and starting battery is a satisfactory source of energy for the spark coils. The battery should be insulated in order to avoid unnecessary and dangerous differences of potential between the recording instruments and the neighboring lines and grounds. In case of railway tests the apparatus should be connected with the line on the ground side, or the apparatus and operator should be placed on an insulated platform to be considered as an artificial ground of the line being tested.

Three-phase tests may be made by using a polyphase wattmeter, but as most tests for which such a recorder might be used are either single-phase or balanced three-phase systems, a single-phase wattmeter only is provided. The current coil is cut in on one line leg and the potential coil may be connected to an artificial neutral. In alternating-current work, of course, the shunts are replaced by one current transformer. In direct-current tests the wattmeter spark is usually cut off.



APPARATUS FOR RECORDING SIMULTANEOUS READINGS

The outfit is equipped with a 5-amp., 150-volt, single-phase Weston wattmeter, a Weston millivoltmeter with shunt, and a direct-current voltmeter and millivoltmeter of the same type. Pin switches are used for controlling the sparks to the individual instruments. A vibrating jump-spark coil is connected successively to the various broom-straw insulated instrument pointers by means of the distributer and the non-spillable iron mercury cups and binding posts. The millivoltmeter is connected through an adjustable resistance to a suitable direct-current magneto for recording speeds.

COAL SAVING EFFECTED BY CONSERVATION PLAN

Data Show that Campaign of Education Among Power-Plant Operators and Attention to Small Leaks Saves Coal and Revenue

An analysis to show how much coal twenty-three generating stations saved by educating their power-plant operators in the proper fulfillment of their duties is given herewith. Every single station paid more for its coal in 1918 than it did in 1917, according to column No. 3 of the table. The total increase in cost of operation due to the increase in the cost of coal per ton was $43,987.42. The increase over last year due to change in output was $11,208.20. The total increase, excepting new plants, was $46,161.02. This figure would have been higher by $9,034.60 if it had not been for the persistent effort of the combustion engineering department, which fought the rising coal costs in the stations.

On property No. 1 alone the coal costs were reduced $1,492.72 by increasing the efficiency of the station. This increase was due partly to the addition of a new and more economical turbine and partly to more careful firing. Property No. 4 affords a still better example of what a campaign of conservation can do. No changes were made in the plant's apparatus, and the campaign of conservation was on for only three months, when a saving of $2,540.60 showed up in the coal pile. The same statements hold true for properties No. 8, No. 10, No. 13 and No. 21. Property No. 12 made a good showing because a new and efficient plant was started. Property No. 9 is the exception which proves the rule, for even in carefully maintained stations accidents will happen. In this case the economizer which had been helping the plant to save coal was out of order.

COAL-SAVING RECORD OF TWENTY-THREE GENERATING STATIONS

(Analysis of Increased Cost of Coal for Month of July, 1918—Increase in Cost of Coal in 1918 Over 1917)

				Increase in Coal Expense			
Property	Increase in Kw.-hr. Generated	Decrease in Pounds per Kw.-hr. Generated	Increase in Cost per Ton	Due to Change in Output	Due to Change in Efficiency	Due to Increase in Cost per Ton	Total Increase
No. 1	134,110	0.9278	$0 3224	$574 09	$1,492 72*	$1,947 03	$1,028.40
No. 2	21,200	0 1508	0 45	125 25*	97.41*	939.71	717.0
No. 3	130*	0.5316	1 0633	2 09*	15 88*	153.12	135 15
No. 4	280,770	1 4999	1 3503	1,831 72	2,540 60*	6,203.73	5,494.85
No. 5 (new plant)	61,020*	.....	.....	......	....	....	....
No. 6	47,469*	0 4552†	0 9122	289 53*	599 01	2,260.74	2,570 22
No. 7	21,995*	1 7438†	1 72	196 20*	807.37	1,849 66	2,460 83
No. 8	609,705	0 0644	1 3298	2,883 69	327 70*	8,227.39	10,783.38
No. 9	63,590	0 5407†	1 0085	489 94	1,189 28	2,318.96	3,998.18
No. 10	6,159	1 4051	0.9200	82.83	306.30*	774.26	550.79
No. 11	8,400	0.1015†	1 4276	63 82	27 97	832.29	924.08
No. 12	747,200	4 3001	0 7505	8,602 22	9,529 67*	3,208 40	2,280.95
No. 13	19,610	0 3232	1 8005	152 68	394 65*	5,976 17	5,734.20
No. 14	86,100	1 0796†	0 5337	701.49	899 12	912 44	2,513.05
No. 15	279,100*	1 7317†	0.3190	4,233.05*	107.59	53 96	4,071.50*
No. 16	40,639	1 0424†	0 7441	475 98	616 21	911 45	2,003 64
No. 17	31,581	0 6811†	1 5177	252 18	398 62	856.97	1,507.77
No. 18	18,600	0.0125	0 6675	76 32	19 23*	1,615.75	1,672.84
No. 19	168,100*	0 3083†	0 6292	547 03*	732.61	2,138.00	2,323.58
No. 20	136,300	0.2061†	0.5909	449.81	577 56	2,353.68	3,381 05
No. 21	2,380*	2.1176	1.0512	35 42*	265 78*	453.71	152.51
Totals	1,581,370			$11,208.20	$9,034 60*	$43,987 42	46,161 02
No. 22 (new plant)	....	......	...			.....	305.94*
No. 23 (new plant)	.....	......	...	....	..	.....	70.67
Total	..	......	......	......	....	..	$45,925 75

* Decrease. † Increase.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

DEDUCTING FOR TWO NIGHTS A WEEK WITHOUT LIGHT

Methods of Arriving at Reduced Charge for Street Lighting in Such Case as Practiced by Two Middle West Electric Companies

In an Iowa town of about 16,000 people two lightless nights each week were established in the interests of fuel conservation. In order to give an entirely equitable charge to flat-rate sign and window-lighting customers this company billed such service at five-sevenths of the original contract price. Since the company did not furnish any lamp renewals or glassware on these contracts, the deductions which it made were based entirely upon the number of hours burning with two nights of the week eliminated. Another company operating an interconnected transmission system in the Middle West deducted 20 per cent from flat-rate monthly charges when two lightless nights per week were declared, although the actual outage figures slightly more than 20 per cent. The company stated to its customers that such lighting schedules are usually based on costs, of which the actual kilowatt-hour consumption is but one factor.

COMMERCIAL PROGRAMS ARE AGAIN OPENING UP

Nebraska Central-Station Company to Sell Appliances to Popularize Electricity, Better the Load Factor and Make a Profit

Commercial plans for central stations are again in the making. An interesting sidelight on this situation is furnished by J. E. Davidson, vice-president and general manager of the Nebraska Power Company, Omaha, Neb., who says:

"For a few years prior to last May when we moved into the building of which we are sole occupants—known as the Electric Building—this company did little or no merchandising. In fact, it did not furnish free or sell incandescent lamps. I have always been insistent that the companies with which I am connected be very active in the sale of energy-consuming devices and machinery and the solicitation of general lighting and power business.

"In this building we have an electric shop which we believe is very attractive, and a year hence we will double its size. I regret to say that, on account of war conditions, we have not had so many solicitors since we have been in this building as we would like, but we are now putting on more. We are also advertising in newspapers, by circular letters, illuminated bulletin boards, etc.

"The results of our efforts are very satisfactory. We feel that this is a virgin field and will push the sale of energy-consuming devices, lamps, etc., for three reasons: First, to popularize electricity in the home; second, in order to have our customers consume more kilowatt-hours and thereby improve the load factor at our power house; third, because we make a profit on our merchandise, as we maintain prices to protect contractors and others who handle electrical appliances."

COMMERCIAL TRUCK LOAD IS A DESIRABLE ADJUNCT

In Spite of Numerous Difficulties Truck Owners in City Where Local Lighting Company Gives Service Refuse to Part with Electric Trucks

A brief survey of electric road-truck affairs in the past few months indicates that an increasing demand for such equipment in fields where it is economically justified will be felt in the coming year. At present the two principal manufacturers of electric trucks are actively engaged in production.

Users of such trucks and central stations furnishing energy for battery charging or selling service on a mileage basis have been much handicapped this year by the shortage and high cost of labor. In one town where about 100 trucks are operated on a service-mileage basis the drain upon local labor produced by the war at one time cut down the number of trucks on the street to about two-thirds of normal, and this condition is only now beginning to show signs of relief. The high cost of material has also been a deterrent to normal rates of business expansion. Where labor has been available for truck driving, wages almost 70 per cent above peacetime standards have been demanded, and it has been difficult in some cases to hire truck operators at less than $25 per week. Another difficulty has been to obtain an adequate supply of skilled labor for truck and battery maintenance.

In spite of these obstacles, however, it is significant that in the above city, where mileage service has been vigorously developed and most intelligently maintained during the past three or four years, the customers of the local central station refused to listen to the suggestion that they part with their trucks on the basis of a refund of investment cost. The central station did not contemplate withdrawing the service with any idea that it was impossible to make it a success, but wished to find out its customers' opinion as to the permanent value of the service in face of the difficulties brought about by the war.

In one city having an excellent electric truck service a gleam of humor was injected into the darkness of war conditions during the time of the "gasless Sunday" period. Signs bearing a legend to the effect that the electric trucks of the local central station's battery service system had run 3,000,000 miles without gasoline were displayed on the vehicles.

From interviews with men in the trade familiar with electric truck performance and prospects it appears that if manufacturing facilities, and in some places garage facilities, are expanded to meet the requirements of the coming year, a period of renewed prosperity will be enjoyed. That a light electric delivery wagon would be specially useful if available in quantities is one central station's viewpoint. It is felt that the battery-charging load was never so desirable to the central station as to-day, when it is confronted with the prospect of at least a temporary curtailment of power load due to the transition of industry from a war to a peace basis.

EFFECT OF FUEL-ECONOMY ORDERS IN IOWA TOWNS

Gross Earnings Affected from 10 to 15 per Cent, Fuel Saving About 5 per Cent; City Council Reasonable as to Street-Lighting Price

A central-station company operating in an Iowa town of about 3000 population reports that its gross earnings were affected from 10 to 15 per cent by the daylight-saving measure. The manager says:

"There was undoubtedly some saving in fuel, but it would be rather hard to say just how much of it was due to the daylight-saving situation. We were compelled to burn different grades of fuel under different conditions. This further complicated matters. It is probable that the fuel saving was approximately 5 per cent.

"We made no adjustments in street-lighting charges where short burning hours have been in effect. In one town which we served by a transmission line this matter automatically took care of itself, and the lighting was metered and the charges were rendered on the metered basis. In another town, where the company has a flat rate in effect, the company's financial position was put squarely before the city authorities, and they agreed to pay the customary charge rather than take action which would add further to the burdens of the lighting company."

TREATMENT OF MAXIMUM CHARGE IN RATE CASE

Clause Providing for Maximum Charge Depending on Demand Changed to Include Energy Charge on High-Load-Factor Business

A clause inserted in the wholesale power rate of the East St. Louis (Ill.) Light & Power Company about five or six years ago, as an attractive sales argument, provided that the cost to the customer under the provision of the rate should not exceed $4.47 per month per kilowatt of demand. Later, when several large consumers with high load factors came on the company's line and when rising operating costs persisted, this clause became a burden.

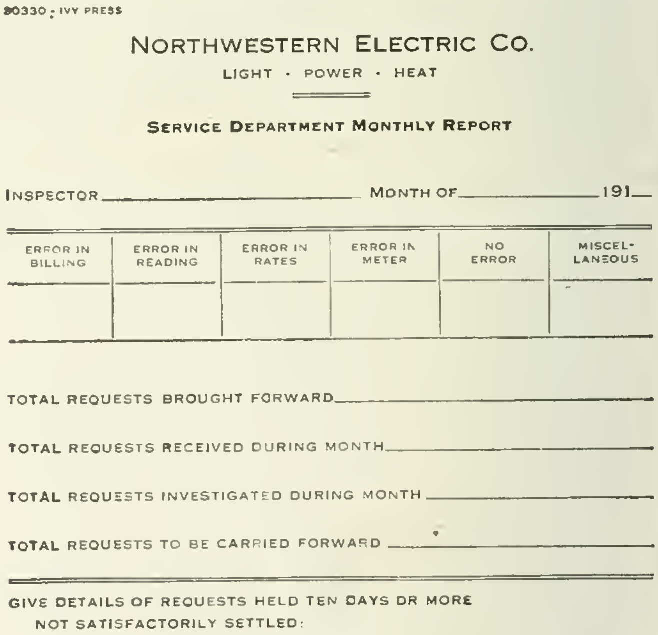
About a year ago this maximum charge was increased to $5.50 per kilowatt of denmand up to and including 100 kw. and to $5 per kilowatt for demands in excess of 100 kw. On the company's second application for increased power rates, which was granted on Nov. 26, 1918, it desired to omit the clause. The Public Utilities Commission of Illinois refused, substituting this one:

"If during any monthly period the total charges at prices set forth in this rate are in execess of the charge per kilowatt of maximum demand hereinafter specified, then such excess consumption shall be computed at the rate of 0.8 cent per kilowatt-hour. The demands at which such excess shall begin to be computed are as follows: For maximum demand up to and including 100 kw., $5.50 per kilowatt; for maximum demand in excess of 100 kw., $5 per kilowatt. Provided that in no case shall the charge at which such demand begins to be computed for customers with maximum demands in excess of 100 kw. be less than $550 per month, and provided further that in no event shall this clause operate to reduce the minimum charge."

THE ABOLISHMENT OF THE COMPLAINT DEPARTMENT

Northwest Company Substitutes Therefor Service Department with Better Psychological Effect as Regards Relations with Customers

The Northwestern Electric Company of Portland Ore., has abolished the old complaint department. Instead there is a service department which investigates and reports to the management all mistakes or discrepancies in meter reading, billing or repair work which are referred to it by customers or unearthed by the department itself.



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NORTHWESTERN ELECTRIC CO.

LIGHT · POWER · HEAT

SERVICE DEPARTMENT MONTHLY REPORT

INSPECTOR ______ MONTH OF ______ 191__

ERROR IN BILLING	ERROR IN READING	ERROR IN RATES	ERROR IN METER	NO ERROR	MISCELLANEOUS

TOTAL REQUESTS BROUGHT FORWARD ______

TOTAL REQUESTS RECEIVED DURING MONTH ______

TOTAL REQUESTS INVESTIGATED DURING MONTH ______

TOTAL REQUESTS TO BE CARRIED FORWARD ______

GIVE DETAILS OF REQUESTS HELD TEN DAYS OR MORE NOT SATISFACTORILY SETTLED:

RECORD OF "REQUESTS" SUPERSEDES RECORD OF "COMPLAINTS"

The psychology of a complaint department was wrong, asserts George B. Bowen, sales manager for the Northwestern, and to prove it he cites the changed attitude of the customer who deals with the service department. The service department classifies all errors and once a month makes a report on the form here shown so that the number of errors of each kind may be seen at a glance. Thus errors that are frequently repeated or that are increasing month by month are traced and corrected.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

The Homopolar Generator.—ROBERT V. MORSE.—In this article is described the Morse homopolar generator designed with the idea of reducing the bulk of such machines. The construction of armature and brushes permits an ample number of series connections to be arranged compactly around the armature in place of the large number of slip rings placed side by side in the old construction. The size of the Morse machine is not dependent on the number of armature circuits in series as was the old type. Combined with this brush arrangement is the utilization of both homopolar fields of the central magnetic circuit, resulting in a still further shortening of the machine and a more effective use of the flux.—*Sibley Journal*, October, 1918.

Faults in Generators and Motors.—This is the second installment of the series entitled "The Electrical Study Course." It concludes the discussion of open circuits in armatures and proceeds to the subject of short-circuits, treating of the symptoms of their detection, the tests required to determine their exact location and the remedies to be applied.—*Power*, Nov. 12, 1918.

Commutation Voltage of Single-Phase Motors.—R. MOSER.—The calculation of the transformer and rotation voltages induced in the coils under commutation of single-phase motors is rather complicated even for the case of the motor with a single pair of brushes and even if the field is assumed to have the simple form of a trapezium; *i.e.*, if the influence of the slotting of the armature and the effect of saturation are neglected. The calculations are still more complicated in machines like the Deri motor with double brushes. It is now shown that both the above-mentioned induced voltages for the motor with double brushes may be easily deduced from formulas for the case of the motor with a single pair of brushes. As the formulas are not easily found in textbooks, they are given in the article, and from them expressions are deduced that apply to the Deri repulsion motor.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Elektrot. u. Maschinenbau*, April 14 and April 21, 1918.)

Surges in Transformer Windings.—K. W. WAGNER.—In previous articles the author has considered the transformer coil as being made up of a series of reactances with capacities in parallel with each and capacities to earth situated at the ends of each reactance, the mutual inductance between the adjacent sections being neglected. The mutual inductance was allowed for by O. Bohm. The author now points out certain mathematical errors in a former paper, which he corrects. A special section is included concerning the calculation of resonance frequencies. A number of new formulas are derived by which the production of surges in coils can be calculated more exactly than by previous methods.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Archiv. f. Elektrot.*, 6, 1918.)

Behavior of Three-Phase Transformers on Unbalanced Load.—R. BAUCH.—The article discusses the behavior of core-type three-phase transformers in star-star connection in the event of load being put on one phase or one limb. Such loads are liable to occur in three-phase, four-wire systems, or if one coil of a transformer becomes short-circuited by a surge, or if one line becomes earthed and the star point is normally earthed. The occurrence of such loading is shown to produce a leakage field that is not present in ordinary working, with consequential shifting of the neutral point of the transformer.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Elekt. Zeits.*, June 20 and June 27, 1918.)

Generation, Transmission and Distribution

Stream Regulation in Quebec Province.—OLIVER LEFEBVRE.—Partial regulation of the flow of the St. Francis River by the storage of water in Lakes St. Francis and Aylmer has been completed. By this means the increased water-power development on the river has been estimated at 7450 hp. The hydraulic statistics of the river are given in considerable detail.—*Canadian Engineer*, Nov. 7, 1918.

Details of Line Construction, Guying and Anchors.—CHARLES R. HARTE.—The forces acting on pole lines are briefly pointed out. Tables are presented showing the size and depth of deadmen for use in guying lines. Many ingenious kinds of anchors and guying attachments are shown in considerable detail.—*Electric Railway Journal*, Nov. 16, 1918.

Maintenance of a Proper Heat Balance.—R. N. EHRHART.—The article describes hand and automatic control of exhaust steam from auxiliaries so that the quantity of exhaust steam available for feed-water heating may at all times be proportional to the load on the main units, thus preventing waste of exhaust steam at light loads.—*Power*, Nov. 12, 1918.

Industrial Coal Economy.—D. WILSON.—The writer bases this paper on the results of the general survey made for the coal controller, having traveled all over the world in connection with the scientific combustion of coal. He says: (1) that the efficiency information in most cases is inaccurate and it appears that many firms simply ask the boiler contractors or insurance companies what number they should multiply the coal tonnage by to get the evaporation figure; (2) that close coöperation between engineers and managers and the men who actually fire the coal is desirable; (3) that much good can be done with simple and obtainable apparatus (relatively few works possess even the pyrometer, draft gages, etc., necessary for intelligently controlling efficiency); (4) that arrangements should be made for more accurately determining the actual steam consumption of the individual plants; (5) while the highest thermal efficiency is obtained from burning the highest quality of coal, the commercial economic results may be in favor of the low-grade fuel at works where it can be obtained at a low price; (6) there is a considerable quantity of anthracite rubbly culm available for those who can use it. Anthracite fuel has a high calorific value, but it requires more draft to burn it, and a big allocation can only be made to firms which have ample boiler margin or special furnaces fitted with forced draft. Probably many firms could take a small percentage of this fuel to mix with the more bituminous fuel irrespective of the boiler margin or type of furnace.—London *Electrician*, Oct. 25, 1918.

Calculation of Single-Phase and Three-Phase Lines. —J. R. DICK.—In this installment the writer extends the theory developed for single-phase transmission to the case of the three-phase cable. A comparison is made between the copper required for single-phase and three-phase lines. In the determination of voltage drop in the three-phase cable an approximation to the working current is attained. Numerical examples are given amplifying the theory.—London *Electrician*, Sept. 27, 1918.

Establishment and Exploitation of Condensing Apparatus.—CHARLES OETTINGER.—In central stations, the author holds, the condensing apparatus sometimes receives insufficient attention either as regards its original method of installation or as regards its operation. Hence, especially where steam turbines are in use, losses result which may be considerable. In this article the author deals with the proper establishment of the condensing apparatus, leaving its operation for a second installment.—*Revue Générale de l'Electricité*, Oct. 26, 1918.

Overloads in a Three-Phase Network.—E. PIERNET.—A discussion of the means by which the bad effects of an overload thrown on a three-phase network without the possibility of effecting modifications in the line carrying it or in the step-up and step-down transformers can be remedied. These suggested remedies are, however, the author says, merely expedients to be used in absolute necessity. The real solution lies in improving the power factor.—*Revue Générale de l'Electricité*, Oct. 12, 1918.

Installations, Systems and Appliances

Home-Made Water-Softening Plant.—H. D. ODELL.—It was determined that the character of the boiler-feed water required softening, so a home-made water-softening system was installed. The results, though at first unsatisfactory, owing to improper use of chemicals, were made satisfactory when a chemist was employed to formulate proper control. Data are given on the design of the system and the cost of softening water per 1000 gal. treated.—*Power*, Nov. 19, 1918.

Electric Rolling-Mill Plant.—For the speed regulation of large three-phase motors, such as are used in collieries, rolling mills, steel works, etc., several methods are briefly described. Particular attention, however, is given to a method which, it is stated, satisfies all the conditions met with in general practice by connecting two induction motors in cascade. This arrangement has the very considerable advantage that it eliminates all commutators since the auxiliary motor is of the squirrel-cage type and therefore the simplest and most reliable electrical machine which has ever been designed. The slip energy of the auxiliary motor is utilized since it is mechanically coupled with the main motor. The arrangement, however, only permits of a step-wise speed regulation, the steps corresponding with the synchronous speed of individual motors and the speed resulting from the fact that they are connected in cascade. An equipment of this type has been developed by the Atelier de Construction Oerlikon, which has introduced the combination of cascade coupling with an arrangement for varying the number of poles of both the induction motors by means of pole change-over switches, and has obtained some very satisfactory results. Data have been collected from the operation of a large plant working on this system in which speed control and efficiency are considered at length.—London *Engineer*, Oct. 11, 1918.

Methods for Determining Resistance Used for Starting Various Types of Motors.—B. W. JONES.—A simple method is given for determining the ohmic value of the resistance used for starting series, shunt and compound-wound direct-current motors and wound-rotor induction motors under various load conditions.—*Power*, Nov. 19, 1918.

Electrophysics and Magnetism

Analysis of Periodic Curves.—H. WEISS.—This article gives a detailed comparison of the methods of curve analysis of L. Hermann and S. P. Thompson. It appears that the two methods are essentially only two different methods of carrying out the same mathematical process, and the question as to which method is the more practical depends on the particular curve to be analyzed.—*Science Abstracts, Section A*, September 1918. (Abstracted from *Soc. Int. Elect. Bull. 8*, June 1918.)

Apparatus for Facilitating the Interpretation of Oscillograms Obtained with the Braun Tube.—G. C. TRABACCHI.—The difficulty of obtaining a photographic registration by means of a rotating mirror is discussed. A photograph of the new apparatus is given, and the working of it is described in detail. There is also a sketch showing the diagram of the primary current used with an X-ray (Corbino-Trabacchi model for direct current) apparatus, combined orthogonally with a suitably chosen sinusoidal current, and, on the right, the transformed tracing obtained with the apparatus described, in which the abscissas are proportional to the time.—*Science Abstracts, Section B*, September, 1918. (Abstract from *N. Cimento*, January-February, 1918.)

Electrochemistry and Batteries

The Ferro-Alloys.—J. W. RICHARDS.—It is quite commonly known that the addition of certain metals to steel greatly improves its qualities for special purposes. The customary method of adding these metals to the steel is in the form of an alloy of the metal with iron, these ferro-alloys being now made almost exclusively in the electric furnace. This article describes the composition of each of these alloys, the method of manufacture and the properties imparted to the steel by the addition of each of the molten metals.—*General Electric Review*, November, 1918.

Electrodes for Electric Furnaces, Part 2.—JEAN ESCARD.—This installment of the series considers the form, dimensions, grouping and composition of the electrodes and their arrangement in the various types of furnaces, the life, wear and protection of electrodes and electrode holders, cooling systems and methods of attaching the connections. The article is concluded with a short description of some of the less common forms of electrodes, such as the tubular electrode and the hearth electrodes.—*General Electric Review*, *November*, 1918.

Electric Furnaces for the Production of Steel and Ferro-Alloys.—J. A. Seede.—The writer briefly reviews the fundamentals of high-grade steel manufacture and gives a number of sound reasons to account for the superiority of the electric steel furnace over all other types. The article is concluded with descriptions and sketches of some modern designs of electric furnaces, and numerous wiring diagrams are included, showing the electrical connections in common use—*General Electric Review*, November, 1918.

Origin of the Line Spectrum Emitted by Iron Vapor at High Temperature.—G. A. Hemsalech.—The results obtained with thermo-chemical excitation, both in flame and furnace, have revealed a gradual progression in the development of the iron spectrum as the temperature rises, and between the limits of 1500 deg. and 2700 deg. C. it should be possible, wherever this mode of excitation exists, to determine the state of temperature from the degree of development of its spectrum. But whether one would be justified in deriving the state of temperature in an electrical source by extrapolating the values found for flames is not yet certain. —*Philosophical Magazine*, October, 1918.

Units, Measurements and Instruments

Boiler and Furnace Testing.—Rufus T. Strohm.—The author points out the necessity for testing steam boilers and gives in a simple manner a brief description of methods of measuring the various quantities involved. Analysis of the results is also indicated.—*Bulletin No. 1, United States Fuel Administration.*

Telegraphy, Telephony and Signals

Radio-Frequency Changers.—E. E. Bucher.—The author describes a frequency-multiplying transformer and points out its advantages over the radio-frequency alternators of either the Alexanderson or the Goldschmidt type. This frequency-multiplying transformer consists of a transformer with ordinary primary and secondary windings, but with an added coil excited from direct current to such an extent that the core will be normally saturated when this direct-current circuit is closed. The exciting current in the primary will change the magnetism considerably only when in opposition to the magnetic effect of the direct-current circuit. A double-frequency current is thus induced in the secondary. By the use of several of these transformers the frequency may be increased many times.—*Wireless Age*, November, 1918.

Leeds Automatic Exchange.—The largest of the Automatic Exchanges so far installed by the British Post Office was successfully brought into service on May 18, when the transfer to automatic working of the subscribers on the Leeds Central Exchange was effected. After two months of service general satisfaction is expressed over the rapid settling of the plans to a business and efficient basis.—*Post Office Electrical Engineers' Journal*, October, 1918.

Marconi's Improved Radio Transmitter.—The apparatus developed by G. Marconi for the production of continuous oscillations by overlapping wave trains has proved most effective for long-distance communication at high power. It has done away with many of the intricate mechanical and electrical problems encountered in the construction of radio-frequency alternators or arc transmitter systems. Moreover, it makes an apparatus capable of generating damped oscillations at any spark frequency desired.—*Wireless Age*, November, 1918.

Miscellaneous

Phenomena of Water Hammer.—Maurice Gariel.—In a concluding article upon this subject the author puts in mathematical and graphical form his determination of the maxima of pressure from above or below upon a conduit when a floodgate or a hydraulic turbine gate is opened. He believes that his formulas will be of great assistance in the case of hydroelectric installations where the turbines are furnished with dischargers or deflectors and where in consequence water hammer becomes an important consideration.—*Revue Générale de l'Electricité*, Oct. 5, 1918.

Commonwealth Edison Company's Plan for Recruiting Engineers.—W. L. Abbott.—A brief description is given of the method used by the Commonwealth Edison Company of Chicago for keeping the young engineering recruits under observation and for properly directing their energies with the idea of developing them for use in the company's system. According to this plan, the engineering student spends his summer vacations with the company, giving part time to the training school and part time at the actual work, receiving some compensation during this period.—Paper read before Society for the Promotion of Engineering Education, October, 1918.

Electrically Operated Railway Bridge.—Details are given of a railway bridge over the Trent River at Keadby on the Great Central Railway, which was opened in May, 1916. The bridge is described as a combined railway and highway Scherzer rolling-lift bridge. Its most remarkable feature is the rolling-lift opening span, which weighs over 2900 tons and is the largest in Great Britain, if not in the world.—London *Electrical Times*, Oct. 24, 1918.

What the War Board Is Doing for the Industry.—The Electric Railway War Board, owing to its representative and authoritative character, has been able to establish cordial war-time relations with the governmental departments at Washington and is hopeful of securing federal relief for the electric railways. On behalf of the board P. H. Gadsden recommended the appointment of some kind of a representative body to act for the industry in peace time also.—*Electrical Railway Journal*, Nov. 9, 1918.

Symposium on the Conservation of Tin.—In this paper is a discussion of tin alloys such as are used for bearing metals, solders, bronzes and substitutes. Considerable data have been compiled by the Bureau of Standards on the use of cadmium as a substitute for tin.—*Chemical and Metallurgical Engineering*, Nov. 1, 1918.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ELECTRIC SHIP PROPULSION AN ENGINEERING ACCOMPLISHMENT

Secretary of the Navy in His Annual Report Speaks in Highest Terms of the Performance of the U. S. S. New Mexico

In the annual report of the Secretary of the Navy, made public in Washington this week, it is announced that "the most striking engineering accomplishment during the year was the completion of the electrically propelled battleship New Mexico."

The result of the trials of this battleship, Secretary Daniels says, confirms the judgment of the department in adopting this type of machinery for the battle cruisers and marks an engineering advance which will affect battleship construction the world over. Electric propulsion had its inception in the navy, having first been applied in the collier Jupiter, where its superior advantages were so clearly demonstrated that the Bureau of Steam Engineering recommended it for adoption in the New Mexico and subsequent battleships, and still later in the higher-powered battle cruisers.

"It will be recalled that this decision of the department led to the bitterest criticism, not only from engineers pecuniarily interested in other types of machinery, but also from others eminent in their profession who had no pecuniary interest, but who feared that we were embarking upon an experiment that would be fraught with national calamity. Despite the criticism of these eminent engineers, the decision of the Navy Department, supported by the judgment of the best electrical engineers in the country, was followed in the full conviction that no mistake was being made.

"The wisdom of this decision has been amply vindicated by the performance of the New Mexico, which has been tested in every way, her trials including many more than those specified in the contract. She has failed in none of them; the operation of her machinery has been highly satisfactory in every respect, and today, in this unique vessel, the United States Navy has a battleship which has no peer in the world's navies, not only for economic propulsion and less liability to serious derangement, but for her military superiority in greater maneuvering power and increased underwater protection.

"As so often before, American ingenuity and inventive skill now lead the world in the propelling machinery of battleships. To the vision and the wisdom of Rear Admiral Griffin, chief of the Bureau of Steam Engineering, and his able assistants, who gave approval to this new method of propulsion, the idea first fully tried in the Jupiter upon plans of W. L. R. Emmet, a Naval Academy graduate and member of the Naval Consulting Board, the world owes this successful revolution in the propulsion of the biggest fighting ships."

SAN FRANCISCO'S MUNICIPAL HYDROELECTRIC PROJECT

One Million of Hetch Hetchy Bonds Sold and Effort Will Be Made to Complete Work as Far as Moccasin Creek Power Plant

On Dec. 9 San Francisco closed the sale of $1,000,000 of Hetch Hetchy bonds to the Anglo and London-Paris National Bank. The purchaser also took an eight-month option on the remaining $8,000,000 of 4½ per cent bonds now authorized for sale. The transaction was at par with accrued interest, and the bonds run serially and begin to mature July 1, 1920.

The $1,000,000 to be immediately available will provide funds for the prosecution of the work at full speed and will cover construction costs during the next six or eight months. The $8,000,000 would cover the construction of the dam and the first section of the aqueduct.

An effort will be made to complete the work as far as the Moccasin Creek power development as soon as possible so that the 66,000 hp. to be generated there will be available for the city's use.

RESOLUTIONS AFFECTING UTILITIES

At the Reconstruction Conference of War Service Committees held in Atlantic City, N. J., last week the following resolutions dealing with public utilities and water power were adopted:

PUBLIC UTILITIES

Public utilities have faced different problems, which have been accentuated by conditions arising out of war. The development and efficiency of such a utility as local transportation has immediate importance for every community. It is recommended that the Chamber of Commerce of the United States should appoint a committee to investigate and study the question of local transportation as it relates to the control of rates and service, franchises, taxes, the attraction of capital into the business and such other questions as the committee may find pertinent. Such a committee should report its recommendations to the board of directors of the national chamber, and the board should deal with them in accordance with the established procedure.

WATER POWERS

Industrial activity is dependent upon the available supply of power. A bill which would affect the development of hydroelectric power upon waterways and lands which are subject to federal jurisdiction is now before a committee of conference between the two houses of Congress. It is important in the public interest that federal legislation on this subject should be enacted without further delay. We accordingly urge that the conference committee arrive at an acceptable form of legislation in season for enactment at this session of Congress.

ELECTRICAL SUPPLY JOBBERS DISCUSS GENERAL BUSINESS

Manufacturers Also Participate in Considering Reports of War Service Committees and General Good of Industry

With representatives of manufacturers, central stations and contractors and dealers in attendance, the Electrical Supply Jobbers' Association introduced successfully the policy of open meetings at its convention in the Statler Hotel, Cleveland, on Monday, Tuesday and Wednesday of this week.

Chairman Franklin Overbagh, in welcoming the representatives of other branches of the industry, said that the innovation had been begun following suggestions from various sources and emphasized its particular importance at a time when many problems are faced. As part of the meeting was given to consideration of the work of the war service committee of the electrical jobbing industry, the jobbers, who, though not members of the association, were interested in the activities of that committee, were also asked to be present.

W. E. Robertson of Buffalo, N. Y., as chairman, reviewed the war service committee work. When the committee appeared before Judge E. B. Parker of the Priorities Division of the War Industries Board it had proxies from eighty-seven jobbers in addition to those of the association members. It had anticipated that it would be asked whether it represented the entire industry. It was anxious to be relieved of the necessity of making detailed monthly reports by the tenth of the month and to be allowed to adopt pledges of compliance with the board's program.

War Service of Jobbers

Taking the position that the jobbers were as much interested in winning the war in as short a time as possible as any other group of citizens, the committee, said Mr. Robertson, showed the value of the service which it renders, a service to the industry and to the government itself which no single manufacturer or all manufacturers combined could render. For instance, one jobber in Chicago received an order from the Quartermaster's Department amounting to $780 and consisting of 110 items made by 63 manufacturers. The goods were delivered out of stock. Another order from the Aviation Section called for goods made in Washington State, Indiana, Pittsburgh, Pennsylvania, Virginia and the Carolinas and other miscellaneous items. It was for rush work, the goods were delivered the following morning, and the work went on.

Showing how the claims of the jobbers for priority recognition, the use of the pledge form and responsibility for policing the industry were accepted, together with the request for maintenance and replacement of stocks, Mr. Robertson touched on the importance of the jobbing industry. It has stocks of $40,000,000, he said, and is doing an annual business of over $300,000,000.

F. B. Eaves of the Bryant Electric Company, who was in the organization of Walter Robbins, chief of the Electrical and Power Equipment Section of the War Industries Board, said that many war service committees which were designed to serve between the government and their industries failed to secure recognition. He said that 218 actual jobbers' certificates were issued and mentioned the work done by representatives of other electrical manufacturing companies who served in the organization of the board.

E. Donald Tolles presented a resolution which was passed, expressing recognition by the war service committee with gratitude of the coöperation and assistance rendered by the electrical manufacturers' war service committee, further stating in the preamble that particular and singular aid was rendered by Clarence L. Collens, 2d, of the Reliance Electric & Engineering Company of Cleveland, in his capacity as chairman of one of the divisions of the manufacturers' committee and recording appreciation of the patient, thorough and highly unselfish aid rendered to the electrical jobbing industry by Mr. Collens.

F. M. Bernardin, temporary chairman of the war service committee during the United States Chamber of Commerce convention at Atlantic City last week, reported on the three groups of that convention which specially affected the jobbing industry—iron and steel, wholesale and retail distribution, and public utilities.

Effectiveness of Manufacturers' Organization

Clarence L. Collens, 2d, who talked at the afternoon session Monday, said that the results accomplished in the last year show the effectiveness of organization. He spoke of the rearrangement of steam-turbine manufacturing schedules to meet War Department transport needs and of the rapidity with which arrangements were made to manufacture a self-contained submersible pump of special design. He mentioned the rigid development of priority regulations and added that all could breathe a sigh of relief that they are no longer necessary. In outlining the achievements of the period Mr. Collens referred to the knitting together of all branches of the industry for coöperative effort. The war, he said, has democratized industry. Each war service committee absolutely represented every unit or showed that it had given that unit opportunity to coöperate in the work. Moreover, the practicability and desirability of a working coöperative arrangement between the government and business has been proved. In the past the government felt that no two competitors could get together on anything without plotting something against the public interest. The work done by the war service committees has been exceedingly helpful in removing that opinion. Mr. Collens said that the electrical industry is exceedingly fortunate in that Walter Robbins has been asked by Secretary of Commerce Redfield to act as one of his personal advisers in future relations between the industry and the Department of Commerce.

The new world, Mr. Collens declared, is purged to a large extent of motives of self-interest, avarice and greed, and manufacturers ought to do everything they can to promote coöperative business associations under proper government control. The war is practically over, he said, but coöperative action between competitors under the proper government control, especially as it was developed in the last year under the War Industry Board, has just begun.

A symposium on business conditions and the outlook, in which many members participated, occupied a large part of the afternoon session. W. E. Robertson of Buffalo, who spoke optimistically, said that the first new business would be from central stations extending lines to dispose of energy not needed for munitions manufacture and from development of the household appliance business.

John J. Gibson, manager supply department Westinghouse Electric & Manufacturing Company, made an address on Tuesday morning on price differentiation on a basis of quantity and service. Much discussion followed which served to bring out the importance of warehouse and other jobbers' service as a factor in price.

Dangers of Goodwin Plan

In his address on inherent dangers of the Goodwin plan from a jobbing standpoint, W. E. Robertson gave the following as his definition of the plan: The Goodwin plan, he said, is the result of a belief on the part of W. L. Goodwin that in recognizing the service rendered by the jobber and contractor as essential and economical channels of distribution in bringing the products of the electrical manufacturer to the user, it follows that proper coöperative steps should be taken to insure to the jobber and contractor fair and certain compensation for the service rendered, and that through the elimination of duplication in effort and waste in method this result can be obtained without raising the price to the user or limiting the opportunity of the manufacturer in supplying an existing demand or creating a larger or new demand.

Although indorsing the educational features of the Goodwin movement, Mr. Robertson said that the strongest supporters of the entire plan are the electrical contractors, who suffer most from the evils complained of and see in it a chance not only to profit by the elimination of these evils particularly applicable to their business of contracting but also to gain the profit to be derived from suddenly acquiring a large volume of profitable business in the field of merchandising without having earned it.

Other obstacles are the danger of infraction of the laws and the danger that the strike or the boycott would be invoked against any manufacturer or jobber who refused to follow the plan or who sold other than through the agreed channels, as, for instance, to industrial plants. There is also the danger, he said, that the almost certain annual increase in business due to the steady progress of the industry would be jeopardized by disturbance of the channels of distribution.

Mr. Robertson emphasized that he felt that it would be to the advantage of jobbers to coöperate in the continued effort to establish contractor-dealers who would sell to domestic consumers, and he thought that this advantage warranted the expenditure of a reasonable amount of time and money.

At the Tuesday afternoon's session a paper by T. I. Jones, general sales agent of the Brooklyn Edison company, was read by M. S. Seelman, Jr. E. W. Rockafellow called attention to this as the first time in the history of the jobbers' association that an address had been made before it by a representative of the central-station industry.

The paper described the policy and methods of the Brooklyn company. It expressed the opinion that sale of appliances on a proper merchandising basis with a fair profit according to local conditions is the only course that can be adopted to produce the greatest sale of energy, the greatest number of houses wired and the greatest development in the industry.

In the discussion it was suggested that special sales, if conducted, should be held in off-seasons, following the practice of the department stores in holding fur sales, for instance, in summer, not in winter.

W. L. Goodwin made an extended talk favoring his plan. He laid stress upon the importance of coöperation between all branches of the industry and upon the possibilities for development of the contractor-dealer. He said that there are 200,000 contractor-dealers, who can become successful factors in merchandising.

On Tuesday evening a peace celebration dinner was held at the Hotel Hollenden.

Publicity Plans

A. M. Little, chairman publicity committee, presented its report on Wednesday morning. He outlined the plan of publicity which it is proposed to follow in 1919 to make clear the economic essential character of the jobbing industry. The association authorized the expenditure of not to exceed $12,000.

Mr. Little explained in some detail the plans of the committee, and they were discussed fully and indorsed by the association. It is desired to make plain to all elements of the industry the exact function of the association and the jobbers' service rendered by its members. The campaign plan will point out the extent of the business and stocks of the jobbers, the thoroughness with which the entire consuming field in the United States is covered, the diversity of supplies furnished without delay, the value of the jobbers' service in creating new business, and, in fact, the whole economic commercial advantage arising from the established position of the jobbing industry.

H. F. Thomas, chairman, presented the report of the uniform accounting committee. The report was approved, and it was recommended that members install the system on Jan. 1, 1919, or at the end of the fiscal year. So far as was practicable the system follows that of the electrical manufacturers, which was approved by the Federal Trade Commission.

E. W. Rockafellow, chairman of the rubber-covered wire committee, called attention to the presence of J. N. Shreve of the Electric Cable Company. Considerable discussion, in which Mr. Shreve and a number of members participated, took place on wire. In the interest of conservation and the reduction of stocks it was recommended that the manufacture of double-braid and duplex wire be discontinued in sizes Nos. 8, 10, 12 and 14 and that No. 15 be not put on the market. This resolution will be brought to the attention of the wire and cable war service group committee, which has been developing a conservation program under direction of the War Industries Board.

The association will carry on work for the reduction of unnecessary stocks as conducted through its war service committee and to promote conservation through elimination of unnecessary types.

Engineering Educators Convene at Boston

Welcome to British Educational Mission and Discussion of the Lessons of the War for Technical Instructors Features of Meeting—Broader Training for Engineers and Necessity for Greater Thoroughness in Professional Preparation Urged

WITH the members of the British educational mission to the United States as guests and the problems of war and reconstruction periods at the forefront of discussion, the Society for the Promotion of Engineering Education held its twenty-fifth anniversary convention at Boston on Dec. 6 and 7. The occasion was one of the most enjoyable in the history of the society. The victorious conclusion of the war and prospects of an early strengthening of relations between educational institutions in the United States and Great Britain were dominant notes in the proceedings, and the sessions were marked by a new appreciation of the importance of broadening and deepening the training of the engineer. The desirability of capitalizing some of the benefits of military discipline for permanent use in character building by undergraduate students was generally recognized. A special session devoted to research prospects united the members and delegates in asking that federal support be given to a comprehensive and constructive program certain to aid the United States in maintaining its new place in world leadership and to facilitate its economic progress.

INTERNATIONAL AMENITIES

At the opening session, held at the Massachusetts Institute of Technology, Cambridge, President John F. Hayford of the society and President Richard C. Maclaurin of the institute welcomed the British educational mission and other delegates. The society has grown since 1893 from a membership of 150 to 1500, representing over 200 educational institutions and including thirty-two members from Canada, seven from Australia, four from India and two from England. Its problems have always been viewed broadly, seeking the professional outlook and offering expert knowledge to the world in preference to the skill characterizing trade instruction and competence. Responding, Dr. Arthur E. Shipley, F.R.S., vice-chancellor of the University of Cambridge, England, expressed the pleasure of the British mission in attending the convention and sketched briefly the changes wrought by the war upon English schools. At Cambridge all members of the engineering school went away and the buildings were temporarily utilized for war purposes. The losses of young men at the front are scarcely realized on this side of the Atlantic. The English schools contributed with might and main to the technical side of the war as well as to combat activities. These institutions are now endeavoring to perform the service of special short courses to men in khaki, and because of their proximity to the continent they are in an excellent position to be of real use. Men in the service taking such courses can be returned to the military zone in from twenty-four to forty-eight hours. Closing, Dr. Shipley said that getting to understand one another internationally means far more than a league of nations and expressed his opinion that the ties of friendship now existing between the United States and Great Britain will be perpetual.

Addresses were also made by the Rev. Edward Mewburn Walker of the University of Oxford, Sir Henry Miers, F. R. S., vice-chancellor of the University of Manchester, and Dr. John Joly of Trinity College, University of Dublin.

International friendship and the solidarity of educational interests between Great Britain and the United States were voiced at a dinner given in honor of the British mission on Dec. 6 at the Hotel Brunswick, when addresses were made by President Hayford, Dr. William T. Sedgwick of the Massachusetts Institute of Technology, Sir Henry Miers, Dr. Joly, President Matheson of the Georgia Institute of Technology, and Dr. A. E. Kennelly of Harvard University.

WAR'S EFFECT ON ENGINEERING EDUCATION

At the session on Dec. 7 the opening address was upon "The Effect of the War upon Engineering Education in the United States," by C. R. Mann, Massachusetts Institute of Technology. Dr. Mann believed that the Students' Army Training Corps experiment lasted too short a time for the deduction of lessons from its work and stated that the war has as yet had little or no effect upon engineering education, although it has disorganized thinking and schools alike. The colleges and universities have done their utmost to meet the demands of the government, even when such demands were very irksome. Thus, the universities were asked to prepare a large number of men to be mechanics, and the work was handled with a will. The training of civilians to become soldiers was a problem of less difficulty than the production of sufficient men to handle the problems of supply. The selective service law accomplished remarkable results, but there was serious delay in the provision of ships, clothing, guns and ammunition. A satisfactory schedule of national preparedness must include at least a potential organization to meet the industrial needs of the country in time of war. To prepare men for work as engineers in meeting these industrial problems under war conditions it is necessary to anticipate requirements. Accurate definitions of the work to be accomplished are necessary, with intensive training toward the specific end and the introduction of military organization and discipline. The highest value of military training is the discipline it imposes upon the individual, resulting in improved coördination, "attack" upon the task ahead and obedience to duty. Humanistic studies are essential for both technical and trade education. Dr. Mann said that the war issues course is well worth developing for wider application than was originally planned. The national needs are no less pressing now than they were a few months ago. The public is ready to expend large sums of money for education if its results and value can be demonstrated. In closing, Dr. Mann referred appreciatively to the work done by the army authorities in making intelligence tests of soldiers and to the coöperative publication of reconstruction material taken in hand by the World Peace Foundation and American Society for Historical Research.

Training Engineers for the Army

Maj.-Gen. William M. Black, chief of engineers, United States Army, outlined the duties of the military engineer in active war service and under peace conditions. In war military engineers are classified as combat and non-combatant engineers. Both classes are equally essential, but in combat troops officers and "non-coms" are selected primarily from the military viewpoint. Non-combatant engineers are selected on the basis of their work in civil life, their rank corresponding in a general way to their grade in business or profession. These men are largely concerned with the "S.O.S," or Service of Supply. The combat engineers, as their class implies, are liable to be under fire frequently, and their duties may extend from the most advanced positions to the bases.

The engineering profession responded most patriotically to the country's call, General Black stated with appreciation. Many specialists offered their personal services for work in their own fields, but it was necessary to explain that valuable as expert knowledge and ability are in warfare, the highest degree of all-around ability in engineering is demanded for combat service. Maximum versatility and not one-sided specialization is required. The tasks which must be done include, for example, the organization of a line for defense, involving the consolidation of trenches, construction of communication trenches, proper drainage, sanitation, communication, etc.; the clearing and placing of obstacles (not a good life-insurance risk), the securing of the maximum effect from a minimum quantity of explosive; the provision and maintenance of road and railway facilities immediately after a rush forward, including building of new lines, reconstruction and reorganization work, with traffic regulation. In many parts of France the only road-building material available in the war zone was obtained from demolished buildings. Mining operations combine both the civil risk and the military risk; the operation of lighting and power plants, construction and installation of machinery and lines, with fireproofing and shell-proofing work, all fall upon the engineer's shoulders, besides water supply, sewerage, local illumination and other problems.

A working knowledge of the general principles of an engineering practice in all branches is essential for the army engineer, the speaker said. In peace times civil works provide valuable professional practice. Such works in the experience of a typical army engineer covered the construction of locks and dams on the Ohio River, river regulation, improvement of a bar along the coast, sea wall and groins for coast protection, harbor development and improvement, with pile driving, hydraulic dredging, etc.; the sanitation of a large city after 500 years' of neglect; lighthouse construction, water and sewerage systems, fortification work, water-power development, wharf construction, canal design and construction, and acting in an advisory capacity to the government with respect to possible encroachments upon navigation facilities.

In a brief discussion of General Black's address, Prof. J. C. Olson of Rensselaer Polytechnic Institute, Troy, N. Y., contended that the use of the military method in education does not encourage originality or inventive faculties, and maintained that engineering education should not lose sight of the importance of producing technical specialists. The speaker deprecated the production of engineers with too much all-around training. Prof. M. I. Pupin, Columbia University, New York, said that he had found a West Point graduate far ahead of others in usefulness in certain research work, and he felt that military discipline was of great value and that American universities are deficient in the matter of disciplinary emphasis. A born inventor, said Professor Pupin, will work along the lines nature intended, regardless of obstacles. The speaker strenuously objected to the training of specialists inside the walls of the engineering school. Fundamentals are the important thing. President Matheson of Georgia "Tech" referred to the intensive application resulting from the war motive in aviation students and said that the lessons of heroism and self-sacrifice should not be lost now that the war is over. F. L. Bishop, University of Pennsylvania, and C. R. Dooley, Pittsburgh, Pa., also spoke upon the value of discipline, the former favoring specialization after receiving a general training.

Now Is the Time to Encourage and Support Research

That the time has arrived to urge federal support of research and to plan for its development along comprehensive lines was the unanimous opinion of a session devoted to this subject, at which President Maclaurin occupied the chair. In opening the discussion, Dr. Maclaurin emphasized the importance of bringing the matter before Congress with a united front and said that the country should now make adequate provision for science in all its branches, aiming at a great federal organization comparable to present government departments. Such a policy is absolutely necessary to the progress of the nation. He then described the main features of the Smith-Howard bill, now before Congress, under which $15,000 per year and ultimately $30,000 would be appropriated for research in each state and distributed through the state legislatures.

For the National Research Council, Professor Pupin suggested that the Smith-Howard bill might well be amended to provide for the distribution of the federal aid through a committee of five scientific men in each state, to be appointed by the governor or legislature. There should be a general federal agency to keep track of the work as a whole, with adequate records, etc., but without detail control. The Bureau of Standards is fitted to do this, but it is doubtful whether it would be wise to grant any single government bureau so much power in excess of that possessed by other bureaus. President W. M. Riggs of Clemson College, South Carolina, favored the Smith-Howard bill. A long discussion followed, leading finally to a unanimous resolution in favor of federal aid for research with the widest possible measure of coöperation, and this action was indorsed at the main meeting. Prof. W. S. Franklin, Massachusetts Institute of Technology, contended that the time is ripe for establishing such conditions that a young man desiring to make research his life work might be trained for such professional service. It was pointed out by other speakers that an appropriation of $1,500,000 per year for research in a country like the United States is far too small for the opportunities waiting to be utilized. Various other national organizations are considering this matter, and early action by Congress is to be sought. During the discussion it was pointed out that there are certainly six institutions in this country which should be granted at least $100,000 a year each for research, in proportion to their facilities and staffs. President W. O. Thompson of Ohio State University urged the importance of encouraging state aid to research as well as federal assistance.

Engineering Educational Problems

At the final session a general discussion took place as to educational methods. The principal points emphasized were the amazing speed and success of military training under the selective service law; that the patriotism of peace must succeed the patriotism of war among students; that theoretical instruction must fall within understandable range of practice, and that inventive adaptability to meet immediate problems is not necessarily antagonistic to military training methods. Among the speakers were Dr. C. R. Mann, Prof. A. L. Williston, Boston; Maj.-Gen. W. M. Black, U. S. A.; President V. C. Alderson, Colorado School of Mines; Prof. J. C. Olson, and Prof. C. F. Scott, Yale University.

PROBLEM OF ELECTRIFICATION OF STEEL-PLATE MILLS

Practical Aspects of Motor Applications Discussed Before Philadelphia Section of the Association of Iron and Steel Electrical Engineers

The Philadelphia Section of the Association of Iron and Steel Electrical Engineers met at the Engineers' Club, Philadelphia, on Dec. 7. D. M. Petty, superintendent of the electrical department, Bethlehem Steel Company, president-elect of the Association of Iron and Steel Electrical Engineers and at present chairman of the Philadelphia Section, was in charge of the meeting, and the principal speaker of the evening was G. E. Stoltz of the general engineering division, Westinghouse Electric & Manufacturing Company, whose topic was "Electrically Driven Plate Mills."

Mr. Stoltz approached the subject from the standpoint of the importance of plate production as a factor in the development of the merchant marine and outlined the problem of the electrification of the plate mill in its practical aspects, which include the selection of the size and type of the motor, of the control and of the flywheel, no one of which can be determined without a proper consideration of the other two.

In his discussion of these phases of plate-mill electrification Mr. Stoltz explained in detail the important differences between the mill equipped with high-speed direct-driven motors and the low-speed-geared equipment, touching on the use of the reversing motor in connection with the Ilgner system of control, the increased cost of the last being shown to be offset, in general, by its simplicity of operation and the time saved in the reduction of the interval between passes. The importance of the flywheel was discussed at length from the standpoint of its value and applications to the characteristically intermittent and variable load of such mills.

A point which is perhaps not always appreciated is the desirability of arranging the control so that the flywheel shall not give up its energy until the motor is fully loaded, and in this connection the usefulness of the notching-in relay and the liquid slip regulator was explained. An analysis of the latter in conjunction with the scheme of magnetic control, based on curves for each system, was used as the basis for the conclusion that the liquid slip regulator is best suited to this type of drive.

In discussing the type of drive, the scheme of placing the flywheel effect in the rotor of the motor itself through the use of large-diameter rotors was pointed out, and the need was emphasized of liberal bearing surfaces where flywheels are mounted on the same shaft with the motor as a preventive against sagging of the motor rotor due to the stresses caused by the heavy flywheel. As an alternative the suggestion was made that the flywheel may well be placed on a shaft separate from that of the motor. The peripheral speeds of the flywheel and the attendant mechanical stresses limit cast-steel wheels for such service to about 12,000 ft. (3650 m.) per minute for peripheral speeds for the usual r.p.m.'s corresponding to a diameter roughly of 24 ft. (7.3 m.), the latter being one of the dimensions quoted. Plate wheels are operated on the order of 25,000 ft. (7600 m.) per minute peripheral speed and may thus be of smaller diameters when operated with even higher r.p.m.'s.

In the selection of the motor, 60 cycles was used as the illustration, and the choice was based on efficiency, power factor, cost and weight. The cost of gearing was shown to be an important factor in the high-speed motor equipment and should be included in such cost figures. Lack of reliable gearing was shown to have been one of the limiting factors in the past in the use of high-speed motors, but the speaker emphasized his belief that with the further development in high-class gears high-speed 60-cycle motors will ultimately be the choice for such equipments. It was pointed out that caution must be exercised in comparing the horsepower required in the motor for such a mill with that of engine drive, as the latter often falls short of the tonnage it is capable of producing.

Increased Tonnage Through Electric Drive

Among the important data cited by Mr. Stoltz was that of the increased tonnage output of motor-driven mills in comparison with engine drive, the tonnage usually being based upon the charged weight rather than the finished weight, owing to the variable item of scrapped material deducted from the former to give the latter. Figures ranging from 18 kw.-hr. to 31 kw.-hr. per ton of charged weight for the main drive of plate mills were given, an approximate average of about 25 kw.-hr. being apparent from the figures submitted. Equivalant kilowatt-hours per ton of charged weight for engine-driven mills ranged from 65 to 171, which makes very evident the saving in energy consumption for the motor drive. The two outstanding advantages which may be claimed for the motor-driven mill are therefore the material economies in power consumed and the increased tonnage per month made possible.

The discussion of Mr. Stoltz's paper was participated in by representatives of the Allen-Wood Iron & Steel Company, Midvale, Sparrows Point, Md., and the Bethlehem Steel Company, emphasis being placed on the importance of employing a sufficiently large motor for such mills and of having an adequate supply of power available from the driving units. R. B. Gerhart outlined experiences with General Electric Company 25-cycle motors and the low interval between the passes in the Sparrows Point plant. The higher power factor with comparatively low-speed 25-cycle motors in comparison with 60-cycle motors operated at the same speed was advanced as a point favorable to the lower frequency and tending to eliminate one of the objections to the 60-cycle equipment at low speeds. Mr. Gerhart gave a figure of 50.4 kw.-hr. per ton of charged weight as the gross power consumption for the auxiliaries in a given plate mill, this, of course, to be added to the power consumption of the main drive in each case.

Other views included practical difficulties sometimes experienced with the notching-in relays and the tendency displayed now and then by the operator to depend on fixed resistance in the rotor circuit even where relays formed part of the equipment. Comment favorable to mounting the flywheel on a shaft separate from that of the motor was made.

Mr. Stoltz in closing the discussion mentioned that the iron and steel industry electrical load represents about 8 per cent of the entire industrial load of the country and called attention to the increasing desirability of tying in several plants electrically and the corresponding advantage often felt in having all equipment 60-cycle. He added emphasis to his former statement that the future prospects strongly lean to the adoption of 60-cycle equipment, and that with a high class of gearing for avoiding some of the gearing difficulties experienced in the past there is no reason why rather high-speed 60-cycle motors should not be generally employed. He cited cases where the notching-in relays were giving good service under actual operating conditions. Of the two advantages of the motor as compared with engine-driven mills, the increased tonnage of the former was advanced as probably being of greater importance than the saving in energy consumption, although the latter, owing to the magnitude of the power used for these mills, is an item which deserves the most careful attention.

Electrical and Power Equipment Section of the War Industries Board

Left to right: Front row—J. H. Waterman; G. N. Peek, Commissioner of Finished Products; B. M. Baruch, chairman War Industries Board; W. Robbins, Chief Electrical and Power Equipment Section; A. W. Shaw, chairman Conservation Division; F. B. Eaves. Center row—F. H. Schubert, M. Greenburg, L. W. Grothaus, J. O. Merwin, W. S. James, T. S. Knight, F. S. Wilholt.

CONSERVATION AND ECONOMY RECONSTRUCTION THEMES

Public Utility Group at Chamber of Commerce Meeting Commends Those Employers Who Re-employ Men Who Had Gone to War

Conservation and development of great national resources, constructive use of capital, conservation of the electric railways in the interests of the public, thrift and economy and the reëmployment of the returned soldiers and sailors were the outstanding features of the series of meetings held by the public utility interests during the reconstruction conference of the United States Chamber of Commerce last week at Atlantic City. The meetings were attended by about sixty leading representatives of the electric lighting, electric railway and gas interests of the United States. Encouragement for the future was expressed by all those present. At the first of the series of meetings P. H. Gadsden, chairman of the war board of the American Electric Railway Association, dwelt at some length on the imperative need of increased returns on the investment in electric railways, if the roads are to give adequate service, and suggested as a remedy standard franchises based upon the essential nature of the service and mutuality of interest of the public and the railways.

On motion of Mr. Gadsden a resolution was adopted recommending that a committee be appointed by the Chamber of Commerce of the United States to study the question of local transportation as relates to rates, franchises and investment and report its recommendations in the manner provided for in the constitution of the Chamber of Commerce. This resolution was adopted by the entire conference at the last session.

Running through various technical addresses a distinction was drawn between the serious conditions of the street transportation systems of the country and the relatively good conditions of the electric light and power plants.

J. B. McCall, president of the Philadelphia Electric Company, spoke at the opening session optimistically of the future of public utilities. He also stated that the 800 employees of his company who had gone to war, nearly all of whom were in service abroad, would find instant employment on their return. On motion of J. W. Lieb, vice-president of the New York Edison Company, a resolution was unanimously adopted favoring similar action on the part of all industrial corporations.

The importance of gas in war service was outlined by W. H. Gartley of the United Gas Improvement Company, Philadelphia.

The necessity of favorable water-power legislation was brought to the attention of the conference in the first meeting by J. W. Lieb, Calvert Townley and H. L. Doherty. This discussion was crystallized by W. W. Nichols, Allis-Chalmers Company, in a resolution subsequently adopted by the entire conference. Mr. Nichols urged that the development of our resources for power would make it possible for America to meet world competition in world markets.

Mark Requa of the Fuel Administration, speaking at one of the later meetings, pointed out that our industries were on a basis to export as never before. "America," he said, "must compete with economy and thrift in Europe. Trade will be controlled only by satisfactory service and terms, acting under a just administration by a league of nations." Government supervision in some form, Mr. Requa believes, is inevitable, but government supervision must be on such a basis that it will leave industry to execute the plans agreed upon.

Mr. Requa offered as a solution of our national problems, first, a principle of a national budget; second, that members of the Cabinet sit in the House of Representatives and be answerable to the House of Representatives for their actions, and third, that a United States Board of Trade embued with the dignity of the Supreme Court be established as a method of proper government supervision.

OHIO UTILITY OPERATORS STRIVE FOR GREATER ECONOMIES

The Coal Situation and Future Success of Public Utilities Make Saving in All Directions Imperative

The committee conferences of the Ohio Electric Light Association are again in full swing for the winter season, the first gatherings having been held at Cincinnati on Dec. 10, 11 and 12. The committees which met on the three successive days were respectively those on station operating, new business and transmission and distribution. From all of the sessions it was evident that the optimistic spirit which always characterized central-station meetings in pre-war days had not been lost. In general, all Ohio companies are preparing for a very active period in the years just ahead. Business will be sought in an aggressive manner, and lessons learned from the war will be capitalized.

The papers presented at the meetings were: "Fuel Economy in the Boiler Room," by J. G. Worker, Pittsburgh, Pa.; "Fuel Conservation from the Standpoint of the Fuel Administration," by M. S. Hopkins, administration engineer for Ohio; "Practical Phases of Boiler-Room Practices," by Edward Marshall, Cincinnati; "Industrial Electric Heating to Replace War Contracts," by W. S. Scott, Pittsburgh, read by C. O. Cramer, Pittsburgh; "Improvement in Power Factors and Load Factors," by C. T. Crippen, Youngstown; "Underground Survey and Record," by M. K. Thoenen, Toledo; "Duct and Manhole Ventilation and Cable Protection," by C. M. Rakestraw, Cleveland, and an address by W. W. Freeman of Cincinnati. D. L. Gaskill of Greenville, O. L. Oppenheimer of Pomeroy, T. F. Kelly of Dayton, A. C. Shepard of Cleveland, J. C. Matthieu of Dayton, W. H. Whittington of Springfield, H. B. Dates of Cleveland and Mr. Culver of Cincinnati took a prominent part in the discussions.

Quite frequently the point was emphasized that the central-station industry is faced with problems of greater magnitude now than has been the case ever before, even including the period just after war was declared. Then the chief problem was one of meeting the insistent demands made by prospective customers. The selection of labor then required no brains because it was a case of taking whatever was offered. This situation is changed now. There is a great opportunity for exercising judgment in selecting men. Effort will be necessary to capitalize on the good will toward the utilities which the war has created in the public's mind. The association as a body is also considering taking an active part in promoting the installation of two-year engineering courses in Ohio colleges to accommodate the soldiers who will soon come home.

Many well-formed opinions were expressed as to the possible policies of central stations during the readjustment period. The labor situation, which is already easing up, is expected to be alleviated by the employment of men who are now soldiers. These men are expected to make the best employees because of the training they have had. It is expected that loads will fall off somewhat, although not to any marked degree, leaving some generator capacity available for other uses. Industrial electric heating was mentioned as one of the loads to develop.

The financial situation is not viewed with alarm by Ohio executives, nor does the question of rates cause any worry. The opinion generally expressed is that rates generally have been too low in the past and the margin of profit too narrow. Fuel conservation in central stations and in isolated plants will be continued with vigor by central-station forces. A reduction in wages is not considered so necessary as the development of men who can become worth the price now paid for labor. The need for educating central-station men so that they can handle industrial electric heating business is said to be immediate in Ohio, owing to the failure of the gas supply.

Mr. Freeman's remarks were addressed particularly to the station operating men. He said the problem of economical production is vital now, because the bread and butter of the industry depends on it. The Union Gas & Electric Company of Cincinnati has shown its belief that the central station can produce energy cheaper than isolated plants by investing $8,000,000 in a power plant in a community to which new industries are not coming rapidly and in which load for the plant must be secured by shutting down existing isolated plants. Economical operation, he said, is also important because conservation of fuel will continue to be a live topic. Waste of anything will become an economic crime, and Mr. Freeman urged utility men to approach their problems from this viewpoint because that kind of thinking will make the utilities more truly than ever the real public servants they strive to be.

NIAGARA FALLS COMPANY LARGEST IN THE WORLD

Consolidating the Hydroelectric Properties at Niagara Falls, N.Y., Makes Available an Aggregate Output of 2,000,000,000 Kw.-hr.

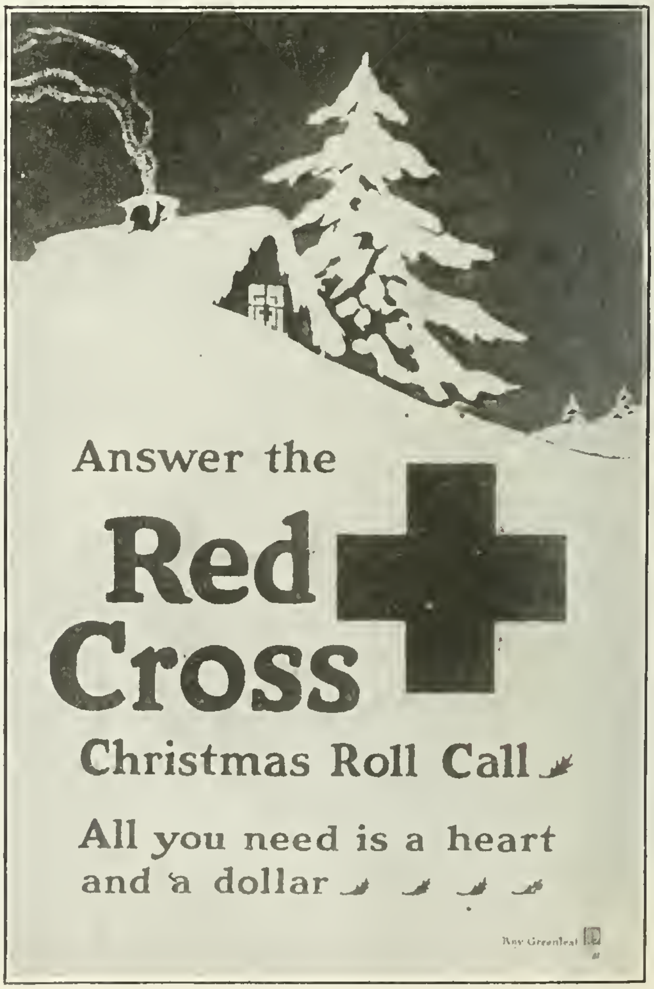
The consolidation of the Niagara Falls Power Company, the Cliff Electrical Distributing Company and the Hydraulic Power Company of Niagara Falls into a new corporation under the name of the Niagara Falls Power Company has created the largest electric power company in the world in point of energy output. Approximately 2,000,000,000 kw.-hr. yearly will be generated in the hydroelectric plants of the company.

Including the plant of its subsidiary, the Canadian Niagara Power Company, the company has an installed capacity of about 370,000 hp. and is installing an additional 100,000 hp., to be ready for operation during 1919, making it the largest and most important power installation of the world.

It is proposed to substitute for one of its present 100,000-hp. plants a new 200,000-hp. plant. For the undertaking of this work of reconstruction the constituent Niagara Falls Power Company has put itself into a strong cash position. The consolidated company has liquid assets available approximating $6,000,000.

The board of directors, composed of most of the former directors of the constituent companies, organized on Nov. 1, 1918, by the election of Jacob F. Schoellkopf to be chairman, Stacy C. Richmond president, C. P. Hugo Schoellkopf vice-president, Paul A. Schoellkopf vice-president and general manager, Morris Cohn, Jr., vice-president and general counsel, Philip P. Barton vice-president, Frederick L. Lovelace secretary, W. Paxton Little treasurer and Carlton W. Pierce assistant secretary and treasurer. Messrs. Richmond, Barton, Lovelace and Little held the same offices in the constitutent Niagara Falls Power Company. The others were officers of the Hydraulic and Cliff companies. Francis Lynde Stetson, Edward D. Adams, Ogden Mills, Victor Morawetz, Charles D. Dickey and Nicholas Biddle, all of New York, who had been members of the board of directors of the constituent Niagara Falls Power Company for many years, are continued on the board of the consolidated company.

An Appeal to the World



Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Interconnection Again Ordered in Illinois.—When application for authority to increase rates at the Tilden lighting plant came before the Public Utilities Commission of Illinois an investigation disclosed that considerable cause for complaint existed as to the quality of service. This is a direct-current system, and energy is generated by two oil engines operating from dusk until 11 p. m. The fault is chargeable to the condition under which the utility is operated rather than to any delinquency in the management, trouble having been experienced with the oil engines due to breakage and inexperienced help. The engineering department of the commission has recommended the construction of a transmission line from Tilden to Coulterville and favors supplying a twenty-four-hour service. The new rates authorized are at 15 cents per kilowatt-hour net.

Partial Relief in California.—The California Railroad Commission has authorized the Bell Electric Company to increase its rates for electricity in and around Auburn, Placer County. The Bell company gets its electrical energy from the Pacific Gas & Electric Company, whose rates were increased by the commission last July. The rates fixed by the commission will give partial relief only, the commission believing it possible for the company to effect economies which, with the increases allowed, will earn a reasonable amount on capital invested under the war-time emergency. The commission expressed the view that all must share in the burdens resulting from the war conditions. The decision says: "Testimony at the hearing showed that for several years the street-lighting system in Auburn has been the subject of heated controversy. The system is admittedly obsolete and inadequate, energy being supplied from the general lighting system of the company. In the past the street lights have been permitted to burn twenty-four hours a day because no means have been provided for switching them off without at the same time interrupting general lighting service. The company testified that about two years ago it started to install a modern series street-lighting system and, because no satisfactory rate was agreed upon with the city trustees, the construction was obliged to be discontinued. It is to be lamented that the matter was not placed in the hands of the commission at that time, because there is little doubt that a rate satisfactory to all concerned could have been established and the company ordered to proceed with the installation."

Smelter Service Rates.—Authorizing a higher rate for smelter service by the Colorado Power Company in the Salida district, the Colorado Public Utilities Commission says in part: "It appears that in establishing its rates the power company has found it to be either necessary or desirable to quote slightly preferential rates to smelter companies, especially to the smelters in Salida and at Louisville. The present rate to the smelter at Leadville is 9.5 mills per kilowatt-hour, while the smelter at Salida enjoys a rate of 7.65 mills per kilowatt-hour. It will not be the purpose of the commission to disturb the classification created for smelters at this time, although it might be considered slightly preferential as regards other power consumers. It is clear from the record that both the demand and the consumption of the Leadville smelter are approximately double that of the Salida smelter, that the load factor conditions are as good as if not better than at Salida, so that under any proper form of rate the Leadville smelter would earn a lower specific rate per kilowatt-hour than the Salida smelter could ever hope to earn. Therefore, if specific kilowatt-hour rates are to be established for these two smelters the commission must recognize that on account of the difference in conditions of service at these two smelters—a condition created entirely by the smelters themselves, and for which the power company is in no way responsible—that smelter furnishing the greater demand, greater consumption and better load factor is entitled to the lower rate. Since the standard power rates for larger consumers in the Salida and Leadville districts are identical, it might be reasoned that the commission should either order this standard rate applied to both the Leadville and Salida smelters—with the result that the Salida smelter would pay a rate of approximately 11.4 mills per kilowatt-hour and the Leadville smelter 9.5 mills per kilowatt-hour—or that slightly lower rates for smelters as a class should be established. To apply the standard power rate to the smelter business would afford the power company a measure of relief in excess of that asked for in its application, and inasmuch as no relief has been asked over the rate now being paid by the Leadville smelter, the rate paid by the Salida smelter will be adjusted very largely on the assumption that the Leadville smelter rate is a reasonable one for the conditions under which that smelter operates. The commission is of the opinion, however, that some consideration must be given to the higher operating expenses in the Salida district in making such adjustments, and that under conditions prevailing at this time, a fair and reasonable rate to be charged by the Colorado Power Company to the Ohio & Colorado Smelting & Refining Company is 9.5 mills per kilowatt-hour for all energy furnished, and that the rate of 7.65 mills per kilowatt-hour now charged to the smelting company should be canceled."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

A. S. M. E., Buffalo Section.—On Nov. 27 C. H. Bierbaum addressed the Buffalo Section of the American Society of Mechanical Engineers on the subject of "Bearings."

Electrical League of Cleveland.—At the regular Thursday noon meeting of the Cleveland Electrical League held Dec. 5 F. C. Sauer spoke on the subject "The Military and Political Conditions of Germany."

Louisiana Engineering Society.—William T. Hogg read a paper entitled "Suggested Changes in the Operation of the Street-Car System of New Orleans" before the Louisiana Engineering Society on Dec. 9.

Empire State Gas and Electric Association.—The following officers of the Empire State Gas and Electric Association were elected at the annual meeting: E. H. Palmer, Geneva, president, and C. B. H. Chapin, secretary.

A. I. E. E., Pittsburgh Section.—On Dec. 10 the Pittsburgh Section of the American Institute of Electrical Engineers was addressed by P. M. Lincoln, past-president of the A. I. E. E., on the subject "The Power Developments at Niagara."

I. E. S., New York Section.—"Light as an Aid to the Transportation of Material" was the title of a paper presented by A. L. Powell and R. E. Harrington at the December meeting of the New York Section of the Illuminating Engineering Society held Dec. 12.

N. E. L. A., Toledo Section.—A stag get-together meeting of the Toledo Joint Company Section, National Electric Light Association, was recently held at which a film entitled "Romance of Rails and Power," from the Westinghouse Electric & Manufacturing Company, East Pittsburgh, was shown.

N. E. L. A., Commonwealth Edison Section.—After a dormant period since the country entered the war, the Commonwealth Edison Section, National Electric Light Association, held a big "revival" meeting Nov. 20. Samuel Insull delivered his annual message and Chairman de Clercq read his annual report.

A. I. E. E., Seattle Section.—The annual election of officers for the Seattle Section, A. I. E. E., held Nov. 19, resulted in the election of John Harisberger as chairman and T. C. Smith as secretary-treasurer. A paper was presented by Dr. C. E. Magnussen, University of Washington, on the subject "A Basic Plan for the Development of Our National Electric Power Resources."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Essential Industries Finance Corporation Not Needed Now.—The Essential Industries Finance Corporation will be dissolved. It had not made any loans but had planned to advance funds to the Portland (Ore.) Railway, Light & Power Company. Application was made to the War Finance Corporation, but that body decided that the armistice removed the necessity of government aid in financing public utility and other companies.

Navy Acquires Wireless Stations.—The Navy Department has purchased all of the radio stations except four high-power stations of the Marconi Wireless Telegraph Company of America. The stations sold by the company are forty-five in number, of which nineteen are on the Atlantic and Gulf coasts, sixteen on the Great Lakes and ten on the Pacific Coast. The Navy Department has purchased from the Alien Property Custodian the radio station at Sayville, L. I.

More Working Capital Needed.—The San Diego Consolidated Gas & Electric Company has filed with the California Railroad Commission an application for authority to issue and sell $350,000 face value of its 6 per cent debenture bonds and $133,700 par value of preferred stock. The bonds are intended to be sold at 88 per cent and the preferred stock at 95 per cent, and the proceeds are to be used for the purpose of financing past and future construction expenditures and to increase the company's working capital from $205,600, as authorized by the commission in 1916, to $300,000. This increase in working capital must be made, the application says, because of the higher cost of materials. The company estimates that new constructions in its gas department for next year will be $126,400, in its electric department $214,450, and that general expenses will be $4,500.

New York City Maximum Rate to Hold.—In a statement before the New York Public Service Commission, First District, John W. Lieb, vice-president and general manager New York Edison Company, indicated that the prevailing maximum rate of 7 cents per kilowatt-hour will be continued for another six months. This rate has been continued for two years by agreement between the commission and the company. Mr. Lieb said that while the company would be justified in asking restoration of the old rate of 8 cents, no objection would be raised to the continuance of the existing rate. He said that he knew of no other community in the country where the public utility corporations had such an issue to face. Daylight saving and the general war economies practised by consumers had the effect of reducing incomes while expenses mounted, Mr. Lieb said. Coal cost rose in one year from $2,900,000 to $3,400,000.

Special Rate to Leland Stanford Junior University.—Leland Stanford Junior University, through its board of trustees, has filed with the California Railroad Commission an answer to the petition of the Northern California Power Company to increase rates, in which it points out that the university should be excepted from the operation of any general order allowing the power company to increase its rates, basing its request upon the following: In 1906 the university made a conditional grant of a right-of-way across certain of its lands in Butte and Tehama Counties to the Battle Creek Power Company, predecessor in interest of the Northern California Power Company, and as a consideration for the grant a contract was entered into that energy should be furnished to the board of trustees by the company as long as it should use the right-of-way at a special rate, which rate remained in effect until a recent order of the commission granted an increase.

Loans by the War Finance Corporation.—Reporting to Congress, the War Finance Corporation says that it has loaned $71,385,000 to war industries since its organization six months ago. It suggested changes in the existing law to permit it to continue "judicious use of its large resources" during the period of readjustment. Since the passing of the war emergency the corporation practically has ceased receiving applications for advances. "It is believed unless a new emergency should arise," the report says, "that meritorious enterprises can now be financed through their accustomed channels." Most of the corporation's loans were to public utilities at interest rates ranging between 6 and 7 per cent. Sixteen public utilities shared in the $40,858,000 to these industries, while other industries received $26,899,000 and farmers $3,628,000 as chattle loans. Banks borrowed only $2,619,000 and savings banks $550,000. Loans directly to war industries amounted to $68,217,000. Repayments have amounted to $37,172,000 and loans still outstanding are $34,214,000. There were 816 applications for $353,607,000 of loans, although less than one-fifth of these were granted.

Peculiar Line Accident on Central Maine System.—Nineteen short circuits on 2300-volt wires of the Central Maine Power Company in the Skowhegan district were recently caused by line vibrations due to the accidental backing of a large motor truck owned by a local industrial plant against a transformer pole structure. The blow was so severe that seventeen sections of line were affected, including two 90-deg. turns and about 1500 ft. of overhead-main wire runs. Several phases were either burned off or grounded between the point where the accident occurred and the Kennebec No. 1 power plant of the company. The accident occurred at 4:30 p.m., and the nearest line crew was 6 miles distant. C. T. Abbey and three other local representatives of the company started emergency repairs after sending an automobile for the line crew and notifying its members by telephone to return prepared to meet the emergency, and in fifty minutes from the time of the accident thirteen splices were made and about 500 ft. of new wire erected, restoring service on the north side of Skowhegan and on a greater part of the south side. In about two hours after the accident important industrial plant service was again in operation, and by 9 a.m. next day all customers in the district were being supplied as usual.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Appropriation of Water Rights.—In a suit involving water rights to which defendant claimed to have title by prescription, it was error to fail definitely to find what quantity of water, if any, was continuously appropriated by defendant, a finding of an equivalent quantity of water not being sufficient, according to the California District Court of Appeals in Willits Water & Power Company versus Landrew (175 P. 697). The defendant was not estopped to claim title thereto by prescription because plaintiff was a public service corporation and defendant stood by and made no objection to the construction of its flumes.

Sufficiency of Evidence.—In an action against a lighting company for the death of a boy from electric shock the way in which the defendant's system operated, the arrangement of its circuits and the effect of a broken wire were all pertinent facts in reaching a decision as to the ultimate fact of the boy's due care, but did not warrant a finding of law that the company was not liable, the Supreme Judicial Court of Massachusetts held in Jordan versus Adams Gas Light Company (120 N. E. 654). The evidence was held sufficient to support finding of the company's negligence, testimony as to condition of broken wire alone being sufficient. Discretion of court in permitting an expert witness showing only meager qualifications to testify as to effect of electricity on the human body will not be disturbed on appeal. The competency of a witness offered as an expert rests largely, though not exclusively, within the discretion of the trial court.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

M. C. Gilman, formerly sales manager of the Toronto Electric Light Company, has lately joined the staff of the Montreal Light, Heat & Power Company as special agent and research engineer. Mr. Gilman was appointed secretary of the Canadian Electrical Association about a year ago upon the resignation of that office by Alan Sullivan.

Roy P. McConnell, recently manager at Westchester, Pa., for the Philadelphia & Suburban Gas & Electric Company, and brother of H. L. McConnell, general commercial manager of the United Gas & Electric Engineering Corporation, New York City, is now an American Red Cross lieutenant in southern Europe. Mr. McConnell and a fellow lieutenant were the first Americans to enter Trieste, reaching that city ahead of the Italian army. Just prior to going to Europe, Mr. McConnell had resigned his position as Westchester manager of the Philadelphia & Suburban Company to become traveling commercial engineer for the company's group of stations.

D. L. Galusha, who is one of the electrical engineers of the newly organized consulting engineering firm of Dwight P. Robinson & Company, Inc., has been working under Mr. Robinson's direction for twelve years, the last five as head of the electrical division of Stone & Webster. His experience also covers a long list of power stations and industrial plants in all sections of the country. Some of his best-known work was done as electrical engineer in charge of the Mississippi River power development at Keokuk and the Minneapolis General Electric Company's large steam station, replacing one destroyed by fire. This was built in less than four months, although it involved extensive changes in the system of distribution and control through substations, overhead high-tension and underground systems. His experience has also included the design, construction and operation of hydroelectric stations, substations, transmission lines, motor applications, lighting and power in industrial plants and apprentice and test work in the Westinghouse Electric & Manufacturing Company. He is thirty-seven years old and a graduate of the Massachusetts Institute of Technology.

Mortimer Elwyn Cooley, dean of the College of Engineering of the University of Michigan, was elected president of the American Society of Mechanical Engineers at the annual meeting held in New York City last week. Dean Cooley was born in Canandaigua, N. Y., March 28, 1855, and was graduated in 1878 from the United States Naval Academy. Upon his graduation from the Naval Academy he spent two years in the naval service and then entered the faculty of the University of Michigan, with which he has been associated ever since. He has been professor of mechanical engineering since 1881, dean of the College of Engineering since 1904 and dean of the College of Agriculture since 1913. For the past twenty years Dean Cooley has been associated with numerous engineering investigations and appraisals of utility properties and has been in charge of appraisal work at different times for the Wisconsin Railway Commission and for the Michigan Railroad Commission. Since 1906 he has been special investigator for public utility properties in Minneapolis, Milwaukee, Cleveland, St. Louis, Boston, New York, Sault Ste. Marie, Red Wing, Buffalo, Evansville, Washington, D. C., New Jersey, etc. He was chairman of the block-signal and train-control board of the Interstate Commerce Commission from 1907 to 1912, was a member of the Engineering Commission of the Chicago Exposition in 1903, commissioner on awards of the Pan-American Exposition, a fellow of the American Association for the Advancement of Science and its vice-president in 1898, a director of the American Society of Civil Engineers from 1913 to 1916, member of the Franklin Institute, and vice-president of the Society for the Promotion of Engineering Education from 1908 to 1909, besides numerous other affiliations with engineering societies.

M. E. COOLEY

Obituary

Oscar Rosenberg, president of the Standard Cooper-Bell Company, manufacturers of insulating varnishes and paints, died Nov. 30 at Chicago.

J. M. Strasser, division superintendent for the Public Service Company of Northern Illinois at Joliet, died Nov. 11 after an illness which had lasted for several months.

Major John Trumbull, formerly chief engineer of the Connecticut Public Utilities Commission, died recently in France, following an operation.

B. Jensen, Phelps, N. Y., superintendent of the local works of the Empire Gas & Electric Company, was accidentally killed on Nov. 26. Mr. Jensen was in his thirty-second year.

Charles F. Simms, for many years manager of the Omaha office of the H. W. Johns-Manville Company, died recently. Mr. Simms was associated with the company for nearly thirty years and played no small part in the development of its Western enterprises.

Edward Bennis, managing director and founder of Messrs. Edward Bennis & Company, Ltd., of England, one of the pioneers in the introduction of mechanical means of firing boilers, died in England on Oct. 29 at the age of eighty years. Mr. Bennis did considerabe development work in this field, and the value of his work was recognized frequently through the bestowal of medals of merit.

Horace E. Andrews, president of the Rochester Railway & Light Company, died at his home in New York City of pneumonia on Dec. 1 at the age of fifty-five years. He was also president of the New York State Railways, the Mohawk Valley Railway and the Schenectady Railway. Mr. Andrews spent virtually his entire business career in the electric traction industry, in the upbuilding of which he played a prominent part.

Edward Allen Wickes, formerly president of the Niagara Falls (N.Y.) Power Company, died suddenly at his home in New York City on Dec. 6 at the age of seventy-five years. Mr. Wickes resigned as president of the Niagara Falls Power Company in the summer of 1917 on account of advancing age. He had been president many years and had been active in the affairs of the company since its inception in 1890. Mr. Wickes was a graduate of Williams College and a brevet major of volunteers in the Civil War.

Paris Moore Fletcher, one of the oldest and most popular men in the electrical supply jobbing business, died suddenly at his home in Yonkers, N. Y., on Oct. 27, aged fifty-five years, following an operation for appendicitis. Mr. Fletcher was born at Northfield, Vt., in 1863 and began his electrical career with the Western Electric Company, remaining in its employ about ten years. He then became associated with W. R. Ostrander & Company. Some three years later Mr. Fletcher organized the Fletcher-Stanley Company, this firm later becoming Stanley & Patterson, one of the leading electrical supply houses in New York City. In 1914 Mr. Fletcher organized the Fletcher Electric Company, New York, of which he was the head. He was a member of the New York Electric Club and the Jovian Order and was prominent in Masonic affairs, being a thirty-second-degree Mason.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

CONDITION OF NEW ENGLAND STOCKS IN JOBBERS' HANDS

Wiring Supplies Spotty, but It Is Generally Felt that Replenishment Can Wait for at Least a Month or Two

A great expansion in the building industry in the spring of 1919 is confidently expected in New England. Electrical jobbers plan to meet the demands of this revived market, although they are postponing the purchase of wiring materials and supplies for at least a month or two. Meanwhile they are depending upon existing stocks for supplying any sudden demand and for getting a fair start on next year's business. Stocks of wiring supplies are decidedly spotty. The larger houses are heavily loaded with material which is being carried at high overhead cost and which was purchased during the stress of war conditions or held over from prior stocks accumulated. Such establishments are anxious to turn over their stocks before going into the market extensively for replenishment.

Most of these houses appear to be "sitting tight" and awaiting a chance to take advantage of any near-future drop in prices should such occur. They figure that the manufacturers are now in a position to accumulate stocks of wiring material and equipment for early delivery, with the passing of the war orders, and propose to rely upon the manufacturer to meet the situation in this way. If prices refuse to go downward, the jobbers in general are of the opinion that there will be time enough a month or two hence to get in on the ground floor and by rapid accumulation of stocks as the building work develops meet the demand without serious difficulty. Among the smaller houses the pressure upon capital has tended toward smaller stocks and more or less speculative buying and selling of electrical building material. Present prices are a deterrent to buying, even though stocks are irregular and shot here and there with gaps in important material. Orders are being delayed with the idea that if this is not carried too far into the winter, no harm will result.

Only a very rough approximation is just now possible as to the percentage of normal stocks of wiring materials carried at present by New England jobbers as a whole. The figures of individual jobbers may show considerable variation from any average ranges here set forth. Some jobbers consider that they have enough conduit in hand to take care of normal requirements, but there is little doubt that as a whole 15 to 25 per cent of normal stocks will appear on the Jan. 1 inventories. At the present rate of buying it appears that normal stocks could be established in four months as a minimum and six months as a maximum. Lamp stocks, on the other hand, are in much better shape. In some cases the house is carrying more lamps than ever before, in others a normal stock has been attained; but, by and large, perhaps 60 to 75 per cent of the normal lamp stock is a fair estimate of the present supply in the wholesalers' bins. It would probably not require more than one to two months to accumulate enough lamps in this district to meet any anticipated demand.

In spite of war demands, a good deal of wire is now in stock. The larger houses have been buying heavily for war purposes, and much of the wire now on hand will be useful in the peace market. One good-sized house has a big stock on hand, up to and including 1,500,000-circ.mil. cable; another large house reports 60 per cent of normal stock, and another jobber serving a big industrial district with a medium-sized establishment has 70 per cent of his normal wire on hand. It would probably be conservative to put the average wire stock at about 50 per cent of normal. At the present rate of buying about three or four months would be required to fill the normal stock.

Stocks of fuses seem to run from 25 to 75 per cent of normal, with very large accumulation in one or two cases investigated. Here again it is felt that the factories will be able to stock up and deliver rapidly as soon as the need becomes urgent.

Iron fittings are running low in general. Not a few jobbers are probably carrying about 25 per cent of normal. A shortage of "T's," elbows and some special fittings is reported. Of course, in an exceptional case the contractor may "strike it lucky" if he has need of fittings in a hurry, but here is a supply subdivision which it would seem ought to be given early and constant attention. It is not likely that a normal stock of fittings can be secured much under four months, even wih orders placed now.

Houses carrying fixtures are in general on "Easy Street" as regards supply, and little need for buying by jobbers is in view yet. Hardware stocks are very spotty, probably not over 40 or 50 per cent of normal in many cases, and subject to at least two months' delay if ordered at this time. On schedule material stocks show from 50 to 75 per cent of normal in many cases, with about two months' leeway. The concensus of opinion appears to be that a conservative policy is the safe one until midwinter, after which greatly increased buying appears to be inevitable.

CONDITIONS OF STEAM TURBINE MANUFACTURE

Shops Have Unfilled Orders That Will Keep Them Busy for Some Months—Deliveries Vary from Three to Fourteen Months

Steam-turbine business is expected by the producers to fall off. A survey has been made by the ELECTRICAL WORLD of conditions in steam-turbine shops, and it is found that these shops have contracts either directly or indirectly with the government which, depending on the plant, it will take all the way to a year to clean up. About 50 per cent of the manufacturing capacity will be absorbed in this work, although one of the smaller concerns finds that this work will take but 25 per cent of its capacity.

These contracts are protected by prior purchase of raw material on government account. Generally speaking, the manufacturers have considerable stocks of raw materials on hand, which, having been obtained during the war period, are being carried at high prices.

Besides the government work there are other unfilled orders which will absorb a large part of the manufacturing capacity for some time. One plant puts this at 90 per cent, another at 75 per cent for the next six to eight months, and a third plant finds that unfilled orders will employ its facilities for the best part of a year to come.

Deliveries, consequently, on orders now placed must be somewhat delayed. They will depend, apparently, entirely on the volume of unfilled orders. Two companies making only small-size turbines quote one of them two weeks to three months and the other ten months on units under 2500 hp. Companies producing all sizes are quoting up to fourteen months in all sizes, although units apparently can be had in three to four months.

No quotations as far as could be learned are being made as of date of shipment. They are rather firm as of date of order.

Prices are expected by the manufacturers to hold for some time. This is concisely put by the sales manager of one concern as follows:

"We can see very little prospect of material price changes in finished apparatus for several months to come, as raw materials, which would naturally be used in filling orders booked in the near future, will largely be drawn from stock purchased at the highest prices current during the past year. Labor conditions may change some, but probably cannot be greatly changed until living costs come down, and there seems no imminent prospect that commodities of this kind will be materially cheaper for some time. The inevitable trend of prices will be toward lower levels, but it will be vastly to the benefit of us all if these changes can be effected gradually, and we believe this can be accomplished if the business men of the country think calmly and act with care and continued patriotism."

The outlook for the future apparently shows diminished demand. A statement by one of the men prominent in the industry is to the effect that this condition is brought about by the largely increased capacity installed and under manufacture. "We think," says this man, "that when the war started central stations were generally under-powered. We believe that condition has changed or will change to that of their being pretty generously powered until conditions settle down and the natural increase in demand comes upon them."

METAL MARKET SITUATION

Copper Market at Standstill—Tin Situation Featureless—Spelter Dull—Lead Still Falling

The copper market is now completely at a standstill. Prices to prevail after Jan. 1 can only be surmised at this time, but while consumers anticipate lower prices to result from an open market, producing interests are confident that copper will not be pressed upon an unwilling market. The only business of importance reported last week was the order for 10,000,000 lb. of electrolytic copper placed by the Italian government at 26 cents a pound, despite the fact that there has been some talk of copper being offered below the government price of 26 cents.

The most encouraging development in the copper trade since the armistice was signed is the report from Washington that the government authorities have decided to hold the quantity of copper on hand. In other words, the raw material purchased for the army and navy will not be returned to the producers or dumped upon the open market.

The tin market is featureless, no cables being received. The Inter-Allied tin agreement will probably be discontinued this month. Spelter is dull and barely steady with prompt shipments extremely scarce. Lead is still falling and being offered from ¼ cent to ⅝ cent under the committee's price.

Old metals keep on shrinking daily. The bottom is out, there is no support to the market, and cancellations of orders are numerous.

NEW YORK METAL MARKET PRICES

	Dec. 3	Dec. 10
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26 00
Electrolytic	Govt. price 26.00	Govt. price 26 00
Casting	Govt. price 26 00	Govt. price 26.00
Wire base	28 75	28 75
Lead, trust price	7 05	7 05
Antimony	8 62½	8 62½
Nickel, ingot	40 00	40 00
Sheet zinc, f.o.b. smelter	15.00	15 00
Spelter, spot	8.75	8 67½
Tin	72 50 (official)	72 00
Aluminum, 98 to 99 per cent	Govt. price 33.10	Govt. price 33 10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	21 00 to 21 50	18.50 to 19.00
Brass, heavy	11 50 to 12.00	10 50 to 11.00
Brass, light	9 00 to 9.25	8.50 to 9 00
Lead, heavy	5 75 to 6.00	5.25 to 5 50
Zinc, old scrap	5 75 to 6.00	5.25 to 5 50

THE WEEK
IN TRADE

A GOOD holiday buying in appliances has developed and, in spite of the fact that it has come after the idea of big holiday sales was practically abandoned, bids fair to be almost as large as that of last year. Buying in other lines is very slow. Jobbers are still turning over stocks previously laid in, nor is there any indication that they will make any large effort to enlarge stocks before late in January.

Deliveries are much better and with an open winter should be in excellent shape by spring. Prices are still the same, but there are unmistakable evidences that the new year will bring reductions. The iron and steel men are already talking of a gradual reduction to begin immediately. The copper market, unless consumption is greatly increased, may find it necessary to stimulate buying. Producers, of course, are anxious to keep prices up as long as possible. Buyers and distributers, however, are emphatic that they must come down if domestic purchasing in any volume is to take place.

Labor thrown out of work is being quickly assimilated and a shortage still exists. Inquiries concerning building projects are becoming more numerous, but investment building is not ready to go ahead at the prevailing prices. There is a lot of work waiting to be done, but lower costs of construction and money must come first.

NEW YORK

The market is still quiet and can be characterized as one of watchful waiting. It is now generally conceded throughout the trade that the cancellation of war contracts will not have such a detrimental effect as at first supposed and that manufacturers are becoming eager to resume production of material for civilian purposes. Manufacturers, however, show a disposition not to put their plans for peace trade into immediate effect. Uncertainty of governmental action in relation to certain regulations and restrictions on trade and the present high rate of wages and costs of materials tend to keep the brakes on until the house is in order.

Stocks on hand, generally speaking, are low and spotty, with actual shortages still in small wire, conduit and practically all electrical appliances. This condition, it is expected, will right itself or nearly so by Jan. 1. Christmas trade has begun to be felt. Jobbers report a feeling that some prices may show a falling tendency for a short time, but it is the general opinion that as soon as the new building program goes into effect there will be a tremendous demand for all electrical goods and prices will again reach the present levels.

The shortage of skilled labor is still being felt and does not seem to right itself so quickly as expected. An interesting instance of this was in a large up-state city recently when 8000 highly skilled mechanics were all suddenly released on the cancellation of a war contract. These laborers apparently disappeared over night to jobs awaiting them.

WIRE.—The small-wire situation shows constant but gradual improvement, and stocks of Nos. 12 and 14 are finding their way into the market in increasing quantities. Warehouse stocks of manufacturers, however, are still depleted and will not, in the estimation of a representative of one of the largest producers, be in shape to take care of much new business in this line until after the new year has been entered upon.

CONDUIT.—Jobbers' stocks are still very low, although one hears of conduit coming into the market. The government is using large supplies for shipbuilding purposes, but it seems to be the general feeling here that the market will soon ease up.

LINE MATERIALS.—Many inquiries for cross-arms, pins, insulators, etc., have been received, showing that new construction along these lines is actively being considered.

WASHING MACHINES.—Producers report no particular change during the past week. Supplies on hand of copper machines are very limited and orders are heavy. It is impossible to say just when the supply will become normal.

VACUUM CLEANERS.—Demand for vacuum cleaners still holds active and strong. A representative of one of the largest manufacturers, who is introducing a new machine, stated to-day that supplies would from now on be coming into the market in much better volume.

CHRISTMAS-TREE OUTFITS.—Notwithstanding the season, the market is very dull and jobbers are stocked up heavily from last year. It is understood that one large producer sold out his stock at cost to get rid of the line.

BATTERIES.—Dry-cell batteries are still in enormous demand, and it will take the manufacturers several weeks yet to catch up with their orders. Supplies, however, now show signs of improvement, and shipments can be made in two or three weeks.

FLASHLAMPS.—Army and navy requirements still predominate, and there are no supplies to speak of on hand. After Jan. 15, however, one of the largest producers stated that he thought the supply would begin to be normal again.

MOTORS.—While it is true that the demand for larger sizes of motors has shown a falling off since the armistice was signed, there does not seem to be any idea that a surplus on the market will occur.

USED MATERIAL.—One of the largest dealers in second-hand power machinery when seen this week voiced the most optimistic views for the future and stated that, in his opinion, if there was to be any temporary depression it would be of the shortest duration. There is no great quantity of material being thrown on the market, and there is so much new work and reconstruction to be done in all lines that he is of the opinion that prices will hold.

CHICAGO

A canvass of the more important central stations in the Middle West shows that activity incident to the rebuilding of central-station commercial departments is in some cases already in full swing and in other cases is at the point of starting. Central-station commercial men are particularly optimistic about the outlook. Jobbers' salesmen also report a great number of prospects for spring building. There is, of course, at present a tendency for large buyers to withhold their orders awaiting lower prices. This situation may become somewhat more pronounced in view of the fact that the fixing of copper and steel prices is to be discontinued on Jan. 1.

Taken on the whole, the labor situation is perhaps as interesting as any other in the Middle West. Quite a number of employees of war industries, finding their weekly earnings reduced by the elimination of overtime, and Sunday work, are seeking employment in other more staple businesses. There seems to be no general disposition for prices to soften.

COPPER WIRE.—The wire situation has taken a turn which is decidedly for the better. Sufficient stock of Nos. 14, 12 and 10 rubber-covered is now available in Chicago. There have been some price readjustments on weatherproof wire. The weatherproof line as a whole has been changed from a 36-cent to a 34-cent base Chicago. On the other hand, the manufacturers of weatherproof wire on account of the high price of cotton and labor have readjusted upward the price of No. 14—where it formerly took the precedence of 3 cents on the base it now takes 4 cents, and where 50 cents was usually added for double braid $1 is now added.

CONDUIT.—Except for the few firms which have large naval contracts conduit buyers in Chicago appear to be in almost normal shape. It is reported that there are no sizes which cannot be obtained from stock in Chicago.

LIGHTING FIXTURES.—Manufacturers of this type of equipment, which has been on nearly a 100 per cent war basis, are completing plans for coming back into the field of pre-war business.

ELECTRICAL APPLIANCES.—Factories in Chicago are going at full speed to produce appliances needed to fulfill the demands of Christmas trade.

WASHING MACHINES.—Business seems by no means to have reached its peak. Manufacturers with plants already built have orders on hand for a long period ahead. Some of the most important factories in the field are actually starting additional plants.

BOSTON

Trade holds up well, considering the readjustment now in progress in most branches of industry. Jobbers are buying comparatively little on account of being fairly well stocked with supplies purchased at high price levels. An undertone of optimism is to be found in electrical circles. The labor supply is increasing, and inquiries from Europe for American goods are coming in rapidly. Collections are very satisfactory at present. Prices are being held firmly and bid fair to continue around present levels for some time, according to current opinion. Deliveries are still irregular and uncertain, and with the prospect of more embargoes the outlook is not satisfactory for quick service between factories and distributers. High prices are holding back much building construction expected to be handled before long, but this is regarded as temporary. The government is still in the market as an important buyer of many materials, but more and more cancellations are to be expected, except in shipping activities and important naval construction. By and large, the readjustment process is going forward with far less disturbance to industry than was feared in some quarters. Central stations are busy utilizing present facilities, and the extension of plants in some cases cannot be long postponed. Appliances are moving well and are in fair supply.

CONDUIT.—A heavy demand is noted for smaller sizes, which are none too plentiful in the New England market. Prices appear to have reached the top. Better classes of residences are beginning to absorb some pipe, as is also an active industrial market. Stocks are rather low generally

CHRISTMAS MATERIAL.—Stocks are now in good shape to meet a rush trade. So far the holiday trade is a little slow, but increased retail sales are looked for.

FIXTURES.—The outlook is better every week. Stocks are in good shape and prices steady.

RADIATORS.—Jobbers' stocks are low, but the retail market is still supplied to meet moderate demands. Distributers have lately been handicapped by the inability of factories to make deliveries, and unquestionably many thousands of dollars have been lost through the oversold condition of the market.

WIRE.—Stocks are spotty, tending toward shortage; but the relaxation of the war demands is being reflected in the industrial field by gradual improvement in supply conditions. The smaller sizes are now easier to obtain.

STORAGE BATTERIES.—Stocks are rather below normal. Trade is brisk in automobile batteries, and the government demands are strongly maintained. It appears unlikely that any further price advances are in prospect.

INDUSTRIAL ELECTRIC TRUCKS.—A slight recession in demand is reported, but this is not regarded as permanent. The high cost of labor insures long-continued business for this class of equipment.

ELECTRIC ROAD TRUCKS.—The outlook is better than for some time, and only the shortage of material seems to stand in the way of large developments. Interests identified with the Boston Edison company are expected soon to establish a large battery and truck service station in the South End of Boston.

SWITCHES AND SOCKETS.—Stocks are large and the distributors are in excellent shape to meet the expected boom in building in the late winter.

ATLANTA

That buyers are deferring new commitments as far as possible, awaiting the further reaction of prices which seems fairly foreshadowed, is the keynote of advices from every center of importance in the Southeast. Then, too, uncertainty exists regarding the exact disposition of various restrictions which still remain effective, and this is a significant element in the present hesitation. The facts, however, that the large manufacturers have substantial unfilled orders booked and that the government intends to go slow and properly compensate manufacturers on cancellation of contracts make for further confidence in the future.

Opinion prevails that during the following three to four months business will mark time until plans develop for early spring expansion. With conservatism and caution conspicuous features, there is less apprehension now of the results of the economic changes that must come.

Restrictions on storage of bituminous coal and upon the use of electric lighting on "lightless nights" have been removed. Reports as to immediate business activity in Florida, Louisiana and Mississippi are very bright. The fixed price on sugar has stimulated the refinery business, and inquiries for equipment are being received daily. The city of New Orleans has completed plans for the construction of a coal-handling plant, including storage, railways and conveyers, to provide facilities for loading steamships with cargo coal. All action on the location of a ten-million-dollar chlorine plant at New Orleans has been held up. Dispatches from Washington state that when the army has been reduced to a peace-time basis only three motor repair shops will be maintained permanently. These will be at Atlanta, Ga., San Antonio, Tex., and Baltimore, Md.

With the removal of certain building restrictions, a small construction boom has been started in Alabama. The items include county work, bank building, tobacco warehouses at Sheffield, a peanut-oil refinery at Andalusia, grain elevators at Decatur and a pine reduction plant at Calvert. In addition, the Alabama Council of National Defense has on file innumerable applications for residences in all parts of the state.

The outlook for big business at the coastal cities looks brighter than ever before. This condition is reflected in the recent organization of the South Atlantic Maritime Corporation, composed of shipping interests at Wilmington, N. C., Charleston, S. C., Savannah, Ga., and Brunswick, Ga. This company is organized to secure a broad and scientific development of harbors and facilities at these ports after expert surveys and engineering advice have been arranged through the government.

CONDUIT.—Reports reaching this section show that while pledges are not required to secure rigid conduit, it is more difficult than ever to get shipments. The factories are flooded with orders and shipments are away behind. The much-looked-for relief is certainly not forthcoming at this time. The heavy demand for conduit is mostly registered from shipbuilding centers.

SEATTLE—PORTLAND

Electrical jobbers in Seattle and adjacent cities are practically unanimous in the belief that the effect of the signing of the armistice will not be felt in this section for a considerable time to come. At present, with but a few minor exceptions, the volume of business is flowing along in the usual channel, there being no particular increase. Shipyard and industrial orders continue heavy, and no particular decrease is noted in sales to lumber manufacturers. The cancellation of some schedule material utilized in ship construction, principally devices for detection of proximity of submarines, concealed lighting, etc., has been noted already. An improvement of dealers' stock is noticed, and but little difficulty is anticipated in the future in keeping stocks up to requirements. It is believed that the prospects of an early peace will result in much heavier Christmas buying than had been expected. There has been an unexpected increase in the sale of domestic appliances for Christmas gifts, particularly washing and sewing machines, percolators and toasters. However, sales appliances probably will not equal those of last year by a considerable amount.

The Portland district reports that since the year is practically completed electrical manufacturers are able to make a close estimate of the year's business and that they report in general that business has been exceptionally good, although the end of the year does not show the same activity that prevailed in earlier months. Looking ahead into the coming year, jobbers believe that there must be a period of readjustment when sales of electrical apparatus are bound to be slow. This will include possibly the first half of 1919, after which extension of peace industries probably will be rapid. In the Oregon district much depends upon the wooden-ship industry. The suspension of government contracts and the failure of the government to allow the yards to accept foreign contracts have caused considerable uneasiness in the industry and a consequent temporary depression in the industrial field. This is clearing up somewhat, and there are now strong hopes that there will soon be enough wooden ships ordered to keep the yards running to capacity for several years to come. Steel yards seems to be in better shape, and there is serious consideration of changing one or more of the large wooden yards into steel yards. A return of the influenza epidemic in Seattle, Portland and other Northwest cities promises to be even more severe than the first wave. The health department will not resort again to a ban on business houses and public gatherings except as a last resort.

CONDUIT.—Considerable shipments are coming through for stocks. Orders for shipbuilding have been filled, and jobbers believe no particular effort will be necessary to keep a plentiful supply on hand.

COPPER WIRE.—Although a decrease in the price of copper was noted recently, there has been no change worth mentioning in the market in Seattle. Demand still equals supply.

FIXTURES.—Sales continue heavy with no noticeable decline in home building. Dealers report that builders are leaning toward the higher class of merchandise.

SAN FRANCISCO

The past week has brought notable improvement in the electrical trade generally, probably because of the approach of Christmas. In addition to business directly chargeable to Christmas trade there have been rush orders for shop equipment and installations which it was desired to have completed before the holidays. The rains have favored the farmers this winter, and thus far indications are for bumper crops. The rice acreage is to be greatly increased next season, and orders have already been placed for electrical pumping equipment to be used in some districts. The prosperity of the farmers is important to the electrical trade, because when money is easy in the two central valleys of California a ready market is found there for appliances and electrical equipment of all kinds.

The labor situation is steadily improving as business returns to a peace basis. Wages have not yet been lowered.

Only a few changes in price have occurred and those are slight. Deliveries are easier in practically all lines, particularly conduit. Business in the general contracting field is showing marked improvement. In many cases this is explained by a desire to complete work before the holidays. Very little power or telephone-line construction is under way, but the number of inquiries received indicates considerable activity in line construction early in the spring.

FLASHLAMPS.—These are in demand as Christmas approaches, the sales volume this season being now estimated as one-third more than just before Christmas last year. This is significant in view of the heavy trade in flashlamps last year occasioned by the supplying of men going into training camps.

STORAGE BATTERIES.—Business is about 50 per cent above the volume booked last season at this time. Orders are being handled satisfactorily.

WIRE—Rubber-covered and weatherproof wire prices are steady and deliveries easier.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S Size	List per 1000 Ft.
No. 14 solid	$61 00
No. 12 solid	71 00
No. 10 solid	90 00
No. 8 solid	106 00
No. 6 solid	145.00
No. 10 stranded	95 00
No. 8 stranded	115 00
No. 6 stranded	160 00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315 00

Twin-Conductor

No. 14 solid	104 00
No. 12 solid	135 00
No. 10 solid	185 00
No. 8 stranded	235 00
No. 6 stranded	370 00
No. 4 stranded	575 00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10%

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+30% to +20%
Coil to 1000 ft	List

	No. 12 Solid
Less than coil	+30% to +20%
Coil to 1000 ft	List

Twin-Conductor

	No. 14 Solid
Less than coil	$115.00
Coil to 1000 ft	100.00

	No. 12 Solid
Less than coil	+30% to +20%
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1 5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg.	15% to 17%

DISCOUNT—CHICAGO

Less than 1·5 std pkg	+30% to List
1/5 to std. pkg	+5% to 20%
Std. pkg.	18% to 30%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 45—$0.46	$0.45—$0.47
2 to 50	.40	.40— 41
50 to barrel	.35— .36	.36— .37
Barrel lots	32— .329	.33— .339

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 40 to $0.45	$0.40 to $0 45
12 to 50	.35 to 38	35 to 38
50 to barrel	.319 to .35	.329 to .35
Barrel lots	.289 to 32	299 to .32

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5 00
⅜	250	7 50
½	100	10 00
¾	50	13 00
1	50	21 00
1¼	50	26 00
1½	25–50	35 00
2	25–50	45 00
2½	25–50	52 00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip.	$75 00	$63 75— 69 75
⅜-in. double strip	75 00— 82 50	72 00— 75 00
½-in. single strip	100 00	85 00— 93 00
½-in. double strip	100.00—110 00	96 00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75 00	$63 25 to $63 75
⅜-in. double strip	78 25 to $78 75	71 25
½-in. single strip	100 00	75 00 to 85 00
½-in. double strip	105 00	93 00 to 95 00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0 05½	1	$0 25
¼	06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	47
⅝	.15	2	.55
¾	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$25 00–50 70	$24 00–35 20	$23 00–30 25
¼-in.—	30.00–56.40	28 00–38 40	26 00–33 00

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$60 00	$30 00	$26 00–29 15
¼-in.—	65 00	33 50	29 00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
¼	$0 08½
⅜	08½
½	.08½
¾	.11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0 05	$0 19
⅜	.06	.19
½	.07	.19
¾	.10	.25
1	13	.37
1¼	.17	45
1½	.21	.50
2	.28	1 10
2½	.40	1 80
3	.60	4.80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	7% to 7 1%	9% to 9 1%
2500 to 5000 lb.	10% to 10 1%	12% to 12 1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+5.5% to 3.5%	+3.5% to +1.5%
2500 to 5000 lb.	+2.5% to +0.5%	+5% to 1.5%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$6 00 to $6 50
Discount	20% to 30%

CHICAGO

List price	$6.00 to $7.00
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	Lis
3-amp. to 30-amp	100	$0.25
35-amp. to 60-amp	100	.35
65-amp. to 100-amp	50	.90
110-amp. to 200-amp	25	2.00
225-amp. to 400-amp	25	3.60
450-amp. to 600-amp	10	5.50
600-Volt		
3-amp. to 30-amp	100	$0.40
35-amp. to 60-amp	100	.60
65-amp. to 100-amp	50	1.50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5.50
450-amp. to 600-amp	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6 00 to $8 75
1/5 to std. pkg	5 25 to 7 00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8.00
1/5 to std. pkg	7.00

Standard packages, 500. List, each, $0.07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

	Std. Pkg.	List, Each
Regular, Clear:		
10 to 40-watt—B	100	$0 35
60-watt—B	100	40
100-watt—B	24	85
75-watt—C	50	70
100-watt—C	24	1 10
200-watt—C	24	2 20
300-watt—C	24	3 25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25	50	60
25-watt—G 25	50	60
40-watt—G 25	50	60
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4⅜-in., Frosted:		
100-watt—G 35	24	1 15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30 47—$40 77
Coil to 1000 ft	27 42— 32.98

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$38.00
Coil to 1000 ft.	28.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24 00 to $33 00

CHICAGO

Net per 100	$23 93 to $30 00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320.	$30 00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30 00
103—C.A., 9, 4R, B 1½	25 00
106—F.A., 7, C.S., 1½, 3 R	20 00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%	20%
$10.00 to $50.00 list	36%	31%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20%	10%
$10.00 to $50.00 list	30%	20%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	5%
1/5 to std. pkg	15%
Std. pkg	25%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$20 00 to $21 00
1/5 to std. pkg	17 00 to 17 85

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$21 00
1/5 to std. pkg	17 85

Standard package, 2200. List per 1000, $20.00–21.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.	Std. Pkg. 4000 Solid Nail-it—N.C.
Less than 1/5 std. pkg	$16 00	$32 00
1/5 to std. pkg	13 60—	27 20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500. 5½ N.C.	Std. Pkg. 4000 Solid Nail-it—N.C.
Less than 1/5 std. pkg	$13 00—	$32 00
1/5 to std. pkg	11 50—	27 20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0 33
½-in. cap keyless socket	500	30
½-in. cap pull socket	250	60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List
1/5 std. pkg	10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0.80
60-amp. S. P. S. T	1 20
100-amp. S. P. S. T	2 25
200-amp. S. P. S. T	3 48
300-amp. S. P. S. T	5 34
30-amp. D. P. S. T	1 20
60-amp. D. P. S. T	1 78
100-amp. D. P. S. T	3 38
200-amp. D. P. S. T	5 20
300-amp. D. P. S. T	8 00
30-amp. 3 P. S. T	1 80
60-amp. 3 P. S. T	2 68
100-amp. 3 P. S. T	5 08
200-amp. 3 P. S. T	7 80
300-amp. 3 P. S. T	12 00
Low Grade:	
30-amp. S. P. S. T	$0 42
60-amp. S. P. S. T	.74
100-amp. S. P. S. T	1.50
200-amp. S. P. S. T	2 70
30-amp. D. P. S. T	68
60-amp. D. P. S. T	1 22
100-amp. D. P. S. T	2 50
200-amp. D. P. S. T	4 50
30-amp. 3 P. S. T	1 02
60-amp. 3 P. S. T	1 84
100-amp. 3 P. S. T	3 76
200-amp. 3 P. S. T	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15% to +10%
$10 to $25 list	2% to 5%
$25 to $50 list	5% to 10%
	Low Grade
Less than $10 list	+5% to list
$10 to $25 list	8% to 15%
$25 to $50 list	15% to 20%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 15%
$10 to $25 list	List to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15% to 16%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0 28
5-amp. single-pole, ind	250	32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole.	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std pkg	+20%
1/5 to std pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List to 10%
1/5 to std. pkg	10% to 16½%
Std. pkg	18% to 25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0 34
No. 160	60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 18%	Net
$2 00 to $10.00 list	10% to 28%	5%
$10.00 to $50.00 list.	20% to 45%	10%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2 00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6 00 to 6 50
Discount	20% to 30%

CHICAGO

List price	$6 50 to $7 00
Discount	20% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.54–$0.66
No. 18, full spools	.52– 56

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0 65 to $0 69
No. 18, full spools	55 to 575

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$20.00–$25 00	$13.50–$17 00	$12 50–$15 00
12	25.00– 27.09	22.50– 23.22	18 75– 23 22
10	31.26– 32.40	28 66– 32 40	25.00– 27 45
8	43 92– 45 72	40 26– 45 72	35.14– 38 10
6	63.69– 72.36	57 90– 60.30	55.58– 57 88

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$25.00	$18 00–$25 00	$15 50
12	$29 46– 31 44	29 46– 31 44	$25 54– 31 44
10	41 10– 43 84	41 10– 43 84	34 62– 38 36
8	57 00– 61 76	57 00– 61 76	50 18– 54 04
6	85 31– 97 68	85.31– 85 47	77 21– 85 47

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4 0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$39 75
25 to 50 lb	39 75
50 to 100 lb	38.75

CHICAGO

	Per 100 Lb. Net
Less than 25 lb	$39 76 to $41.00
25 to 50 lb	38.76 to 40.00
50 to 100 lb	37 76 to 39 00

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Electrically Lighted Bulletins Operated by Typewriter

A novel yet practical electric bulletin board has been erected on the roof of a newspaper building in a Middle Western city. Unlike any other device of this nature, it is operated by a typewriter, letters appearing in electric lights on the device as the keys are struck by an operator. The "electrograph," as it is called, is two-sided, the same bulletins appearing simultaneously on each side. Each side has sixty monograms, arranged in three rows. Each monogram has a clever arrangement of twenty-one electric lights, combinations of which form any letter or numeral and a few other characters.

In writing the bulletins the operator writes the same matter on paper, which is fed into the typewriter from a roll. This roll then gives an accurate record of everything shown on the device. The average bulletin may be produced in about ten seconds.

The operator is stationed on the top floor of the building and cannot see the result of his operations, but a pilot board in front of him tells just what results he is getting. When he strikes a key the contact throws on the corresponding letter, which automatically lights a bulb on the pilot board. If the bulb fails to light, the operator knows that the letter did not appear, and he proceeds to strike it again. Such occurrences are not frequent, but the pilot system affords quick detection of defects, and repairs may thus be made promptly.

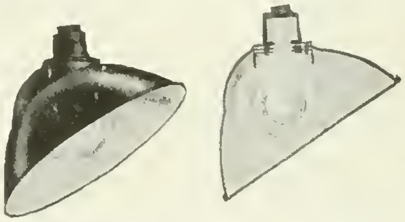
PILOT LAMP BOARD AND TYPEWRITER FOR OPERATING BULLETINS

A double releasing device is provided. One key releases the entire board, clearing it for the next bulletin. Another key releases the letter in any desired monogram without interfering with the other letters. Hence, in case a wrong letter is struck it may be promptly put out and the correct letter inserted. The monograms are approximately 2 ft. by 3 ft. (60 cm. by 90 cm.) and the bulletins may be read at a distance of half a mile under ordinary weather conditions.

The electrograph was constructed by the American Electrograph Company, Columbus, Ohio.

Marine Reflector Fixture

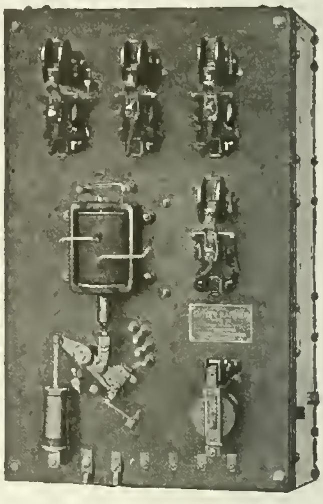
A 30-deg. angle reflector combined with a water-tight, gas-proof and vapor-proof fixture for marine service has just been placed upon the market by the Benjamin Electric Manufacturing Company, 806 West Washington Boulevard, Chicago. The heavy cast-iron hood is furnished tapped for ½-in. (1.27-cm.) iron pipe and contains a receptacle of the easy-to-wire type with a porcelain base and the Benjamin lamp grip to prevent loosening and falling of the lamp. The reflector is made of one-piece steel having an inside finish of white porcelain enamel (not easily discolored, according to the makers) and black-enameled outside. A heavy clear-glass globe is screwed on a copper holder. Two gaskets make the fixture water-tight.



COMBINATION ..XTURE IS WATER-TIGHT AND STRONG

Mine-Duty Starter of the Magnetic-Switch Type

Because of the injurious effects of moisture and severe operating conditions starters and controllers of motors in mine service must be specially and sturdily constructed. Especially is this true of the starters and controllers for ventilation fan and pump motors, since it is often vitally necessary that these be maintained in continuous operation in order to free the mine of water and to exhaust dangerous gases. Wide fluctuation in generator or line voltage caused by main hoists and locomotives also contributes to the desirability of having specially constructed starters and controllers. To meet these conditions a redesigned mine-duty self-starter for motors up to 100 hp., having operating and protective features essential to the continuous operation of fan and pump motors, is being marketed by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis. The starter, which is of the pilot-switch accelerator type, employs a rugged relay said to be very sensitive and positive in its action. Injury to the motor is prevented by the relay, since all of the armature resistance is inserted in case of a bad voltage drop, thus checking the heavy current resulting from the decreasing counter-electromotive force. If the line pressure falls to about 80 per cent of normal, the relay drops out, opening the control circuits to the accelerating switches. These drop in turn and cut into circuit the heavy-duty starting resistance, which has capacity for continuous service at low voltage. The motor then runs at slow speed until the voltage increases, and at about 90 per cent of normal the relay pulls in again, cutting out the resistance and permitting the motor to accelerate to normal full speed.



PROTECTS MOTOR FROM INJURY DUE TO LOW VOLTAGE OR OVERLOAD

A single coil overload, in case of shunt-wound motors, can be added to insert the armature resistance also in case of an overload and thus keep the fan or pump running at a reduced speed. This single-coil overload and the low-voltage relay prevent the shunt motor from flashing over under severe voltage fluctuations. When the voltage drops to a very low value the motor tends to run as a generator and is liable to "flash over" across the brushes, injuring the motor and commutator. With a compound motor the overload relay is not so necessary, because when the motor tends to run as a generator the compound winding opposes the shunt winding, neutralizing the field and preventing those conditions which result in "flashing over."

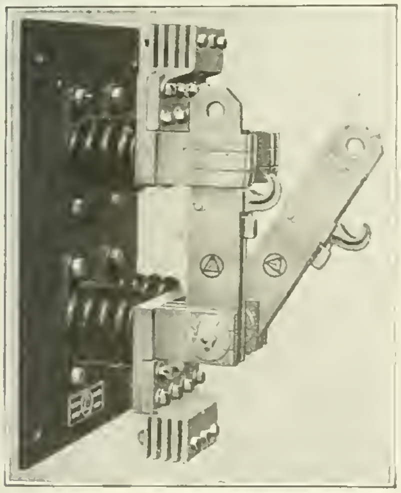
Marine Snap Switch with Molded Base

A very substantially constructed snap switch for marine service has been produced by having the ratchet plate molded into the composition base. While the ratchet plate is made of steel in order to withstand the severe service expected of such a part, it is heavily copper-plated to prevent rusting. The music-wire spring which actuates the mechanism is also heavily plated. This switch is produced by the Bryant Electric Company, Bridgeport, Conn.

The switch is made both single-pole and double-pole, and for either type a ⅜-in. (9.5-mm.) extension stem for a handle is offered for use where watertight covers are employed. The bases are molded of such a size as to permit of standard screw spacing for attaching to the box; that is, 1⅜ in. (3.48 cm.) on centers. The diameter of the switch base is 1¾ in. (4.45 cm.). A groove is also provided on the back of the base which is large enough to permit of running a separate circuit through the box. Two of these switches may be mounted in a standard 4-in. (10-cm.) box.

Flexible Unit-Type Disconnecting Switch

When installing disconnecting switches it is often found necessary to obtain a certain height from the terminals to base in order that the conductors shall line up with existing heights of busbar supports or other equipment. Such variations in height between the switch terminals and the mounting base can readily be made by means of the "unit-type" switch here illustrated, which is manufactured by the Delta Star Electric Company, Chicago, Ill.



SWITCH WITH VARIABLE HEIGHT SUB-BASES

The corrugated insulators are provided with removable sub-bases, which in turn are bolted to the main supporting base. These sub-bases are furnished in various heights, and by selecting the proper size a switch element can be lowered or raised to meet local conditions. The standard high-capacity, separately operated and locking-type switch blades are used as with standard "unit-type" switches.

Vacuum Electric Washer

The "Easy" vacuum electric washer has been redesigned and improvements incorporated in the model "H" washing machine, made by the Syracuse Washer Corporation, Syracuse, N. Y.

The vacuum or suction principle is utilized to wash the clothes, the two vacuum cups in the tub moving up and down rapidly and taking new positions at each stroke. The air contained in the cups at the downward stroke forces the soapy water through the mesh of the garments, while the water is sucked through the clothes again by the upward stroke of the cups. In this way, the manufacturer says, dirt and foreign substances are dislodged without the injury which sometimes occurs to thin laces and lingerie by friction with cleated or corrugated surfaces.

Solid copper, tinned on the inside to prevent discoloring, is used in the manufacture of the tub, which is fitted with a removable one-piece cover. The black-enameled metal frame holds all the operating parts under the tub out of the way, the gears being guarded with metal shields. This wringer swings to any desired position and has an instant-release safety device.

The ⅓-hp. motor runs the washer with a countershaft and pulleys, any stretch in the belt being taken up by automatic adjustment. An additional feature of the machine, which may be obtained as extra equipment, is an easily attachable gas heater. This may be utilized to heat the cold water in the tub and also to maintain it at a desired temperature. It is also pointed out that the ten-sheet or 14-lb. (6-kg.) dry-clothes capacity of this washer is an unusually large one for the space occupied.

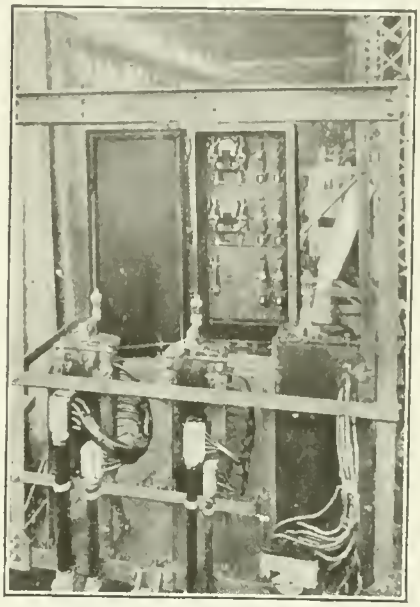
Light-Weight Electric Drill

An electric drill which is the lightest manufactured for the same capacity, the makers say, is being put on the market by the Black & Decker Manufacturing Company, Baltimore, Md. It will take any size of drill up to 3/16 in. (4.8 mm.), is 4 in. (10 cm.) in diameter and 12 in. (30 cm.) over all, weighing only 6⅜ lb. (2.9 kg.).

This drill can be used from any electric light socket on either alternating or direct current, it is equipped with a series-compensated motor designed especially for drilling small holes in steel, iron or wood and has a no-load speed of 1600 r.p.m. and full-load energy consumption of 175 watts, at which the speed is 1000 r.p.m.

Safety First for Crane and Operator

In the article under the above title in the ELECTRICAL WORLD of Nov. 16, describing the crane protective panels manufactured by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis., the illustration was erroneously described as an alternating-current panel for manually controlled cranes. The picture was, however, a representation of the direct-current panels of this company, the illustration herewith reproducing its alternating-current panel, which is used in cabs of cranes having three polyphase motors. The panel is installed with the controllers in front and provides two reverse-current time-limit overlook relays for each motor.



ALTERNATING-CURRENT PANEL FOR MANUALLY CONTROLLED CRANES

Ceiling-Attached Lighting Fixture

A dust-proof lighting unit which is attached directly to ceilings and thus eliminates chains and other dust-collecting parts has been developed and is being marketed by William E. Gray & Company of Utica, N. Y., and is known as the "Ceilite." Varying intensities of light may be secured through a special switch which permits the use of one, two or the full four lamps contained in the bowl. A reflector placed above these lamps aids in the distribution or concentration of the light, which shines through a daylight glass called "Celestialite" made by the Gleason-Thiebout Glass Company, New York City.

Trade Notes

Edison Battery Sale Changes

BERTRAM SMITH, for the past three years district sales manager of the Detroit district of the Edison Storage Battery Company, has been appointed assistant sales manager, with headquarters at the main office, Orange, N. J. Mr. Smith is known throughout the trade as one of the "old-timers" of the storage-battery business, having been active in the sale of lead batteries for many years before the advent of the alkaline storage batteries. Mr. Smith's earlier connections include such positions as Western sales manager, secretary and treasurer of the National Battery Company, manager of the Chicago office of the United States Lighting & Heating Company and assistant manager of the Edison Storage Battery Supply Company, San Francisco.

GEORGE F. SIMONS has been appointed district sales manager of the Detroit district. Mr. Simons has been associated with the Edison Storage Battery Company for the past three years. He has had valuable experience in storage-battery practice, and previous to his going with the Edison Storage Battery Company he was for nine years associated with the old National Battery Company, Buffalo, N. Y., and with the United States Lighting & Heating Company.

J. K. MAHAFFEY, who has been representing the Edison Storage Battery Company in Washington in connection with government business, has been appointed as district sales manager of the Pittsburgh district. Mr. Mahaffey has been in the employ of the Edison Storage Battery Company since 1916. His previous connections include the General Electric Company, the Jandus Electric Company, the Adams-Bagnall Company, the Union Metal Manufacturing Company and the Electric Products Company of Cleveland.

EXPORT LICENSES NOT PRIORITY CERTIFICATES.—The War Trade Board announces the withdrawal of W. T. B. R. 291 of Oct. 28, 1918, regarding procedure with respect to export licenses, priority certificates and permits of the Director of Steel Supply for the exportation of commodities to any destination. Priority certificates and permits of the Director of Steel Supply are no longer required by the War Industries Board, and therefore supplemental information sheet X-26 hereafter will not be required by the War Trade Board.

NEW ZEALAND ELECTRICAL IMPORTS.—The annual report of the Imperial Trade Commissioner in New Zealand points out that the imports of electrical machinery manufactured in the United States increased from $303,535 in 1914 to $566,065 in 1917, while those from Great Britain decreased from $1,960,840 to $1,526,245. The imports of insulated wire and cable from Japan increased from about $44,000 in 1916 to more than $50,000 in 1917. The commissioner states in his report, however, that he is told that the Japanese wire is not at all satisfactory.

FEDERAL CORPORATION TO STIMULATE RUSSIAN TRADE.—The War Board of the United States Russian Bureau, Inc., has been organized by the War Trade Board at the direction of the President for the purpose of helping the Russians to help themselves in stabilizing the economic situation in Russia. It has a capital stock of $5,000,000, all of which has been issued and fully paid in cash out of government funds and is owned in its entirety by the United States government. The company will engage in the business of exporting to Russia and Siberia commodities which the Russian population need, bringing back Russian and Siberian raw materials in return. The company thus is intended to aid in supplying the needs of the people of Russia, in encouraging Russian production and trade and assisting in the marketing of Russian products in America and their exchange for American goods. One of the chief objects which the company will have in view will be the encouragement of private capital to engage in trade in Russia and Siberia as shipping becomes available for the purpose. Its policy will be to coöperate with, encourage and promote such trade with Russia as will assist in the rehabilitation of her economic life, and to cover by its direct operations only such portions of the field as cannot at present be served readily by private enterprise. The head office of the Russian Bureau is in the War Trade Board Building at Washington, D. C.

THE KRANTZ MANUFACTURING COMPANY.—L. E. Schumacher, who for the last eight years has been chief inspector of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa., has been promoted to be works manager of the Krantz Manufacturing Company, Brooklyn, N. Y., the latest subsidiary of the former company. Prior to joining the Westinghouse company in June, 1900, he was employed by the Niagara Falls Power Company. His first duty at the Westinghouse plant was the erecting of switchboards. Two years later he was transferred to the testing department, where his previous experience was valuable in testing the various types of electrical apparatus. Later he was promoted to be general foreman of this department. In 1908 he was made assistant chief inspector, and in 1910 he became chief inspector, which position he has held until now. He is especially prepared by his long experience in the manufacture of safety switches, panelboards and floor boxes for his new position with the Krantz Manufacturing Company, as it makes a specialty of these products.

A. E. SCHUMACHER

PROCEDURE GOVERNING EXPORTS TO HOLLAND.—The War Trade Board announces that a trade arrangement has been concluded between the Netherlands government and the associated governments. Pursuant to said arrangement the following regulations, governing the procedure with respect to the issuance of licenses for the exportation of commodities to European Holland, are effective immediately. The previous announcement with respect to such regulations (W. T. B. R. 287, Oct. 25, 1918) is hereby withdrawn: (1) Exporters should apply for licenses to the War Trade Board, Bureau of Exports, Washington, D. C., using Form X and such supplemental information sheets concerning the commodity as are required. (2) Before filing applications for export licenses, exporters must obtain from the prospective importer in Holland advice that there has been issued by the Netherlands Overseas Trust an import certificate covering the proposed consignment. (3) The number of the import certificate of the Netherlands Overseas Trust should be forwarded by the importer in Holland to the American exporter and must be specified on Supplemental Information Sheet X-119 (or X-102), which must be duly executed and annexed to the application for export license before same is filed with the War Trade Board. (4) The War Trade Board will now consider applications for the exportation to European Holland of all commodities. (5) All shipments to European Holland must be consigned directly to and only to the Netherlands Overseas Trust. (6) Licenses will be valid only for shipment on vessels flying the Dutch flag.

UNIVERSAL MOTOR IN FOREIGN TRADE.—The possibilities in foreign trade for American manufacturers, large and small, regardless of location, are well illustrated by some recent shipments reported by the Universal Motor Company of Oshkosh, Wis., manufacturer of marine motors and electric generating outfits. These shipments are as follows: Raratonga, Cook's Island, generating outfit used with traveling moving-picture show; Soerabia, Java, six light sets for cane-sugar factories; Reykjavik, Iceland, electric generating sets; British Honduras, motor and lighting outfit for Jesuit mission boat; Shanghai, China, generating sets for moving-picture outfits; India, lighting outfit for palace of Indian potentate; Cook's Island, motor and lighting outfit for mission boat; Kano, Nigeria, generating set for moving-picture outfit. This last outfit was transported into the far interior—530 miles in a beeline from the coast town at which they left the ship. Shipments of 12-hp. marine motors have also been made to the following points: Valdivia, Chile; Acapulco, Mexico; Belize, British Honduras; Cienfuego, Cuba; Bombay, India, and London, Eng.

FEDERAL TRADE COMMISSION CALLS ATTENTION OF CONGRESS TO RESALE PRICE CONTROL.—The Federal Trade Commission has addressed Congress by way of a special report designed to direct attention to the subject of control of resale prices by the manufacturers of a class of articles in interstate commerce. The commission says: "The question is whether or not a manufacturer of standard articles, identified either by trademark or trade practice, should be permitted to fix by contract, express or implied, the price at which the purchaser can resell them. The question has been continuously before the commission since its creation. It has been the subject of study, investigation and hearing and constantly recurs, in various forms, in complaints filed with the commission by business concerns. The Supreme Court has made it clear that in the present state of the law the maintenance of a resale price by the producer is a restraint of trade and is unlawful. Such being the judgment of the Supreme Court, the Federal Trade Commission has enforced the law, even though it may have appeared to operate inequitably in some cases. In its enforcement of this rule the commission has been mindful that the cutting of a recognized resale price on well established and identified articles has been at times indulged in for unfair trade purposes. When so unfairly used such price cutting is attempted to be cloaked as lawful competition and justified by the Supreme Court decisions. Thus both price maintenance and price cutting under certain conditions are found to be unfair and business men are perplexed. It is with the desire that this perplexity may be terminated that the commission addresses the Congress. It is urged, and the commission believes with reason, that it would be unwise to vest with the manufacturers of articles the right, without check or review, both to fix and to compel the maintenance of resale prices. It is true that business practice inclines producers to fix the lowest possible retail price in order to secure the greatest possible sale of their product, but in the complex commercial organism functioning between the production of an article and its final sale for actual consumption both the wholesale and the retail merchant are entitled to just compensation for useful service performed. It is similarly urged that manufacturers should be protected in their good will created by years of fair dealing and of sustained quality of merchandise. There must be a common ground wherein the rights of producer, purveyor and consumer may each be fully secured and equity done to all. The search for such a ground has been a task of the commission and results in the following conclusions: (1) That producers of identified goods should be protected in their intangible property right or good-will; (2) that the unlimited power both to fix and to enforce and maintain a resale price may not be made lawful with safety; (3) that unrestrained price cutting is not in the public interest. Therefore it is recommended that it be provided by law that if the manufacturer of an article produced and sold under competitive conditions desires to fix and maintain resale prices, he shall file with an agency designated by the Congress a description of such article, the contract of sale and the price schedule which he proposes to maintain, and that the agency designated by the Congress be charged with the duty, either upon its own initiative or upon complaint of any dealer or consumer or other party in interest, to review the terms of such contract and to revise such prices, and that any data and information needful for a determination be made available to such agency."

TAPE AND WIRE PRODUCTION COST INVESTIGATION.—The Federal Trade Commission during November at the request of the War Department instituted inquiries into the cost of production on tape and webbing and also insulated copper wire.

SHIPMENTS TO OR FROM CANADA THROUGH THE UNITED STATES.—The War Trade Board announces that it has arranged with the War Trade Board of the Dominion of Canada to coördinate their respective policies of export and import control. Regulations have been adopted for the purpose of simplifying the procedure for the licensing of goods in transit from Canada or to Canada through the United States. The War Trade Board has issued a special import license, No. PBF-25, authorizing the importation into the United States, without individual import license, of shipments of all commodities originating in or destined to Canada when the same are conveyed in transit through the territory or via any port of the United States. The War Trade Board has also issued a special export license, No. RAC-56, authorizing the exportation, without individual license, of such shipments.

CUTLER-HAMMER SALES CONFERENCE.—During the week ended Dec. 7 the Cutler-Hammer Manufacturing Company held a five-day sales conference in Milwaukee for the benefit of its men who direct the district office sales of wiring devices, push-button specialties and molded insulation. The conference was in charge of W. C. Stevens, sales manager; A. H. Fleet, manager of the wiring devices department, and Edward Karl. New devices, methods of manufacturing wiring devices and molded insulation products, advertising and selling plans, with special reference to increased sales during the reconstruction period, were some of the important subjects taken up. The wiring-device salesmen in the various district offices were represented by M. F. Coyne, Boston; F. J. Walker, New York; G. W. Donkin, Pittsburgh; C. N. Gilmore, Cleveland, and Z. S. Myers, Chicago.

THE DUDLEY-CURRY ELECTRIC COMPANY, New York City, has moved to 39 Cortland Street.

S. E. COLE has succeeded the late Charles F. Simms in the management of the Omaha office of the H. W. Johns-Manville Company.

THE BUTTE ENGINEERING & ELECTRIC COMPANY of San Francisco announces the removal of its offices and plant to 530 Folsom Street.

W. G. MORSE, who retired from the post of purchasing agent of the New England Engineering Company, Waterbury, Conn., about a year ago, has been recalled to his former position.

THE MONARCH ELECTRIC MOTOR COMPANY, Morris Benjamin, proprietor, has moved from 212 Centre Street, New York City, to larger quarters at 166 Centre Street, corner Canal Street.

W. F. KECKEISEN, formerly advertising manager of the International Filter Company and previously associated with the Federal Sign Company, has joined the staff of Russell T. Gray, advertising engineer, Chicago.

S. M. MOORE, in charge of the motor department of the New England Engineering Company, Waterbury, Conn., for the past year, has joined the staff of Fred T. Ley & Company, contractors, with headquarters at Brunswick, Ga.

THE ROBBINS & MYERS COMPANY, Springfield, Ohio, it is learned, completed its order for 16,000 fans ordered for naval use well ahead of schedule. The entire order was filled only a few days after cessation of hostilities.

THE AJAX ELECTRIC SPECIALTY COMPANY, manufacturer of telephone apparatus and electrical specialties, St. Louis, Mo., announces that it has appointed Champion & Ryan, 299 Broadway, New York City, as its Eastern representatives, to take care of territory embracing Philadelphia, Boston and New York and exportation.

THE F. BISSELL COMPANY, jobber and manufacturer of electrical supplies and machinery, Toledo, Ohio, announces that George B. McNary has resigned as director and secretary in charge of purchases of the company. John S. Huff succeeds him as purchasing agent with Abram A. Cochran as assistant purchasing agent. Mr. McNary has accepted an attractive position with the Willys-Overland Company.

THE McCORMICK LUMBER COMPANY, McCormick, Wash., manufacturer of Douglas-fir cross-arms and lumber, is contemplating the purchase of new generating equipment for approximately 600 kva. to drive additional sawmill equipment which will be installed shortly.

THE FRANCE MANUFACTURING COMPANY of Cleveland, maker of F-F battery boosters, announces the appointment of Champion & Ryan, 299 Broadway, New York City, as its exclusive factory representatives in New York City, Boston, Philadelphia and adjacent territory.

THE ROLLER-SMITH COMPANY, New York City, announces the appointment of W. A. McCombs & Company, Union Arcade Building, Pittsburgh, Pa., as its agent in the State of Pennsylvania west of Altoona and the entire State of West Virginia, to handle the Roller-Smith lines of instruments, circuit breakers and meters.

THE WELLMAN-SEAVER-MORGAN COMPANY, Akron, Ohio, desires to announce to the rubber-manufacturing trade the formation of a complete rubber machinery department. Inquiries are solicited on rubber calenders, mixing and grinding mills, tubing machines, vulcanizing presses, molds and cores, etc., iron and steel castings and jobbing work of all kinds. The combination of modern manufacturing facilities and a highly developed engineering organization is placed at the service of the rubber-manufacturing trade. The company's facilities include iron, steel and brass foundries, pattern shops, forge shops, structural shops and fully equipped machine shops.

THE GENERAL MOTORS COMPANY has bought the equipment and rights of the Guardian Frigerator Company of Detroit and will utilize Cadillac plant No. 5 in manufacture of this product. The "frigerator," a large insulated box in which food is kept cold by an electric motor, will be marketed through General Motors dealers and distributers and will be sold to the dealers on the same basis as cars with a slightly greater profit offered on sales. Agencies will be established in Washington, Atlanta, Buffalo, New York, Pittsburgh, Philadelphia, Cincinnati and Dayton. The new company will be styled the Frigidaire Company. A. W. Mellows, inventor of the "frigerator" and founder of the Guardian company, will retain an interest in the new company.

THE ELECTRO DYNAMIC COMPANY of Bayonne, N. J., which formerly manufactured the electric car-lighting equipment for the Consolidated Railway Electric Lighting & Equipment Company, has bought the entire stock in trade, assets, good will, etc., of the latter company and will continue to manufacture and sell the "axle light" equipment formerly sold by the Consolidated company, together with all repair parts for Consolidated equipments now in service on the railroads. The Electro Dynamic Company is controlled by the Submarine Boat Corporation and is well known in the railway field as the manufacturer of "Edco" interpole motors for railway shop use, machine tools and submarines. A separate department of the Electro Dynamic Company has been created, known as the "axle light department," to handle this work. There will be no interruption of the former Consolidated business, and the Electro Dynamic Company is now in position to make prompt deliveries on the repair parts of all "axle light" equipments sold and in service on the railways during the last fifteen years.

Trade Publications

ELECTRIC VALVE GRINDER. — A valve grinder suitable for repair shops is described in a circular sent out by the Stenman Electric Valve Company, Worcester, Mass.

BLUE PRINT DISPLAYER.—Fixtures for displaying plans, blue prints and maps for ready reference are described in a circular issued by the Universal Fixture Company, 133 West Twenty-third Street, New York City.

GROUNDING EQUIPMENT.—A number of leaflets and circulars have been issued by the Paragon Electric Company, Old Colony Building, Chicago, regarding Paragon ground cones and cylinders for electric light and power installations, telephone and telegraph work and for railroad and trolley systems. "How to Protect Your Valuable Equipment" describes the grounds as well as giving prices, discounts and sizes. Directions for installation are given in a separate circular, while a post-hole auger for simplifying this operation forms the subject of a third publication.

INSULATING BRICK.—The Quigley Furnace Specialties Company, Inc., 25 Cortlandt Street, New York City, in a recent leaflet, tells about its "Insulbrix," a cellular refractory brick for keeping heat in or out of furnaces and other structures.

KNIFE SWITCHES.—Catalog No. 11 of the Trumbull Electric Manufacturing Company, Plainville, Conn., sets forth dimensional and cost data for the switches and other electrical accessories made by the company. A thumb index is a useful feature of the catalog.

MOTOR-STARTING SWITCH.—A two-page envelope folder concerning inclosed switches for starting squirrel-cage motors is being distributed by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. The folder gives necessary dimensions for installing these switches.

ELECTRICAL PYROMETERS.—A very complete line of electrical pyrometers is shown in catalog No. 11 of the Brown Instrument Company, Philadelphia. In addition to prices and general specifications for the apparatus there is much useful information concerning the various applications and installation of these pyrometers.

STANDARD BUILDING TRUSSES.—For use in all kinds of mill buildings, storage houses or substations, the Milliken Brothers Manufacturing Company, Woolworth Building, New York City, has standardized steel trusses to facilitate rapid construction. The system is covered in a bulletin called "Space and Speed in Steel Buildings."

COAL AND ASH CONVEYORS.—Much useful information is contained in Book No. 353 just received from the Link-Belt Company, Thirty-ninth Street and Stewart Avenue, Chicago. This publication covers the handling of coal and ashes in the power plant and also deals with the handling of stored coal. A number of plans are given for each of these problems.

STEAM-POWER PLANT ACCESSORIES.—"Service to Power Users" is the title of a 152-page book just issued by the H. W. Johns-Manville Company, New York. It deals particularly with heat-insulating material, steam packing and fuses. An attempt is made to include the most important engineering data and specifications which a buyer would be interested in.

New Incorporations

THE DOMESTIC ELECTRIC EQUIPMENT COMPANY of Romney, W. Va., has been incorporated by G. F. Staub, H. C. Sanderson, J. Sloan Kuykendall and others. The company is capitalized at $25,000.

THE GEORGIA-ALABAMA POWER COMPANY of Lexington, N. H., has been chartered by Dermott Shemwell, J. E. Foy and others. The company is capitalized at $3,000,000 and proposes to develop water power and generate electricity.

THE WILLIS MITCHELL HEAT & POWER COMPANY of Kittery, Me., has been incorporated with a capital stock of $250,000 to manufacture and deal in machinery and equipment, etc., used in generating light, heat and power.

THE D-G STORAGE BATTERY COMPANY has filed articles of incorporation under the laws of the State of Delaware. The company is capitalized at $550,000, and the incorporators are C. L. Rimlinger, M. M. Clancy and P. B. Drew of Wilmington, Del.

THE BAY CITIES (TEX.) UTILITIES COMPANY has been incorporated with a capital stock of $40,000 by H. W. Caldwell, V. L. Letulle and Martin Thompson. The company proposes to install and operate an electric light plant and waterworks system in Bay City.

THE PITT RIVER POWER COMPANY of San Francisco, Cal., has been incorporated by C. W. Durbrow, W. F. Cordes and Dudley Moulton. The company is capitalized at $2,500,000 and proposes to develop electric energy in California to operate tramways and railway locomotives, vehicles and manufacturing plants and also for lighting and heating purposes.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

MANCHESTER, N. H.—Plans are being prepared for the installation of a new lighting system on Elm Street from Spruce Street to Orange Street. The street was formerly lighted by arches which have been discontinued and ordered removed. The Manchester Traction, Light & Power Company has submitted several designs for the new system.

PITTSFIELD, MASS.—The Berkshire Street Railway Company has notified the Secretary of the Commonwealth of its intention to petition the incoming Legislature for permission to sell electricity for commercial and other purposes.

LITCHFIELD, CONN.—Work has begun on the construction of a two-story addition, 40 ft. by 80 ft., at the works of the Trumbull Vanderpool Electric Manufacturing Company in the Bantam section of Litchfield. The cost of the building is estimated at $20,000.

Middle Atlantic States

BALDWINSVILLE, N. Y.—The Seneca River Power Company has petitioned the Public Service Commission for authority to acquire the capital stock of the Oswego River Power Transmission Company of Syracuse and to increase its capital stock to $200,000. An agreement has already been entered into for the purchase of the stock.

BROOKLYN, N. Y.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the construction of a new machine and electrical shop at the local navy yard to the Lustbader Construction Company, 103 Park Avenue, New York City.

BUFFALO, N. Y.—Contract has been awarded by the Monarch Knitting Company, 19 Doat Street, Buffalo, for the construction of the proposed boiler house at its works on Rustic Place.

BUFFALO, N. Y.—Plans are under consideration by the International Railway Company for extensions to its system in Franklin Street, Bailey Avenue and Abbott Road. The cost of the proposed work is estimated at about $750,000.

BUFFALO, N. Y.—The Salmon River Company is considering the construction of another hydroelectric power plant, including a dam, power house and pipe line near Altmar, for which surveys are now being made. Preparations are also being made by the company to raise the crest of its dam in Redfield 10 ft. Dexter P. Cooper has general supervision of the work.

GLENS FALLS, N. Y.—The Adirondack Electric Power Corporation has petitioned the Public Service Commission for permission to purchase the property of five other companies operating in the Mohawk Valley, including the Schenectady (N. Y.) Illuminating Company, the Mohawk Gas Company, the Schenectady Power Company, the Edison Electric Light & Power Company of Amsterdam, and the East Creek Electric Light & Power Company, of St. Johnsville. The company has also asked for authority to issue $8,300,000 in capital stock, $2,500,000 in bonds and a small amount in two-year notes, the proceeds to be used for completing the consolidation. If the merger is approved, it is planned to build a new storage reservoir on East Canada Creek, near Little Falls, to feed the central and eastern part of the territory. The cost is estimated at about $2,000,000.

JAMESTOWN, N. Y.—The old power house of the Jamestown Lighting & Power Company, located in Race Alley, near Brooklyn Square, has been destroyed by fire, causing a loss of about $10,000. The building was unoccupied.

LONG ISLAND CITY, N. Y.—Bids, it is understood, will soon be asked by S. Karpen & Brothers, 68 Thirty-fourth Street, Brooklyn, for their proposed furniture and woodworking plant to be erected on Jackson Avenue, near Hulst Avenue, Long Island City. The cost is estimated at $750,000.

MOUNT KISCO, N. Y.—The local telephone exchange was recently destroyed by fire, causing a loss of about $150,000.

NEW YORK, N. Y.—Plans have been prepared by the Standard Concrete Steel Company, 105 West Fortieth Street, New York, for a one-story-and-basement machine shop, 110 ft. by 225 ft., on 151st Street near Amsterdam Avenue, to cost about $100,000.

PENN YAN, N. Y.—The Penn Yan & Lake Shore Railway Company is contemplating extending its railway from Branchport to Hammondsport, a distance of 12 miles.

ROME, N. Y.—Ground has been broken by the Rome Gas, Electric Light & Power Company for the construction of a new transformer station, 20 ft. by 25 ft., at its plant. A. B. Morton is manager.

SYRACUSE, N. Y.—The Board of Supervisors has approved the appropriation of $31,408 in connection with the budget for the operation of the Onondaga Tuberculosis Sanitarium, to be used for improvements in the power plant and the installation of a new underground piping system.

SYRACUSE, N. Y.—A committee appointed by Mayor Stone to make investigations relative to establishing a municipal electric plant has submitted a report favoring municipal ownership of a lighting plant and has recommended the purchase of the system of the Syracuse Lighting Company, the proposal to be submitted to the voters.

WATERTOWN, N. Y.—Plans, it is reported, have been submitted by the Samuel M. Green Company, hydraulic engineer and contractor, of Springfield, Mass., for the construction of a power plant on Beebe Island, to cost about $500,000. The following companies are said to be interested in the project: Knowlton Brothers, Inc., the New York Air Brake Company, J. B. Wise, Inc., George A. Lance and A. G. Herrick & Son.

ATLANTIC CITY, N. J.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 13, 1919, for wiring in the United States public building at Atlantic City. Further information may be obtained at the above office.

NEWARK, N. J.—The contract existing between the City Commission and the Public Lighting Service Corporation, 38 Murray Street, New York, N. Y., covering the operation of 2000 lamps in various parts of the city, has been rescinded for the failure to maintain proper service.

NEW BRUNSWICK, N. J.—Plans have bee completed by the Board of City Commissioners for a new boiler house at Weston's Mill Pond for the municipal waterworks.

TRENTON, N. J.—The Board of Public Utility Commissioners has ordered the Trenton & Mercer County Traction Company to make improvements to its system, including the completion of a signal system, the installation of new cross-arms, insulator pins and insulators, new feeder lines and repairs to ground system. This work will also include considerable rail construction, as well as the installation of fire-protection facilities at the car barns and shops of the company. Arrangements, it is understood, are under way for extensions in the system from the present Trenton Junction division terminus at Grand Avenue to Ewing Avenue a distance of about three-quarters of a mile.

ERIE, PA.—Plans have been prepared by the Electric Materials Company for the construction of an addition to its plant, to cost about $5000.

HARRISBURG, PA.—Plans are under consideration by the City Council for extension in the underground conduits for the fire and police alarm systems. It is proposed to connect Briggs, North Court and Cowden Streets.

McKEESPORT, PA.—Ground has been broken for the construction of a coal-handling plant and pumping station at the works of the Fierth-Sterling Company, to cost about $200,000.

NATRONA, PA.—The Pennsylvania Salt Company is planning to install new ash-handling equipment at its local power station.

PHILADELPHIA, PA.—Notice has been filed by the Lewis & Roth Company, Broad and Chestnut Streets, Philadelphia, of an increase in capital stock from $50,000 to $225,000. The company manufactures electric equipment.

PHILADELPHIA, PA.—Contract has been awarded by the Pennsylvania Railroad Company for an addition to its power plant at Butler Street and Glenwood Avenue, to cost about $5,000. The company has also awarded contract to Irwin & Leighton 126 North Twelfth Street, Philadelphia, for the construction of an extension to its engine house at Shire Oaks, to cost about $100,000.

PHILADELPHIA, PA.—The Navy Department, Washington, D. C., is arranging for an appropriation of $5,000,000 for extensions and betterments at the League Island Navy Yard, including the erection of a number of new buildings with the installation of considerable electric machinery and equipment. The plans provide for the erection of a machine shop for light work, at a cost of $400,000, to be equipped with electric motor-driven machinery; a new pattern shop, $400,000; pipe and copper shop, $400,000; new pier for fitting out service, embracing turret, gun and armor installations, $1,000,000. Operating as well as hauling and conveying apparatus will be electrically driven in the various buildings. It is also proposed to complete the new dry dock now in course of construction, at a cost of $1,500,000, and to provide facilities for storing steel, lumber and other commodities, at a cost of $400,000.

BALTIMORE, MD.—Extensive improvements are contemplated by the Water Department during 1919, including the installation of a 30,000,000-gal. pump at the Mount Royal pumping station, to cost about $100,000; a turbo-generator to be used in motorization of auxiliary units in Mount Royal station, to cost about $7 500. An expenditure of $26,000 for operating tables at the Lake Montebello filtration plant is also contemplated. An appropriation, it is understood, has been made to provide funds for the proposed work. Walter E. Lee is engineer.

ELKTON, MD.—The A. J. Reach Company, Tulip and Palmer Streets, Philadelphia, is planning to build a boiler plant at its local works.

HOLDEN, W. VA.—Plans are under consideration by the Island Creek Coal Company for the installation of two large boilers in its power plant. A. R. Beisel is general manager.

MOUNDSVILLE, W. VA.—The Ben Franklin Coal Company is considering the construction of a coal tipple at its local properties. The plans provide for the installation of a mechanical coal-handling system. D. T. Burton, Marshall County Bank Building, Moundsville, is engineer.

NEWTON, W. VA.—Plans are under consideration by the Manganese Steel Casting Company for the construction of a new plant, to cost about $300,000. The plans provide for the erection of a large power plant and the installation of four 10-ton electric furnaces.

TIOGA, W. VA.—The Tioga Coal Company is contemplating the purchase of new electrically operated machinery including generators, motors and accessories, for installation at its local coal properties.

WINDSOR, W. VA.—The West Penn Power Company of Pittsburgh, Pa., is reported to be considering the installation of an additional 30,000-kw. electric generating unit, with auxiliary equipment, in its local plant next year. A 30 000-kw. unit is now being installed at the plant.

NORFOLK, VA.—Plans are under consideration by the City Council for the purchase of the local power plant of the Virginia Railway & Power Company with a view of controlling the heat, light and power systems in this section.

NORFOLK, VA.—The Norfolk Glass Manufacturing Corporation, Virginia National Bank Building, has received bids for the construction of a plant for the manufacture of glass bottles and jars to cost about $200,000. The plant will be equipped with electrically driven machinery. Bids, it is understood, have also been received for machinery. Dixon & Company of Pittsburgh, Pa., are construction engineers.

BELLEVUE, D. C.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., is considering the installation of electric traveling cranes, to cost about $30,000, at the local yard.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 30, under Specification 3681, for installing at the Washington Navy Yard two 2-ton electric traveling cranes, to cost about $21,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows. Until Dec. 20, Mare Island, Cal., Schedule 7365½—one switchboard. Brooklyn, N. Y., Schedule 7383½—one motor-driven lathe. Until Dec. 23, Puget Sound, Wash., Schedule 7320½—14 alternating-current motors, seven follower rests, seven taper attachments and seven steel or scroll geared chucks. Until Dec. 27, Philadelphia, Pa., Schedule 7377½—15 cable carts. Mare Island, Cal., Schedule 7382½—two generating sets and two sets of engine parts. Bids will also be received in the near future as follows: Puget Sound, Wash., Schedule 3555—40 ventilating sets. Brooklyn, N. Y., Schedule 7280½—one heavy duty shaper, 100 lamp guards, one motor-driven grindstone, one motor-driven planer, one motor-driven lathe, etc.; Schedule 7411½—1000 ft. lighting and power cable and 10,000 ft. weatherproof wire. Washington, D. C., Schedule 7392½ — switchboard panels; Schedule 7396½—one power crusher, one grinding apparatus, one hacksaw, one drill press, one electric drill, one inverted metalloscope, one millimeter, one mortar grinder, one assayer's furnace, one electric furnace and six testing machines. Norfolk, Va., Schedule 7409½—15 commutator rectifiers; Schedule 7430½—525 insulators, 600 volts; 4560 T-rails, 350 steel plates and 325 terminal bonds. Brooklyn, N. Y., Schedule 7420½—five motor-driven lathes and one band saw. Mare Island, Cal., Schedule 7427½—for furnishing and installing twenty elevator gates; Schedule 7423½—miscellaneous electrical apparatus. Newport, R. I., Schedule 7432½—one trolley hoist. Applications for proposal blanks should designate the schedule desired by number.

North Central States

CLEVELAND, OHIO.—The Leece-Neville Company, 5353 Hamilton Avenue, Cleveland, has taken over the manufacture and sale of the Wright industrial electric trucks and tractors, formerly made by the Wright-Hibbard Company of Buffalo, N. Y. and contemplates increasing the output. The company manufactures automobile lighting and starting equipment.

LIMA, OHIO.—A movement has been started to establish a municipal electric light plant in Lima.

MOUNT STERLING, OHIO.—Bids will be received by George W. Tanner, village clerk, until Dec. 16, for $10,000 in water and light bonds.

DANVILLE, KY.—Plans, it is reported, are under consideration by L. B. Herrington of Richmond and associates for the construction of a dam across the Dix River, 7 miles from Dixville. The proposed dam is to be 100 ft. high and to back up water 15 miles. The power will be used to generate electricity, which will be distributed in Danville, Lexington, Lancaster, Nicholasville and Richmond. The cost of the project is estimated at about $4,000,0000.

GREENUP, KY.—The City Council is considering rebuilding the local electric light plant, recently destroyed by fire.

RICHMOND, IND.—The City Council has appointed a special committee of citizens to act with a committee of members of the Council to investigate the needs of the municipal electric light and power plant. Owing to the increasing demands for both lighting and power service the installation of additional equipment will be necessary to meet the demands.

SUPERIOR, WIS.—Plans are being prepared by the Globe Shipbuilding Company for the installation of a new steam generating plant, to cost about $25,000.

BUCK GROVE, IOWA.—The City Council is considering calling an election to vote on the proposal to issue bonds for the installation of a complete new plant.

DES MOINES, IOWA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 3, 1919, for conduit and wiring and lighting fixtures in the old United States court house at Des Moines. For details see Searchlight Section.

FORT DODGE, IOWA.—The Minneapolis & St. Louis Railway Company of Minneapolis, Minn., is contemplating the construction of a terminal plant in Fort Dodge, including engine house, machine shop, boiler plant and power house.

ALTENBURG, MO. — The Altenburg Light & Power Company is planning to rebuild its plant, recently destroyed by fire. About $19,000 will be spent for equipment.

HARWOOD, MO.—The Schell City (Mo.) Light Company, it is reported, is contemplating extending its electric transmission line to Harwood.

MACON, MO.—An additional 450-kva. generating unit (directly connected) with condenser and spray pond will be installed in the municipal electric light plant. Frank L. Wilcox, Syndicate Trust Building, St. Louis, is consulting engineer.

ST. LOUIS, MO.—Plans are being prepared for the construction of a new power plant for the Inland Machine Works, Locust Street, to cost about $200,000. Bids for the work, it is understood, will be asked for early in the year. John Flammang is president.

SCHELL CITY, MO.—The Schell City Light Company is contemplating the construction of an electric transmission line to Harwood, a distance of 6 miles.

SUMNER, MO.—The Sumner Electric Company is contemplating erecting an electric transmission line to Forker.

WESTON, MO.—At an election held recently the proposal to issue $20,000 in bonds for establishing a municipal electric light plant in Weston was carried.

SIOUX FALLS, S. D.—Bonds to the amount of $30,000 for the municipal electric light plant have been authorized.

WESSINGTON SPRINGS, S. D.—Bonds to the amount of $20,000 have been authorized for the municipal electric light plant.

LOGAN, KAN.—Petitions are being circulated asking that an election be called to vote on the proposal to issue $15,000 in bonds for improvements to the municipal electric light plant and waterworks system.

Southern States

FAYETTEVILLE, N. C.—Application has been made to the City Council by Herbert L. Jones of Richmond, Va., for a franchise to construct and operate an electric street railway in Fayetteville.

CHARLESTON, S. C.—The Western Union Telegraph Company is contemplating the installation of new equipment, to cost about $50,000, at its building on East Bay Street, now being remodeled.

WILLINGTON, S. C.—Plans are being prepared by G. Lloyd Preacher, Masonic Temple, Augusta, Ga., for the first unit of buildings for the John de la Howe Industrial School at Willington. The present plans include school building, two dormitories and two residences. The ultimate plans provide for from fifteen to twenty buildings at a total cost of $500,000; $100,000 is available at present. It is also proposed to develop water power, erect dairies, etc. Rev. H. B. Blakely is superintendent and treasurer.

SARASTOTA, FLA.—At an election to be held Dec. 23 a proposal to issue $80,000 in bonds, the proceeds to be used to purchase, improve and enlarge the plant of the Sarastota Ice & Electric Company, will be submitted to the voters.

SOUTH JACKSONVILLE, FLA.—Plans are under consideration for an addition to the municipal electric light plant.

ANNISTON, ALA.—The Woodstock Operating Corporation is contemplating increasing the output of its power station, including the installation of new generating equipment and accessories. The company is also considering the purchase of electrically operated lifting magnets in connection with transportation work at its plant.

MARKS, MISS.—The Leach-Nobles Ice Company contemplates the purchase of ice-making machinery, at about $15,000.

NEW ORLEANS, LA.—Plans are under consideration by the New Orleans Boiler Works for the installation of new machinery and equipment at their plant.

NEW ORLEANS, LA.—The Well Electric Works, 821 Perdido Street, New Orleans, is reported, to be in the market for the following equipment: Two 100-kw. generators with switchboard, one 200-kw. three-phase, 22,000-volt, 60-cycle, alternating-current generator driven by a crude-oil engine, directly connected; three 50-hp. vertical motors, six 15-hp. vertical motors, all for the above generator; also about 15 miles of used copper wire, bare or insulated, sizes Nos. 4. 6 or 8. The company will consider horizontal motors if no vertical motors are available; also belt-driven alternators and belted engines if directly connected ones cannot be had.

ADA, OKLA.—The first unit of the large plant of the Oklahoma Power & Transmission Company at Byng, 6 miles from Ada, has been completed. This plant, when completed, will furnish electricity for lighting many towns in this district and power for many industries.

ARDMORE, OKLA.—Plans are under consideration by I. M. Putnam and others interested in the Ardmore Street Railway Company for the construction of an interurban electric railroad from Ardmore to Oklahoma City, Duncan and Sherman or Denison, Tex. The plans include erection of power plant, etc.

BAY CITY, TEX.—The Bay City Utilities Company, recently incorporated with a capital stock of $40,000, is contemplating the installation of an electric light plant and waterworks system in Bay City. H. W. Caldwell is interested in the company.

HOUSTON, TEX.—Plans are being prepared for improvements to the central water plant, including the installation of deep-well pumps, motors, electric generator, etc. It is proposed to change from air-lift system to centrifugal pump lift. E. E. Sands is city engineer.

RANGER, TEX.—Plans are under consideration by the Chamber of Commerce for establishing an electric lighting system in Ranger.

Pacific and Mountain States

McCORMICK, WASH.—The McCormick Lumber Company is contemplating the purchase of new generating equipment for approximately 600 kva. to drive additional sawmill machinery which will be installed shortly. George D. McCormick is vice-president and manager.

OLYMPIA, WASH.—Work has been begun by the Olympic Smelters, Inc., on the construction of a hydroelectric plant at its manganese mines in the Olympic Mountains in connection with two electric smelting furnaces. H. H. Piper is manager.

ASTORIA, ORE.—The Port of Astoria is considering the establishment of a coaling station. The cost is estimated at about $500,000.

MARSHFIELD, ORE.—The C. A. Lumber Company, which furnishes electricity to the Coos Bay and Coquille Valley districts, is planning improvements to its plant involving an expenditure of more than $50,000. The company has recently purchased four new boilers. A. G. Stearns is general manager.

MARE ISLAND, CAL.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 16 (extension of date from Dec. 2), for furnishing at Mare Island, under Specification 3240, electric traveling cranes for structural shop.

OCEANSIDE, CAL.—Plans are under consideration by the Board of Trustees for the installation of an electric power plant in connection with the waterworks system.

SAN FRANCISCO, CAL.—Extensions of time have been granted by the Railroad Commission to the Coast Valleys Gas & Electric Company, the Sierra & San Francisco Power Company, the California-Oregon Power Company, the San José Railroads, the Peninsula Railway Company, the San Joaquin Light & Power Corporation and the Midland Counties Public Service Corporation to comply with the provisions of the state law known as the safety act, under which they must reconstruct their overhead lines.

SAN FRANCISCO, CAL.—Recommendations have been made by Major George F. Sever, special representative of the War Industries Board, for the erection of hydroelectric power plants at various locations in northern California to develop a total of 128,000 hp. within the next three years. Included in the proposed plans is the construction of a new generating station of 40,000 kw. capacity on Butte Creek by the Western Power Company of San Francisco, the construction of a unit on the South Yuba-Bear River development of the Pacific Gas & Electric Company of San Francisco, the erection of a hydroelectric power station by the Sierra & San Francisco Power Company of San Francisco on Stanislaus River, and the construction of a generating station by the government at Sheep Rocks on the Pitt River, with a steel tower transmission line to connect with the systems of the Sierra & San Francisco Power Company, the Pacific Gas & Electric Company and the Great Western Power Company. The project calls for an expenditure of about $20,000,000.

STOCKTON, CAL.—The construction of a new storage reservoir in connection with an electric power plant, to be known as the Don Pedro storage reservoir, is under consideration by the directors of the Modesto and Turlock irrigation districts. The plans provide for a water capacity of 260,000 acre-ft., with a hydroelectric power plant, the initial installation to have a capacity of from 6000 hp. to 10,000 hp.

Canada

MAPLETON, MAN.—The Manitoba Steel Foundry Company has awarded the steel contract in connection with the construction of its proposed power house to the Dominion Bridge Company, Canada Building, Winnipeg. The cost of the power house is estimated at about $10,000.

PETERBORO, ONT. — The Peterboro Street Railway Company is contemplating building an extension from Charlotte to Patterson Street.

Record of Electrical Patents

Notes on United States Patents

(Issued Nov. 5, 1918)

1,284,036. Instrument to Aid the Hearing; Carl Anderson, New York, N. Y. App. filed Nov. 10, 1917. Transmitter may be modified to fit individual peculiarities of deafness.

1,284,042. Means and Apparatus for Depositing and Collecting Aqueous Particles from the Atmosphere and Collecting Rain and Dew; John G. Balsillie, Melbourne, Victoria, Australia. App. filed Dec. 23, 1916. Operates as a natural catchment when collecting rainfall, as a thermal catchment when collecting dew, and when collecting aqueous particles from the atmosphere operates in conjunction with electrical means.

1,284,054. Ignition System; Ivar W. Broegger, Newark, N. J. App. filed April 26, 1917. To overcome trouble tending to destroy the coil.

1,284,090. Electric Rail Bond; Fred W. Gordon, New York, N. Y. App. filed June 29, 1915. Formed by welding and admits relative movement of bonded rails under action of contraction and expansion.

1,284,104. Electric Flatiron; De Witt C. Helman, Portland, Ore. App. filed March 12, 1917. Current cut off when iron is left sitting flat-wise and connected when picked up or stood on end.

1,284,110. Insulator and Bracket; Ewald E. Johnson, St. Charles, Ill. App. filed May 9, 1918. Pull from the dead end of the wire is laterally in a horizontal direction against the cross-arm.

1,284,134. Electric Signaling System for Motor Vehicles; Joseph P. Ogden, Lynn, Mass. App. filed March 24, 1917. May be operated by foot to operate the signals individually or collectively.

1,284,155. Electric Gun; Henry F. Shartzer, Leitchfield, Ky. App. filed June 13, 1917. For directing Hertzian waves in any direction desired to energize apparatus located at a distance and adapted to receive the waves to release explosives or the like.

1,284,189. Heater for Type-Setting Machines; William S. Hadaway, Jr., New Rochelle, N. Y. App. filed March 28, 1914. For supplying heat to the mouth and throat of melting pots.

(Issued Nov. 12, 1918)

1,284,206. Calling Device; Edgar W. Adams, East Orange, N. J. App. filed April 24, 1917. For use with automatic telephone systems to increase capacity of exchange.

1,284,216. Vapor Converter; Fannon F. Beauchamp, Kansas City, Kan. App. filed Dec. 1, 1916. Means for automatically controlling temperature and rate of flow of the circulating medium in the anode-cooling system of a vapor converter.

1,284,219. Starting Device for La Cour Motors; George R. Benjamin, Jersey City, N. J. App. filed July 3, 1915. Once the wheel of motor is given slight rotative motion, that rotation will be continued with progressively increasing speed until the wheel reaches proper speed.

1,284,223. Regulating Means for Battery Charging; William L. Bliss, Niagara Falls, N. Y. App. filed April 29, 1911. To cause the generator to supply sufficient current to the battery to compensate for discharge.

1,284,224. System of Regulation for Dynamo-Electric Machines; Clarence A. Boddie, Pittsburgh, Pa. App. filed April 12, 1916. Relates particularly to voltage and current regulators in which regulation is effected by rapidly opening and closing a circuit in shunt with resistor connected in series with the field-magnet winding of the dynamo-electric machine.

1,284,230. Excess Wattmeter; Alfred W. Burke, Wilmington, Del. App. filed Aug. 23, 1915. To correct automatically the error in recording wattmeters used on alternating-current circuits due to increase or decrease in line voltage.

1,284,231. Excess Wattmeter; Alfred W. Burke, Wilmington, Del. App. filed Feb. 24, 1916. Will record only excess energy used over a predetermined quantity and is substantially unaffected in accuracy by ordinary changes in line voltage.

1,284,239. Automatic Train-Control Apparatus; Thomas E. Clark, Detroit, Mich. App. filed Feb. 26, 1912. For use with block-signal systems for railways.

1,284,212. Semi-Automatic Telephone System; George A. Yanochowski, Chicago, Ill. App. filed Aug. 25, 1914. Means for signaling operator and enabling operator to register the call.

1,284,247. Renewable Cartridge Fuse; John M. Coote, Elizabeth, N. J. App. filed April 13, 1917. Ferrule portion is composed of but two parts.

1,284,258. Wrapping Machine; Thomas A. Dicks, Wilkinsburg, and Israel L. Griffith, Pittsburgh, Pa. App. filed Jan. 18, 1915. Has special reference to applying insulating wrappings to coil bars of dynamo-electric machines.

1,284,266. Electric Motor-Control System; Arthur C. Eastwood, Cleveland, Ohio. App. filed April 26, 1916. May be easily and quickly adapted to different motor-starting requirements.

1,284,274. Common-Battery Telephone-Exchange Trunking System; John Erickson, Chicago, Ill. App. filed March 27, 1908. Relates to automatic or semi-automatic systems in which current for talking purposes is supplied to subscribers' stations from one or more batteries at the exchange or central station.

1,284,291. Weatherproof Outlet; Louis Fort, Jersey City, N. J. App. filed March 29, 1915. Is applicable to conduits whether they are arranged horizontally or vertically.

1,284,292. System of Distribution; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed March 13, 1916. Has special relation to phase-modifying means whereby polyhphase apparatus, such as motors, generators, rotary converters and the like may be operated from single-phase power-supply circuits.

1,284,293. System of Distribution; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed March 13, 1916. Relates particularly to phase-splitting devices and control systems whereby polyphase apparatus may operate on single-phase power-supply circuits.

1,284,294. System of Distribution; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed March 19, 1917. Relates to polyphase systems of distribution. Circuits may be controlled to keep balanced load.

1,284,304. Electromagnetic Transmission Apparatus; Valere A. Flynn, St. Louis, Mo. App. filed May 9, 1916. Electromagnetic mechanism by means of which the power delivered by a prime mover can be efficiently transmitted to a driven member at different speed and torque.

1,284,306. Electrode Holder; George W. Gardner, Lebanon, Pa. App. filed March 29, 1918. To provide an electrode holder for heavy duty whereby the electrode and holder are aligned evenly.

1,284,326. Control System for Bridge-Type Phase Splitters; Max Hartenheim, Pittsburgh, Pa. App. filed Feb. 10, 1916. Relates to control systems for polyphase apparatus that may operate on single-phase circuits through the intermediary of phase-splitting devices.

1,284,328. Theft-Alarm System for Automobiles; Frederick Haynes, Kansas City, Mo. App. filed April 22, 1916. Alarm signals whereby the circuits may be closed to actuate the signals in the event of the car being removed.

1,284,330. System of Control; Rudolf E. Hellmund, Swissvale, Pa. App. filed Sept. 9, 1916. Relates to systems of control for dynamo-electric machines and especially to the regenerative control of electric railway vehicle motors.

1,284,331. Compounding System for Phase Converters; Rudolf E. Hellmund, Swissvale, Penn. App. filed Aug. 30, 1918. To provide a system of this character that shall embody apparatus of standard type and that shall be simple and effective in operation throughout a wide range of load.

1,284,362. Molded Commutator Cylinder; Willard H. Kempton, Wilkinsburg, Pa. App. filed Feb. 3, 1915. A commutator cylinder that shall be simple and inexpensive in construction, and to permit operation thereof at high peripheral speeds.

1,284,365. Electric Machine; Charles F. Kettering and William A. Chryst, Dayton, Ohio. App. filed March 7, 1913. Electrical machine which is adapted to be combined with electrical systems, preferably used on motor vehicles.

1,284,367. Snap Switch; Ernest Klein, New York, N. Y. App. filed April 27, 1914. The circuit-controlling element has imparted to it an accelerated movement independent from and in a direction opposite from the movement of the operating means.

1,284,369. Exciting System for Booster Interpole Rotary Converters; Jan A. Kuyser, Sale, Eng. App. filed Oct. 21, 1916. The interpole of a converter may be properly excited, so that substantially sparkless commutation shall be obtained.

1,284,370. Dynamo-Electric Machine; Jens L. La Cour, Christiania, Norway. App. filed Oct. 7, 1915. The rotor of this machine with a special type of rotor winding at the same time serves as armature winding for the direct current and as short-circuited secondary winding for the alternating-current.

1,284,387. Arc Lamp; George M. Little, Pittsburgh, Pa. App. filed Oct. 3, 1913. Protection of glassware against hydrofluoric gas.

1,284,392. Telephone System; Alben E. Lundell, New York, N. Y. App. filed Oct. 20, 1918. A selectively operable switching device may be controlled to seize a line leading to a station.

1,284,403. Zinc Cell; John L. Malm, Denver, Col. App. filed July 29, 1914. Relates to a battery of cells wherein the electrolyte is supplied in molten form to the several cells to drive off the anion and deposit the metal.

1,284,411. Fire Alarm; Frederick R. Merrell, Dallas, Tex. App. filed March 20, 1917. To close a signal circuit when the temperature in a building or other structure reaches a predetermined height.

1,284,412. Dynamo-Electric Machine; Friedrich W. Meyer, Pittsburgh, Pa. App. filed March 24, 1915. The phase converter may be conveniently started into operation and brought up to synchronous speed and regulated easily.

1,284,420. Electrical Receptacle; Harry J. Morey, Syracuse, N. Y. App. filed April 11, 1917. The switch mechanism is inclosed entirely within a chamber in order that the receptacle may be mounted on a flat support.

1,284,424. Connector for Storage Batteries; William Morrison, Chicago, Ill. App. filed Nov. 9, 1917. A connector which will be acid-proof, readily attachable and detachable, and in which a good electrical connection is provided.

1,284,425. Negative Plate for Storage Batteries; William Morrison, Chicago, Ill. App. filed Feb. 19, 1918. To obviate difficulty of poor contact between paste and grid.

1,284,426. Process of Making Storage-Battery Electrodes and Filling Mass Therefor; William Morrison, Chicago, Ill. App. filed Feb. 23, 1918. Applicable for the production of both negative and positive plates.

1,284,430. Counting Apparatus; William S. Norton, New York, N. Y. App. filed May 16, 1917. A recording apparatus suitably connected to some movable member of the machine so that the total number of movements of that certain machine part will be recorded.

1,284,451. Thermostat for Automatic Fire Alarms; Wilbert Pryor, Condon, Ore. App. filed May 29, 1917. May be readily and conveniently attached to the wall, ceiling or other support.

1,284,458. Dry Battery; Earl H. Rollinson, Lyons Farms, N. J. App. filed Aug. 3, 1917. When the electrolyte solution has become exhausted it may be replenished.

1,284,480. Vibrator; Herbert E. Shreeve, Millburn, N. J. App. filed Sept. 17, 1915. To deliver pulsating direct current of high frequency to the primary of a transformer to produce alternating currents of high frequency in the secondary thereof for the purpose of testing circuits.

1,284,484. Waterwheel Governor; Guy D. Smith, Derby, Vt. App. filed June 26, 1916. For controlling the speed of waterwheels by electrical means.

1,284,487. Motor-Control System; Halfdan A. Steen, Milwaukee, Wis. App. filed July 25, 1914. When the load on the motor exceeds the predetermined value, to cause a slowing down of the motor for the purpose of enabling the flywheel to give up its stored energy.

Electrical World

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The Business Outlook

PROGRESS is being made in readjustment of industrial conditions in this country while the stage for the momentous Paris peace conference nears completion. Prices of some steel products are to he reduced, and the keynote of the pending reconstruction in the steel industry now is that it will be lower return to capital rather than lower return to labor which will prevail. Keen interest is felt in the new copper price to apply after Jan. 1. Sales and quotations below 26 cents are reported. Stocks in producers' hands are enormous, but consumers are holding off, and if the new price is low enough it will invite large buying. Some heating devices will be reduced in price and, with continued employment of labor at high wages, buying in this class of electrical supplies will be stimulated. Labor is still much needed in many lines of industry, and returned soldiers find jobs awaiting them. Employers will try to encourage greater efficiency. Special building requirements in some cities will be met in spite of all deterrents of cost, but new construction as a whole will await the readjustment of markets now in process and relaxation in capital. Certain elements in the administration party at Washington continue to direct their influence and official acts to swing the country to a policy of public ownership of carriers and communication lines.

Economic coöperation is going to be one of the keynotes of the reconstruction period, and whether an engineer believes that interconnection will pay or not in a given case he will do well to analyze its prospects.

Non-Active Committee Members

IT HAS been claimed by some men with demagogic tendencies that the results accomplished by a committee are inversely as the cube of the number of its members. While this trouble may be present when the members of a committee faithfully attend the meetings, a trouble of a different kind arises when the members of a committee are scattered from Maine to California. This is the situation that confronts some of the committees in our national engineering societies. Many members accept an appointment or simply acquiesce in having their name put on a committee without realizing the responsibilities which such an appointment carries with it—or ought to carry. Such an attitude leaves the chairman in the embarrassing dilemma of either not accomplishing anything or passing resolutions and writing reports in the name of his committee when he is really the only one responsible for them. As a result, the membership at large often suffers in the end because of the lowering of the grade of the work done by the societies and because there is a temptation for a few to control these societies to suit themselves. The evil is widespread and deserves serious consideration.

An intelligent understanding of the real value of water powers as a national asset and the best uses to which they may be put is evidently lacking in Washington. On no other ground can one account for the lack of action on pending legislation.

Help the Contractor to Help Himself

CO-OPERATION as a mere slogan bandied about in the hope that it will do something to weld different branches of the industry together is liable to abuse. To attain the end sought it has to receive consistent, untiring attention from those who want to get and give its benefits. In the past we have seen it trifled with by some who did not appreciate its full meaning, misunderstood by others and selfishly interpreted by those who wanted to take its profits unto themselves. What is needed is to dismiss it as a term, but to look upon it as a matter of policy, a thing of naturally slow growth or evolution. Its possibilities as a help in the development of the industry will then be greatly strengthened. Such a policy of coöperation is apparently in process of development between the jobbers and the dealer-contractors.

Dealers and contractors have much to hope for from the jobbers. The jobbers have a thorough understanding of the problems of the dealer-contractors and are capable of being "big brothers" to any movement which is sincerely intended to benefit the "last link in the chain." The contractors have been struggling manfully to establish the association which was launched at a time of adverse seas and winds. They have reached a point where some of the larger opportunities arising from the new world era will soon be upon them, and they need friendly counsel in profiting from these opportunities. Naturally they are in close contact with the jobbers, and harmony in the relations of these two branches will undoubtedly be of value in speeding the growth of the industry as a whole.

President W. Creighton Peet of the contractor-dealers' association undoubtedly voiced the opinion of its members when he appeared last week by invitation before the Electrical Supply Jobbers' Association at Cleveland to express the desire for more intimate relations. We trust that Mr. Peet's request for the attendance of jobbers at the meetings of the executive committee of the contractor-dealers' association as well as at the annual conventions of that association will be complied with. There is a real educational work to be done among the smaller contractors, and for the good of the industry it cannot be started too soon or continued too zealously. The jobber can help the contractor, the jobber should help the contractor to fill the place which that small dealer is fitted by location and neighborhood contact to fill with general advantage to all.

If the same governmental time lag is to be encountered after the war as before the war, every industry will do well to tackle its reconstruction problems and settle them quickly; because soon we shall demobilize at the rate of 15,000 men a day and the problem of how to absorb them will require undivided attention.

Burning Poor Fuel

THE zone system of fuel distribution, although not long enough effective to reduce practice to a steady state, has yet brought forcible lessons which in the long run will be turned to good account. In particular, it has compelled attention to the problem of burning poor fuel at its best efficiency. In our current issue T. A. Marsh describes the practical methods of dealing with a typical coal of peculiarly mean characteristics, the very low-grade bituminous product common in Iowa and some other sections of the Western country. It is, in the first place, of low heating value, somewhere about 9000 B.t.u. (1030 calories), and, second, it carries from 15 to 30 per cent of ash. What is worse, this ash is very fusible. In fact, some of the coal burns so badly that in regular working under boilers it has hardly more than 40 per cent of the evaporative value of a really first-class bituminous coal. Difficult enough to handle successfully by careful hand firing, it has made all kinds of trouble with mechanical stokers highly successful with ordinary fuel. Nevertheless, it is capable of being used with very fair economic results.

Mr. Marsh tackles the problem in its rigorously practical aspects. The first condition to be faced is that by reason of the low heating value of the coal more must be consumed for a given duty, and hence abnormally large grate area must be provided, which frequently implies a considerable change in the boiler settings. Given a big surface of chain grate, there must also be large arch capacity, since from its great ash content and other peculiarities the fuel burns with difficulty and the temperature of the fuel bed must be kept up. Above all, there should be a continuous free discharge of ash, which may well constitute a quarter the weight of the coal. Given these conditions and a fairly good draft, things go along tolerably well. Combustion rates between 30 lb. and 40 lb. per square foot (15 kg. and 20 kg. per sq.m.) per hour have been obtained even with coal of the relatively poorer grades, says Mr. Marsh. Of course, not all Iowa coal is by any means so bad as this would suggest. The better sorts may run consistently above 10,000 B.t.u. per pound (1140 calories per kilogram), and these will work very much like other moderately good bituminous coals and can be handled in more nearly the usual manner.

The big question is what to do with a very considerable supply of poor fuel, somewhat disadvantageous to transport, of low thermal value and troublesome to burn. As time goes on and fuel prices rise even above their present heights, the necessity of utilizing the lower and locally cheaper grades becomes steadily more pressing. The costs of labor and transportation have worked upward on a sort of ratchet which there is small prospect of disengaging, and in the future every effort must be made to hold down final expense by making the most of engineering skill and well-planned machinery. We have long been hammering away at the possibilities of saving at the furnace, and while probably for some time to come the best economic results will be obtained with medium rather than low-grade coal, no opportunity should be lost to study the situation, work out improvements in furnaces and firing and by increasing efficiency make ready for emergencies that are likely to arise. To this end such discussions as that by Mr. Marsh have a very direct value, and they should receive thorough consideration for future if not for present use.

The laborer is worthy of his hire. Samuel Gompers knows it, and so do capitalists like Charles M. Schwab and John D. Rockefeller, Jr. In the abstract the proposition is perfectly clear and accepted by all. The trouble lies in its application. Many a good resolution has been brought to naught through faulty interpretation, and the attitude of labor and of capital has suffered grievously in this respect. When each understands the other both prosper.

Auxiliary Energy Cost a Liability

THE allocation of operating costs and fixed charges to different classes of service has long engaged the attention of rate makers. It is equally important that the total service furnished shall carry the combined charges and expenses involved in providing it. Thus, in a hydroelectric supply system, the rates should not only bear the total burden of fixed charges and running costs on the water and transmission sides of the property, but wherever steam auxiliary service is required or held in readiness at the company's expense.

This point has been emphasized in a decision of the Massachusetts Gas and Electric Light Commission upon the equity of the rates established in a contract between the town of Westfield and the Turners Falls Power & Electric Company. In passing upon the reasonableness of a coal clause, and recognizing that there is no "standard cost" of water power, the commission points out that every unit of hydroelectric energy has to carry the cost of the auxiliary plant which takes the burden when the water power fails, and that although the extent of steam auxiliary service is almost impossible to predict this cost is none the less real.

Such an emphasis by the commission upon an economic relationship which has been none too generally realized by the public is of much value. The popular fallacy that water power costs practically nothing because Nature works while we sleep, so to speak, dies hard. Exery expression by the public authorities making it clear that all the elements of service cost, including capital, labor and material charges, must be included in the final rate structure helps to bring about constructive popular thinking and a more confident treatment of rate problems by the companies themselves.

No sensible person imagines that the war-time conditions under which electric utilities labored so patriotically can long continue to prevail. Fatigue is not necessarily restricted to human beings; machinery succumbs to overwork as well. However, operators have learned greater respect for the sustained performance of their generating equipment.

Charging for the Power Factor

WE HAVE considered in recent numbers the physical problems that are involved in operating loads at low power factor and some of the practical remedies applicable to the situation. In the current issue we bring squarely to the front in another of Will Brown's valuable papers the much vexed question of penalizing those who are at fault. A station manager can do much by proper supervision of motors put upon his lines, by frequent inspection and by moral suasion. But when the remedy costs good money, as it usually does, something more convincing than general logic is often necessary. Already many companies have inserted power-factor clauses in their contracts, generally not enforced and perhaps intended to be enforced only as a last resort. The loads, however, have piled up of late to an extent that has caused real difficulties in operation, and since, generally speaking, the limit of output is determined by the heating of the generators and the distribution losses rather than by lack of capacity for driving the machine, the burden imposed by poor power factor becomes immediately serious.

Various companies, as noted by Mr. Brown, have developed differing schemes for penalizing low power factor. Ordinarily they involve a certain nominal power factor taken as standard and a correction based on the kva. in reckoning either the maximum demand or the metered consumption. The resulting rates look rather intricate, which is always a disadvantage in dealing with the public, and they also involve some considerable trouble in measurement. As in every case of rate making, they evaluate more or less exactly certain factors of the service and take the rest by general average. In the case before us the essential point is that the customer who operates at unity power factor puts, other things being equal, the minimum burden upon the whole equipment from stoker to motor switch and secures to it the maximum efficiency of operation in providing his output. At reduced power factor the trouble and expense he puts it to is in no minor degree some function of the kva. he demands, and it is therefore at least an open question whether the item measured and charged for should not be the kva. furnished, a scale of rates then being based upon average power-factor conditions.

Such a system would cover the circumstances in much the same general way as any other and would be both simple and effective. It would essentially be based on unity power factor with a rate scale determined by average departures from this ideal condition. Of course, where a well-ordered demand system is in use the demand should always be based on kva., but lower power factor does produce an effect on cost of supply as well, which should in some way be included. One thing is certain that any sound system of rates should penalize the customer who makes abnormal demands for kva. The chief consideration practically is that there ought to be some general basis of action on the part of the supply companies. This is a matter that could very properly be taken up by the National Electric Light Association with a view to obtaining concerted effort for reform.

At the annual conference of state governors in Baltimore this week public utility corporations were reminded of the fact that they can exist only when they recognize that their existence is permitted for service and not for self and that they are servants and not masters. To this declaration electric utilities have no hesitancy in saying, Amen!

A Speculation on Government by Formula

THE wonderful old man who was the real head of the French Republic in the long-drawn-out crisis that just preceded victory was in early life a practicing physician. The real head of the British nation was originally a lawyer. Here in the United States, where the real and the titular head are one, the President was in private life an educator. In our legislative bodies and in those of other nations alike lawyers, physicians, manufacturers, merchants, farmers, journalists and mechanics abound and have abounded, but hardly ever is there seen an engineer. Yet surely the engineering mind, with its vision and its certainty, its orderly processes and its logical conclusions, would be a political adjunct of no mean value.

It is a curious speculation how far the mathematical formulas of the engineer could be translated into terms of political economy and social science. Government by formula is, to be sure, no new thing. It has been tried by many an autocrat with the textbooks of Machiavelli and his disciples as guide; but the autocrats have always forgotten the fundamental postulate that Emerson memorably expressed when he said that God would "take the sun out of the sky ere freedom out of man." It was tried, too, by the leaders of the French Revolution, and doubtless is being tried by the Russian soviets to-day. But revolutionists are not engineers; too often they are mere sophists, sciolists and rhetoricians. The two sides of their equations are not equal, and of necessity the solutions are grotesque.

The engineering mind is different. With exceptions so few as to be negligible, bridges stand and bear their traffic, power houses produce the estimated energy, dams hold back the impounded waters, foundations sustain the predetermined weight. The science of engineering has transformed physical life. The science of politics seems sometimes to have stood still since the days when a Coriolanus could insult and an Antony cajole the people. Yet democracy is a fact, not a figment as in Roman days, and those who deal with it are part of it. Their theories have been legion. It would be interesting to see what variations the engineering mind would produce were it to turn from formulas for tunneling mountains and erecting transmission lines to formulas for harmonizing clashing human interests and interpreting the psychology of the mass.

Power-Factor Clauses in Contracts

Commercial Problems Involved—Opinions from Widely Scattered Central Stations Regarding Necessity of Considering Power Factor—Typical Clauses of Two Types of Contract Which Base Charges on Average Power Factor

BY WILL BROWN
Electric Machinery Company

THE great attention which is now being paid to power factor by central-station operating companies is due to the conditions recently brought about by the war. Formerly power systems were built on a larger scale than the market at the time required, consequently their problem was to build up a load for their generators. At the present time, however, the demand for power has outrun the supply, and the acute conditions caused by low power factor have come on in some cases very rapidly.

Power-factor regulations are by no means a new thing. They have been carried in contracts by different companies throughout this country and Canada for several years, but very seldom indeed have they been rigidly enforced. Questions involved so much explanation to the power customer and the whole thing was so complicated from the standpoint of accurate metering that the clauses soon became "dead letters." They did, however, serve the purpose of a club in the hands of the power company to enforce reasonable power factor from the customer. It seems to be the opinion of many central-station men that power-factor penalty clauses can only be used in this way, and that there can be no accurate method of grading rates according to power factor maintained.

Opposed to this view are many prominent central-station managers in this country and Canada, who claim they have proved by experience that they can accurately measure the average power factor of a customer's load and charge on this basis. They claim that the matter of power factor, although a very different thing from load factor, is just as important in basing alternating-current rates.

The case resolves itself to this: There are power consumers who do maintain good power factor. There are consumers who do not maintain good power factor, but who will make a reasonable effort to better their conditions if proper inducements are made. There is a third class of consumers who either by choice or necessity will not make an effort to better power-factor conditions. Is it fair for the central station to make the good customer carry the burden imposed by the bad customer?

Opinions from Many Sources

Various opinions have been expressed on this subject, some of which are given here. The following is an extract from a recent report of the Canadian committee on rate research, prepared in view of the shortage of power and the high cost of machinery to carry increased demands:

> Whereas in the past power-factor clauses have not been vigorously applied, nowadays nearly all companies are requiring the customers to keep their power factor within reasonable limits at all times and to pay for any deficiencies. The question of the measurement of power factor as to whether same should be computed to the time of maximum load of the consumer's installation or to the time of maximum load of the company's system, or whether the average power factor taken by the customer of the whole period of his operation should be taken as the determining factor, is not yet standardized.

The committee of the Canadian Electrical Association on commercial light and power sales says:

> The power shortage has called to the attention of the companies suffering from it the necessity of being much more careful in their sales of power and the conditions of sale, among which perhaps the most important is the regulating of power factor. In the past, owing to loose power-factor conditions and non-enforcement thereof, power lines have become encumbered with motors of excess capacity or of improper voltage, or improperly repaired, with the result that many companies were supplying motor loads at a very low power factor, materially decreasing their line capacity, their generating station capacity and transformer capacity, all of which is so urgently needed at the present time.
>
> Most companies throughout the country are now strictly enforcing their power-factor regulation clauses, or writing in new power-factor clauses in their new contracts, with the result that the users of power, owing to penalties imposed for poor power factor, are readjusting their equipment to operate at a proper and reasonable power factor, which has worked very much to the benefit both of the central station and of the consumer.

The Southern Wisconsin Power Company specifies that where the power factor is below 90 per cent it will add to the number of actual kilowatt-hours an amount sufficient to make the total kilowatt-hours equal to 90 per cent of the total of the apparent kilowatt-hours.

This is an interesting clause because of the fact that it actually charges on the basis of kilowatt-hours at a specified power factor. Nearly all of the power-factor clauses relate to the maximum demand charge entirely and ignore the energy charge.

Typical Power-Factor Clauses

The following are some typical clauses from power contracts:

Cleveland (Ohio) Electric Illuminating Company.—When the current supply is alternating and the greater part of the load is power and the billing demand exceeds 75 kw., the company reserves the right to test the power factor of the consumer's load, and if the average power factor is greater than 75 per cent, then the demand shall be reduced in accordance with the following formula: Billing demand = kilowatt demand as measured ÷ average per cent power factor × 75.

If the average power factor is less than 60 per cent, then the demand shall be increased in accordance with the following formula: Billing demand = kilowatt demand as measured ÷ average per cent power factor × 60.

The company will make without charge a power-factor test at the consumer's request once a year, if his demand exceeds 75 kw. By power factor is meant the average power factor under normal operating conditions.

Niagara, Lockport & Ontario Power Company.— The purchaser shall at all times take and use the three-phase power in such manner that the power factor will be as near 100 per cent as possible, but whenever at any time the current is not taken at 100 per cent power factor and the power factor is less than 90 per cent, then the basis of charge for that day, in lieu of the highest one-minute demand, shall, if the power company so elect, be considered as 90 per cent of the maximum kva. taken for a period of one minute divided by 0.746. This amount shall never be considered as less than the fixed horsepower agreed to be purchased and paid for.

Northern Indiana Gas & Electric Company.—The primary charges will be increased by 1 per cent for each 1 per cent the power factor on the entire load decreases below 75 per cent at any time. If the power factor on the entire load, owing to lagging current, is maintained at 95 per cent or better, a discount of $1 per kilowatt per year will be made from the primary charges.

Harrisburg (Pa.) Light & Power Company.—The consumer shall at all times take and use power in such manner that the power factor shall be as near 100 per cent as possible, but when the actual power factor is less than 80 per cent, then the demand to be charged and paid for shall be obtained by multiplying the demand shown by the meter at the time of measurement by 80 and dividing the product thus obtained by the actual power factor.

Milwaukee (Wis.) Electric Railway & Light Company.—The customer agrees that when possible the average power factor of the equipment to be supplied with electric energy hereunder shall not be less than 80 per cent. Should the power factor of the electric current taken by the customer at any time be less than 80 per cent, then the maximum demand as specified herein shall be ascertained and determined as 0.00080 of the product of the maximum average amperes taken by the customer for fifteen consecutive minutes multiplied by the volts and the factor 1.73.

Duquesne (Pittsburgh) Light Company.—Where the power factor of the customer's load is below the subjoined schedule of permissible power factors the company reserves the right to increase the demand as estimated or measured in the ratio that the actual power factor as determined by test bears to the permissible power factor:

75 per cent power factor for demands from 10 kw. to 50 kw.
80 per cent power factor for demands from 50 kw. to 250 kw.
85 per cent power factor for demands from 250 kw. to 1000 kw.
90 per cent power factor for demands above 1000 kw.

Companies Controlled by the United Gas Improvement Company (Philadelphia).—The primary or demand rate for any month shall be increased 1 per cent for each 1 per cent the lagging power factor on the consumer's load is at any time during such month below the following: 75 per cent at the time of maximum demand, 70 per cent at the time of 75 per cent of maximum demand, 65 per cent at the time of all other demands.

If the lagging power factor on the consumer's load is maintained at all times during the month at 95 per cent or better, 10 cents per kilowatt per month of demand will be deducted from the primary or demand charge.

Philadelphia (Pa.) Electric Company.—We penalize a customer for a power factor below 80 per cent, correcting the stand-by charge to 80 per cent basis.

Toledo (Ohio) Railways & Light Company.—The maximum billing demand shall be determined from actual measurements of the customer's demand and a consideration of the power factor at which these measurements are taken and shall be calculated by multiplying the greatest integrated fifteen-minute demand by 80 per cent divided by the actual power factor at which the demand measurements are taken.

Basing Charge on Average Power Factor

In all of the above contracts the maximum-demand charge only is involved. In Canada, however, central stations have actually been basing their energy charge upon the average power factor of the load. The following clauses are examples of Canadian practice:

Montreal Light, Heat & Power Company.—The minimum power factor of the electrical energy taken shall not be less than the following:

Motors and apparatus of 3 hp. rated capacity and less, 70 per cent; over 3 hp. and not exceeding 5 hp., 75 per cent; over 5 hp. and not exceeding 10 hp., 80 per cent; over 10 hp., 85 per cent.

If the power factor of the electrical energy taken is found to be less than as specified above, then consumer shall pay for the electrical energy taken on the basis of the minimum power factor so specified.

Southern Canada Power Company, Ltd.—If the power factor of the electrical energy taken is found to be less than 85 per cent, then consumer shall pay for the electrical energy taken on the basis of 85 per cent power factor.

Toronto Power Company.—The purchaser agrees to use the three-phase electrical energy in such a manner that the current values, as determined by suitable current indicating or recording devices, for the three phases shall be balanced each with the others to such an extent that the difference between the lowest and the highest coincident current values shall not be greater than 5 per cent of the lowest current value; and that whenever a current unbalance providing a difference in excess of 5 per cent shall occur in the manner hereinbefore stated, then the amount of power may at the option of the power company be taken as 90 per cent of 1.73 times 95 per cent of the highest of the three current values multiplied by the highest phase voltage coincident with the current value used.

The current and voltage are to be determined by commercial instruments meeting the requirements of the Department of Inland Revenue for Canada.

The purchaser agrees to use the three-phase electrical energy in such a manner that the power factor shall be 90 per cent, and that whenever the said power factor shall be less than 90 per cent, then the power company may take 90 per cent of the kva. as the rate of taking power and use the same in determining the demand rate or the energy consumption.

Fundamental Difference Between the Two Clauses

The basic difference between these two types of clauses should be carefully noted. In one case the maximum demand as metered at infrequent intervals varying from once a month to once a year is increased according to the amount of power-factor drop below a certain specified minimum. In the second case every kilowatt-hour of energy as metered by the watt-hour meters is increased in proportion to the amount of power-factor drop below a specified minimum. It is plain that while the former method could be enforced with a fair degree of accuracy, it would not in any way take into account the average power factor of the customer's load.

It may be argued that the central station is only interested in knowing the customer's power factor at full load because at periods of light load the system could be operated at lagging power factor without great inconvenience. But it does not always follow that the periods of light load of the consumer coincide with periods of light load on the system. They may occur at the time when the system load is at the peak. On the other hand, it is possible that the consumer's average power factor might be better than his power-factor test showed at the peak. It would seem, then, that an energy charge based upon the average power factor of the consumer's load would be the preferable method. Why has it not been more widely adopted? The reason is that it has been almost impossible to meter power factor of a load in proper time relation to the energy consumed. This subject will be taken up in the next and final article of this series, which will appear in an early issue of the Electrical World.

Reducing Difficulties in Burning Iowa Coal

General Considerations to Observe in Selecting Stokers and in Designing Furnaces—Specific Changes Which Can Be Made in Order to Adapt Existing Stokers to Lower-Grade Fuels

BY T. A. MARSH
Chief Engineer Green Engineering Company

SINCE the zoning of coal went into effect many central stations in the low-grade fuel districts have had practically to shut down because the stokers were unable to burn the coal available. To assist companies which are facing this predicament as well as those which would preferably burn a poorer quality of fuel if they knew how, in order to save the freight on a better grade, the writer will consider Iowa coals and point out what conditions are essential to their effective combustion. In doing this attention will be called to general considerations to observe in selecting new stokers or building new furnaces as well as in modifying existing equipment to meet different operating conditions. Methods employed to burn efficiently and at good rates of combustion Iowa coals even of the lowest grades containing 7000 B.t.u. to 9000 B.t.u. will be described.

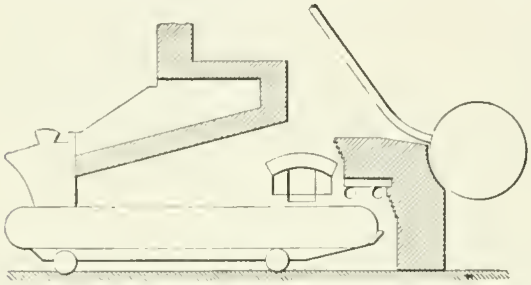


FIG. 1—CHAIN GRATES UNDER STIRLING BOILER WITH LONG ARCH AND FORWARD CORBELED BRIDGE WALL

The coals of Iowa are most difficult to burn. They are bituminous and non-coking and contain a very high percentage of low fusible ash. Typical analyses of screenings are tabulated below·

	Good	Fair	Poor
Moisture (per cent)	7.83	12.36	14.42
Volatile matter (per cent)	38.83	37.65	29.29
Fixed carbon (per cent)	34.42	31.94	30.00
Ash (per cent)	16.23	18.06	26.29
B.t.u. (commercial)	10,476	9,712	7,118
B.t.u. (dry basis)	11,774	11,081	8,316
Sulphur (per cent)	4.75	5.75	7.0

The better grades of Iowa coals are about on a par with the poorest grades of Illinois and Indiana coal. The percentage of ash is high, and it is fusible at a low temperature, so that clinker is easily produced. Fair grades of Iowa coal contain 18 per cent of ash and 9700 B.t.u. Such coals are inferior to the poorer grades of Illinois and Indiana coal. This coal is difficult to ignite in any furnace and produces large quantities of clinker, most sticky when hot and and vitreous when cold.

The poorer grades of Iowa screenings contain approximately 7000 B.t.u. and 7500 B.t.u. and 25 per cent to 30 per cent of ash. Such coals are most difficult to burn and difficult to handle in furnaces, owing to the large amount of clinker which must be removed. The refuse amounts to about 25 per cent by weight of the coal fired.

The plant owner who figures on using Iowa screenings to contain more than 9500 B.t.u (commercial basis) is likely to be disappointed. If he has not made provision for the use of such coals and for coals having more than 25 per cent of ash and clinker, he will probably resort to the use of more expensive coals, imported from Illinois or Indiana, and thereby suffer a loss due to higher steam costs.

These coals cannot be burned unless great care has been exercised in the selection of stokers and design of the furnace. The better grades can be used on hand-fired grates with frequent cleaning and can be burned with some types of stokers, but the lower grades have caused failures of more types of stokers than perhaps any other coals, because of inability of such stokers to provide proper treatment of the fuel in the furnace.

Selection of Stokers

It is evident from a study of the analysis of Iowa screenings that the type of stoker used must have liberal facilities for ash removal. Stokers that have not are limited to better (frequently washed) grades of Iowa coal containing 9500 B.t.u. or more, which in Iowa is a selected coal. Aside from its enormous quantity of ash, calling for practically continuous ash removal, the coal is difficult to burn because its ash has a low fusibility point and a clinkering tendency that make it imperative, for successful combustion, that the fuel bed be unagitated. These characteristics of continuous ash discharge from the furnace and undisturbed fuel are best exemplified by the chain grate.

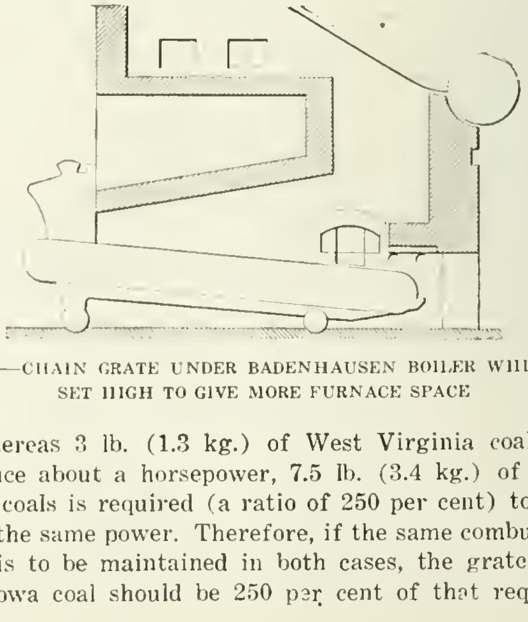


FIG. 2—CHAIN GRATE UNDER BADENHAUSEN BOILER WHICH IS SET HIGH TO GIVE MORE FURNACE SPACE

Whereas 3 lb. (1.3 kg.) of West Virginia coal will produce about a horsepower, 7.5 lb. (3.4 kg.) of some Iowa coals is required (a ratio of 250 per cent) to produce the same power. Therefore, if the same combustion rate is to be maintained in both cases, the grate area for Iowa coal should be 250 per cent of that required for West Virginia coal. Stokers of extreme width and length must be furnished in order to provide the maximum grate area.

Obviously, no rule of thumb or standard table of chimney or flue areas based on horsepower developed will serve to determine the necessary areas for gases from these coals. The analysis must be based on fuel to be burned, allowing a liberal excess of air as required by such fuels.

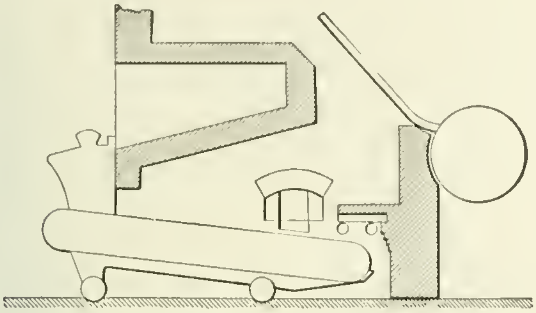


FIG. 3—ARCH WITH OFFSET FRONT TO SEAL OFF AIR

Furnaces Required

Iowa coals require an extreme amount of reflecting brickwork and arch to produce combustion temperatures. With chain grates it is customary to provide arches from 8 ft. to 10 ft. (2.4 m. to 3 m.) long augmented by bridge walls with vertical reflecting faces or with faces sloping forward to reflect the heat forward and down on the fuel bed. So large is the volume of ash from the average Iowa coal that an opening of 5 in. (12.7 cm.) must be left between the grate and waterback for the discharge of ash. This constant stream of ash 5 in. deep the full width of the stoker, which travels at the rate of from 2 in. to 8 in. (5 cm. to 20 cm.) per minute, gives some indication of the ash produced and explains why continuous discharge is advisable and why intermittent cleaning may produce undesirable results.

A setting of chain grates with Stirling boilers, which is typical of installations burning Iowa coal is shown in Fig. 1. Attention is called to the length of arch and the forward corbeling of the bridge wall. This furnace has burned coal of the following analysis at rates of 36 lb. per sq.ft. (175 kg. per sq.m.) of grate surface hourly:

Moisture, per cent	14 05
Volatile matter, per cent	31 92
Fixed carbon, per cent	28 82
Ash, per cent	25 21
B.t.u. (commercial)	7,900
B.t.u. (dry basis)	9,192

The same setting has burned over 30 lb. per sq.ft. (146 kg. per sq.m.) of grate surface per hour of coal of following analysis:

Moisture, per cent	11 65
Volatile matter, per cent	29 00
Fixed carbon, per cent	26.75
Ash, per cent	32 60
B.t.u. (commercial)	7,100
B.t.u. (dry basis)	8,085

A similar furnace applied to a Badenhausen boiler is shown in Fig. 2. The boiler is set higher, giving more furnace space, which increases the furnace efficiency. Fig. 3 shows the application of an arch with the front offset to seal off air, a very desirable adjunct for use with Iowa coals. Fig. 4 shows a furnace of extreme design with a reversed arch to reflect the heat and gases forward. This furnace was developed to burn coals running as low as the following analysis, which approaches the low limit of quality of coal being successfully burned on stokers to-day:

Moisture, per cent	19 03
Volatile matter, per cent	25 02
Fixed carbon, per cent	22 23
Ash, per cent	33 72
B t.u. (commercial)	5,315
t.u. (dry basis)	6,576

Revision of Existing Furnaces

Few existing furnaces have either sufficient arch effect or sufficient furnace volume, and most of them permit great improvement, especially when they are to be used with Iowa coal. The improvement must usually be of a radical nature, generally starting with an increase in grate area. Long arches must be supplied. With low-set, vertically baffled boilers this sometimes results in a change to some type of horizontal baffling in order to obtain suitable furnaces. Each furnace presents an individual problem, but analyses by competent combustion engineers usually permit marked improvement.

With chain grates, fuel beds of from 5 in. to 8 in. (12.7 cm. to 20 cm.) are carried at speeds of from 2 in. to 8 in. (5 cm. to 20 cm.) per minute. These items depend on the ratings desired, the size of fuel and the draft. Iowa coal, being very inert and having its ash so intimately a part of the coal structure, requires liberal draft. It is well to provide for 0.40 in. to 0.50 in. (10 mm. to 12.5 mm.) in the furnace.

Another characteristic of Iowa coal which is common to many low-grade fuels is that wetting the fuel improves the combustion appreciably. It is not to be understood that the addition of water helps combustion from a chemical standpoint, but it certainly does from a physical standpoint. The water should be added at least two hours before firing so as to be thoroughly absorbed in the fuel. The physical action is threefold: First, the sifting of coal through the grate is diminished; second, the fuel bed is made more compact; third, the steam generated by the moisture in the coal cracks open the pieces of coal, presenting new clean surfaces for quick combustion. These advantages more than offset the detrimental effect of excess moisture, which, of course, must be evaporated and superheated up to the temperature of the escaping gases from the boiler.

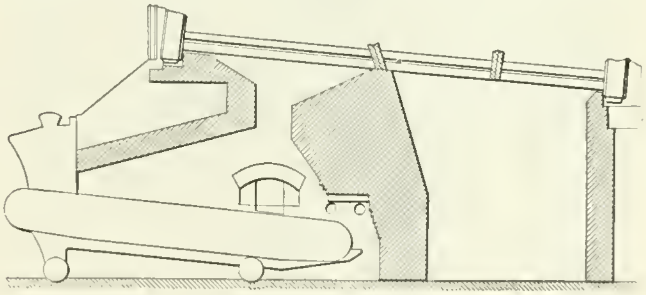


FIG. 4—REVERSED ARCH TO REFLECT HEAT AND GASES FORWARD

From the foregoing discussion of Iowa coals the following conclusions are evident:

(1) The coals of Iowa are extremely high in ash, clinker easily and contain from 7000 B.t.u. to 10,000 B.t.u. Iowa coals containing above 9000 B.t.u. (commercial basis) may be called selected coals.

(2) With coals having one-fourth of their weight in ash the ash discharge should be continuous and liberally proportioned. Chain grates are burning these coals successfully.

(3) Large grate areas are necessary, as also are high draft and long arches. None of these items of design is likely to be overdone. Chimney and flue areas must be liberally designed, based on high coal per horsepower.

(4) Existing settings can be improved to handle these coals. Revisions usually must be radical, such as larger grate area, longer arches and larger furnaces.

While the foregoing article is written specifically regarding Iowa coals, the same principles apply to any high-ash, low-heating-value, non-coking coals such as those mined in Texas and Nebraska.

SELECTION OF MOTORS FOR CEMENT INDUSTRY

Types of Apparatus Best Suited to Conditions—Starting and Running Power Requirements—Methods of Applying Motors to Machines

THE paper by R. B. Williamson on the "Selection of Electric Motors in the Cement Industry," presented before the A. I. E. E. in New York recently, is an admirable example of the way in which industrial applications ought to be discussed. After explaining briefly the processes involved in the manufacture of cement, the writer pointed out the general conditions under which the motors must operate. Then the starting and running power requirements are discussed and the motors having characteristics suitable for the service are named. Recommended methods of applying the motors to various machines are cited. All through the discussion reasons are given for the statements made. Not much has been said regarding control and protective equipment, but this is probably due to the fact that only simple control in the form of a knife switch or compensator is required in most cases.

Mr. Williamson pointed out that alternating-current motors are used more extensively than direct-current motors in this service on account of the relatively higher alternating voltages that can be used and the greater mechanical simplicity of the alternating-current motors, particularly those of the squirrel-cage type. In general, the service is continuous and the starting conditions are particularly severe, often making the use of wound-rotor motors necessary. Particular attention must be given to the protection of brushes, commutators and collector rings from the cement-mill dust. Bearings also must be protected from this abrasive action. Low-speed or moderate-speed motors are usually preferred on account of the slower speed reduction necessary and the fact that these motors are mechanically more substantial. For motors of 75 hp. or larger outboard bearings are commonly required. Regarding elevator and conveyor motors, the starting torque is likely to be above normal running torque, but standard squirrel-cage motors, if large enough to take care of the peak loads, as mentioned above, should have no difficulty in starting them. Screw conveyors occasionally wear their bearings down so far that the screw may rub against the trough for most of its length with consequent overload. These possibilities make it advisable in the case of individual drive always to install motors from 25 to 50 per cent larger than necessary to meet the average power demand. This is not true when the group drive is used as it is very unlikely that more than one unit of the group would be subjected to overload at the same time, and this would probably not affect the operation of the motor to any extent. Dimensional data and motor requirements are given for a number of installations. Crushing, grinding and drying machines are taken up in the same manner, data on power and torque requirements being given, and the particular motor best fitted for the service is recommended in each case. Tables giving power required for gyratory and rotary crushers are reproduced herewith.

TABLE I.—POWER REQUIREMENTS OF GYRATORY CRUSHERS

Maker's No.	Size of Opening on Each Side of Tap Bearing Arms	Size Cube Which Can Be Crushed	Horsepower
3	7 × 28	7	10- 20
4	8 × 34	8	15- 25
5	10 × 40	10	20- 35
6	12 × 44	12	25- 40
7½	15 × 55	15	50- 70
8	18 × 68	18	65-100
9	21 × 76	21	100-140
10	24 × 99	24	125-175
18	....	36	150-200
21	....	42	150-200
24	....	48	175-225
27	....	54	200-250

In the discussion following the paper President C. A. Adams said that it had been the experience in studies of this sort that processes may be greatly improved by the application of electricity and that the ease of measuring power taken by electric motors makes such investigations particularly feasible. A. M. Dudley, for the committee on industrial and domestic power, explained that this was the first paper brought out by the committee which has undertaken a study of motor requirements for machine-tool installations for cement mills and for elevator service, these industries having been selected as typical. Lynn Bradley told of a method of collecting potash as a by-product in the cement industry, and Prof. W. I. Schlichter pointed out that electric drive is so well established that authors no longer offer apologies or reasons for its application in the industry. Mr. Williamson, in conclusion, pointed out the fact that the synchronous motor may be very useful in the cement industry (for not much starting and stopping is required) by reason of its large air gap and high power factor.

TABLE II.—POWER REQUIREMENTS OF ROTARY CRUSHERS

Machine Size	Approximate Capacity in Tons per Hour	R.P.M.	Approximate Hp.
00	1 to 1½	300	1 to 2
0	½ to 2	250	3 to 4
1	1 to 6	300	6 to 10
1½	4 to 10	200	15
2	8 to 15	250	15 to 20

ELECTRICAL PRECIPITATION OF METALS IN WASTE GASES

By Using Cottrell Method to Remove Copper, Zinc, Etc., from Flue Gases Company Expects Saving That Will Buy Treating Equipment

IN REFINERIES there is always a chance of valuable by-products escaping in the waste gases that go up the flues. This is very true in the metal treating field. At a copper-refining plant in the East it has been found possible to remove 90 per cent of the solid and liquid particles from the flue gases by an electrical process and that the value of the copper, zinc, etc., recovered in a short time will be sufficient to pay for the treating equipment. The process involves passing the gases through tubes in which are suspended chains charged with high-voltage direct-current power. The particles carried by the gases become electrified and are projected against the walls to the tubes. These tubes are grounded and thus the particles drop into hoppers below. It has been calculated that 0.5 amp. is required in the high-tension direct-current circuit at full load.

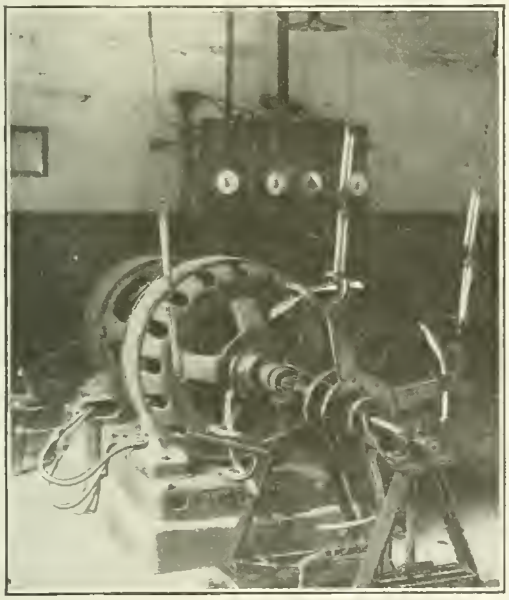


FIG. 1—RECTIFIER DRIVEN BY SHAFT OF GENERATOR ENERGIZING TRANSFORMER

In plants of this type the electrical equipment is generally split up into a number of small units. However, in this case all the current is handled by a single generator and transformer. A duplicate set has been installed for emergency purposes. With this arrangement there is a sacrifice in flexibility of operation, but the use of large units makes the installation more compact.

The tubes containing the high-tension electrodes and through which the flue gases pass are arranged in six groups. The electrodes are suspended from a rack which provides ample insulation and are connected with the high-tension direct-current line at the bottom. Disconnecting switches permit cutting off any group to permit inspection and repairs. The gases can be made to go through the treater or directly to the stack.

The generating equipment includes two 40-kva., 60-cycle, single-phase motor-generators that deliver energy at 150 volts to 250 volts to 200/100,000-volt transformers. Taps are provided from which voltages of 50, 62½, 75 and 87½ per cent of the maximum voltage can be obtained, the full transformer rating being available on each tap. The high-tension leads pass out of the transformers through condenser-type bushings. Choke coils are provided inside the transformers to smooth out the static surges that are liable to occur in the high-tension circuit. To the motor-generator shafts are coupled mechanical rectifiers that transform the high-tension alternating current into direct current.

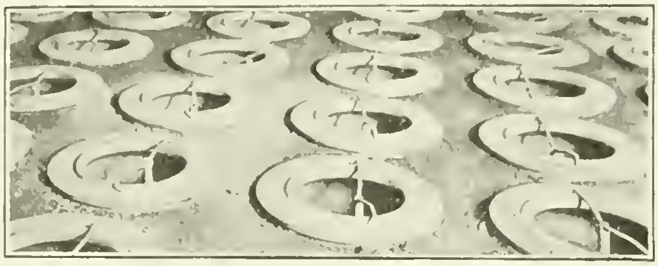


FIG. 2—ELECTRODES SUSPENDED IN PRECIPITATOR TUBES

The voltage of the high-tension direct current must be varied according to the condition of the flue gases being treated. The large variations can be made by changing the transformer taps, while the small adjustments are obtained by regulating the generator. In addition, a bank of adjustable resistance is connected in series with the low-voltage alternating-current circuit to serve as ballast and permit further adjustment of the voltage. Resistance is also provided in series with the high-tension direct-current circuit in the form of tubes mounted above the rectifiers.

Under ordinary operating conditions, the motor-generators are employed to supply all energy used in the treating apparatus, but in emergencies current from the alternating-current lines can be fed into the transformers. Under such circumstances the rectifiers driven by the generators cannot be used. In their place are employed auxiliary rectifiers driven by synchronous motors which keep the rectifiers in synchronism with the current being rectified. The generating, transforming, rectifying and control apparatus is Westinghouse.

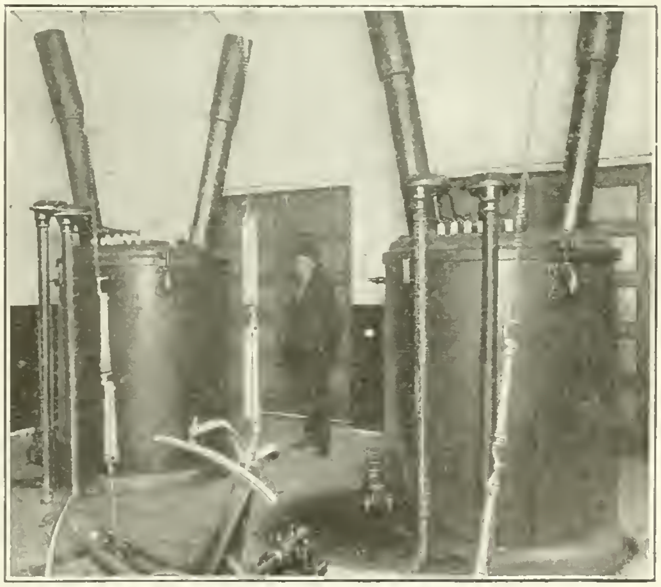


FIG. 3—100,000-VOLT TRANSFORMERS AND PORTION OF RECTIFIER IN FOREGROUND

Economic Position of the Jobber

Electrical Supply Jobbers' Association Plans to Conduct Organized Advertising and Publicity Campaign in Interest of Its Members, Pointing Out Economic Value of Jobber's Service to the Industry

This article gives substantially the features of the report adopted at the meeting of the Electrical Supply Jobbers' Association in Cleveland last week. The real strength of the electrical jobbing branch of the industry is indicated by the statement that it carries stocks of $40,000,000 and does an annual business of over $300,000,000.

ON JUNE 14 the following committee was appointed by the secretary: F. R. Elliott, Elliott-Lewis Electrical Company, Philadelphia; A. M. Little, chairman, Mohawk Electrical Supply Company, Syracuse, N. Y., and E. D. Van Winkle, Post-Glover Electric Company, Cincinnati.

Necessity of an Organized Advertising and Publicity Campaign

A glance at the electrical trade journals shows that practically every unit of the electrical trade is advertised more or less systematically, excepting the jobber, and the small number of jobbers advertising simply accentuates this statement.

Manufacturers can afford to advertise in trade journals and make the widest use of this publicity. Contractor-dealers are brought definitely to the attention of the trade through their own journal and latterly through the influence of the Goodwin movement.

The jobber, notwithstanding that he occupies a position between the above two classes of trade and is directly affected by the same things that affect them, is not in evidence as an organization, excepting in the case of the above-mentioned small number of jobbers who do any advertising of the above kind.

If the manufacturer is benefited by national advertising both in trade and other journals, the jobber can be benefited in the same way; yet no individual jobber can advertise in the above mediums, because he does a local business. Granting the above, if the manufacturer benefits by advertising his particular product, there is every reason why the Electrical Supply Jobbers' Association can benefit by advertising its particular product, which is the service that its members have rendered and are prepared to render.

Throughout the electrical contracting trade there has been and is now a disposition to buy from the jobber only as a last resort. Throughout the manufacturing trade there is an element of uncertainty as to whether its products should be marketed direct to the consumer, through the contractor-dealer, through the jobber or through both of them. This attitude of mind on the part of buyers was one of the first things reflected in government work when men from civil life became active in government purchasing, and as a result great stress was laid by them, and naturally by those under them, on eliminating the jobber or middleman in all classes of trade so far as possible. Notwithstanding the fact that the government has to a large extent seen that this was an error, the fact remains that the prejudice is strongly ingrained in the minds of the people to-day.

It is true that individual manufacturers and individual buyers throughout the industry are completely converted to the necessity of the jobber, but this opinion should be shared by all.

The Electrical Supply Jobbers' Association, in gathering statistics and interchanging ideas and information regarding business methods, has done a splendid work in educating its members to improve the service they are prepared to render, to improve their own operating conditions and to strengthen themselves in the industry; but it seems to your committee that this work should not stop there, but should extend its undoubted benefits to the jobbers' customers and eventually the public in general and thus complete its work.

Individually, all that we advocate in favor of the publicity campaign has been done by the individual jobber, but we feel that collectively this work can be made much more effective. What an individual jobber may do or may claim along these lines is discounted by the hearer or reader as trade talk. This same work backed by the Electrical Supply Jobbers' Association would carry the necessary weight and become effective.

There is a widespread misunderstanding throughout the trade as to the real purposes of the association. This misunderstanding, for the good of the association and its members and in the interest of mutual coöperation between different classes of trade, should be removed.

Many matters are brought to light in discussions in association meetings which, if collected through statistics, would be of great interest to buyers as well as jobbers themselves; but the only way to get this information before the buyer is through paid advertising combined with other publicity. The editors of reputable trade and technical papers are as much interested in building up the industry as we are, and they are ready and anxious to publish matter of real news value and of real interest to their readers; but a definite advertising and publicity plan is necessary to collect this information and see that it is put out in the proper manner and through the proper channels.

What an Advertising and Publicity Campaign May Accomplish

First—The removal from the minds of trade buyers, particularly those in the electrical trade, of the erroneous impression that the association does anything in the way of fixing resale prices.

Second—Educating buyers of electrical merchandise to purchase of electrical jobbers rather than of hardware jobbers, drug houses or other concerns not strictly engaged in the electrical business.

Third—Attracting the attention of manufacturers, especially new ones, to the service that members of the association may render them as mediums of distribution and marketing of their products.

Fourth—Impressing upon manufacturers the advantage to them of giving due consideration to the electrical jobber regardless of what their sales policy may be.

Fifth—Educating the buyer, especially those directly in the electrical business, to buy from the jobber rather than direct from the manufacturer and giving arguments in support of this.

Sixth—Calling the attention of the buyer to the stocks carried by the jobber and the geographical distribution of them, and consequent better service that may be given by a jobber than by a manufacturer, even on that manufacturer's own line.

Seventh—Educating the buyer to the wide diversity of articles and lines carried in jobbers' stocks.

Eighth—Directing the attention of all readers of trade journals to the fact that everything that may be advertised in the particular issue he is reading can be purchased by him from a jobber.

Ninth—Directing the attention of all readers of trade journals to the fact that the membership of the association undoubtedly includes one or more jobbers in his immediate locality who are prepared to render him a distinct service in furnishing goods advertised.

Tenth—Directing the attention of manufacturers to the Electrical Supply Jobbers' Association as including the best jobbers in the country, and thereby quite likely influencing the manufacturers to refer to the fact in their own advertisements that their products may be secured from members of the Electrical Supply Jobbers' Association.

Eleventh—Making the buyer familiar with the enormous aggregate in dollars and cents value of the stocks carried as a whole by the Electrical Supply Jobbers' Association members as a demonstration of the service they can render.

Twelfth—Directing the attention of electrical jobbers throughout the country, both members and non-members, to the real objects of the association and to the educational work it is carrying on for the benefit of the trade.

Thirteenth—Counteracting by dignified and businesslike arguments any tendency on the part of the government, the manufacturer, the contractor or any other interest to fail to accord to the jobber his rightful place in the industry.

Fourteenth—Directing the attention of the manufacturer to the enormous purchasing power of the jobber.

Fifteenth—Directing the attention of the manufacturer to the thoroughness with which the United States is covered by the activities of the jobber.

Sixteenth—Proving to the manufacturer that the jobber actually creates business in addition to acting as an economic distributer of the material involved.

Seventeenth—Proving to the manufacturer that the jobber can perform the functions of warehousing and distributing more efficiently and economically than the manufacturer can himself.

Eighteenth—Directing the buyer's attention, particularly during war times, to the fact that to take advantage of jobbers' stocks is one way of coöperating with the government, in that manufacturers are not loaded up with orders for material already in the jobber's warehouse.

Nineteenth—Directing the attention of the buyer to the service rendered by the jobber's salesmen, a small part of which nowadays is the actual soliciting and taking of orders.

Twentieth—Directing the attention of the manufacturer to the economy of marketing his product through the jobber from the standpoint of accounting as well as from the standpoint of warehousing and distributing.

Twenty-first—Creating in the minds of readers, especially those in the business, a proper realization of the jobbing business as occupying its own essential and peculiar position in the industry, and thereby counteracting the belief on the part of many central stations, and practically all contractors, that all they have to do to become jobbers is to announce the fact, rather than have them realize that it is a field requiring peculiar fitness from every standpoint.

Twenty-second—The building up of a spirit of good will on the part of buyers toward the jobber, a ready and prompt recognition of the service he is prepared to render, and a natural inclination to make use of that service.

Advertising Mediums to Use and Why

The complete and ideal advertising campaign would involve paid advertising space and publicity not only in electrical trade journals, but in trade journals of other lines directly or indirectly connected with the electrical business, such, for instance, as journals distributed throughout the hardware trade, the drug trade, industrial plants, etc. Such advertising would be of direct benefit to jobbers of electrical supplies, but in the future your committee can see coöperation along advertising lines for the benefit of the jobbers in all lines between the various associations of the different lines, each association bearing a share of the expense involved, and such a campaign including not only trade journals of all classes of business but periodicals of national circulation.

Your committee, however, bases this report on making use to begin with of electrical trade journals only; in other words, the logical steps will be, first, an advertising campaign in electrical trade journals; then the inclusion of trade journals in other lines of business, and next a combination of advertising campaigns to include periodicals and other mediums of national circulation, the expense to be borne by the various associations.

The effect that such advertising will have on the minds of buyers now will be reflected in our ledgers during the reconstruction period.

Many of the objectors to this campaign give as their only argument the fact that no other association of jobbers has ever carried on such a campaign, but in the opinion of your committee this is an argument in favor of it, because it will be to the credit of the Electrical Supply Jobbers' Association that it take the initiative in advertising, and we believe jobbers' associations in other lines will eventually do the same, particularly if our association begins it.

EMERGENCY AND TEST CENTERS VALUABLE DISTRIBUTION AIDS

Circuits Arranged So that Even Complete Failure of Large Substation Would Not Long Deprive Customers of Electric Service

DURING the war period that has just closed a simple and effective method of emergency operation was evolved by the Commonwealth Edison Company of Chicago that can be used to advantage in connection with distribution systems even in times of peace, as can many of the methods worked out during the national emergency. In the case under consideration the construction required is of two rather similar types. One is the emergency center used for transferring load, and the other is the test center used for locating and eliminating a section of outlying line which is in trouble. Both are used exclusively on the company's 60-cycle, 4000-volt circuits.

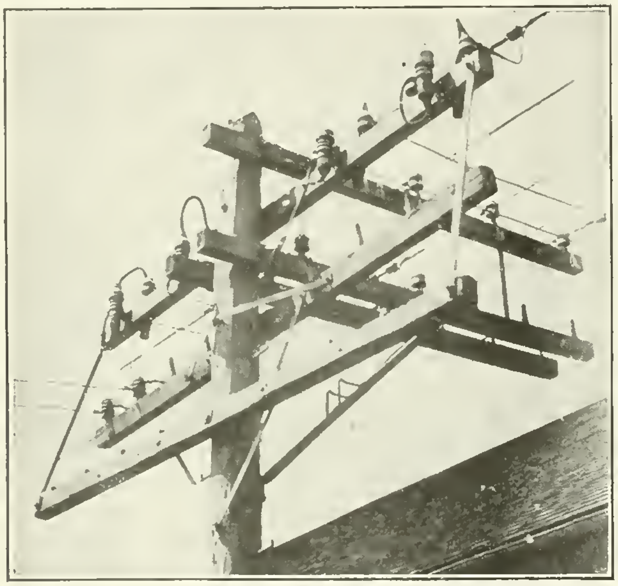


FIG. 1—EMERGENCY CENTER ON WHICH DOUBLE POTHEAD CONSTRUCTION IS VISIBLE

Emergency centers are located on the overhead distribution system at points where the outer ends of circuits from two different substations come near together or where the ends of circuits from the same station are found in proximity to each other. Sometimes the centers can be installed without building extra line, and sometimes it is necessary to construct a few extra spans to bring the circuit ends together. In either case the standard construction employed consists of a combination of strain insulators and disconnecting potheads.

DETAILS OF THE CONSTRUCTION

If it is desired to construct an emergency center between circuits from two adjacent substations, the ends of the circuits are connected mechanically but separated electrically by means of two porcelain strain insulators. Four disconnecting-type G. & W. potheads are then installed on a cross-arm installed at right angles to the line arm. Two complete potheads are used for each line wire (Fig. 2). The tap from the end of one wire is connected into the cap of one pothead, and the tap from the other side of the porcelain breaker is run into the bottom or tube of the other. Thus the tube of one pothead and the cap of the other are merely dummies which carry no electrical connections and which are used to keep the contacts of the live tube and the live cap in position and in good condition. When it is desired to connect the two circuits together, the live cap is placed upon the live tube, thereby making the electrical connection between the ends of the two circuits. This forms a jumper around the porcelain breakers through the pothead. The same practice is followed for installing an emergency center between two circuits from the same stations.

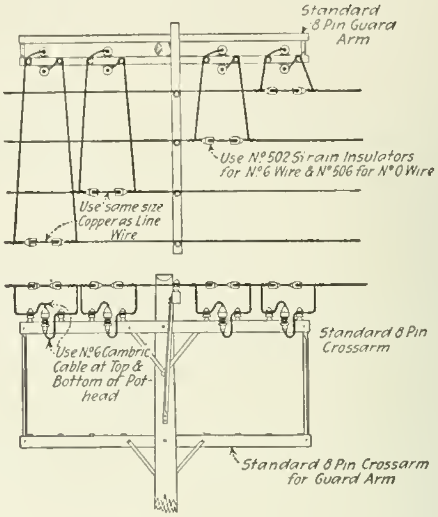

Standard 8 Pin Guard Arm
Use No. 502 Strain Insulators for No. 6 Wire & No. 506 for No. 0 Wire
Use same size Copper as Line Wire
Use No. 6 Cambric Cable at Top & Bottom of Pothead
Standard 8 Pin Crossarm
Standard 8 Pin Crossarm for Guard Arm

FIG. 2—WORKING DRAWING OF A TYPICAL EMERGENCY CENTER

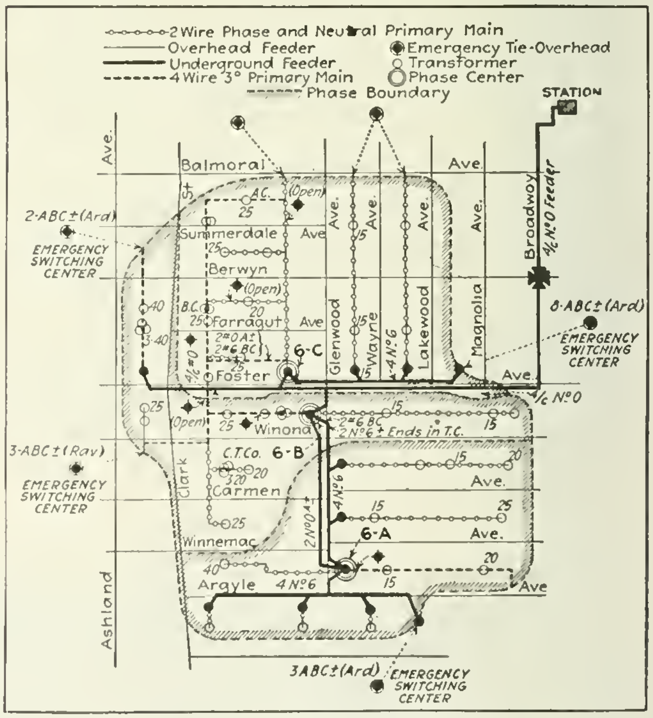


FIG. 3—ACTUAL MAP OF A SECTION OF DISTRIBUTION SYSTEM, SHOWING LOCATION OF EMERGENCY CENTERS

The practical value of this arrangement is that these emergency connections permit the load in any given district to be fed from two or more directions. Within that portion of Chicago bounded by a line drawn through the company's farthest outlying substations every customer can be fed from two or more directions. Moreover, if a large substation should by any chance become completely disabled, the load it serves could be almost completely picked up by surrounding stations in less than one and a half hours, whereas under other circumstances all customers would have to await repairs to the substation. Unavoidable operating troubles which have occurred in the last summer have been remedied so quickly that they have each demonstrated the emergency centers to be worth many times their cost. Moreover, when load from a damaged station can be picked up by surrounding stations through these emergency centers, temporary repairs at the damaged station can be avoided. Hence the actual cost of making repairs can be reduced.

The test centers, which are of somewhat similar construction, are generally installed in outlying sections of the city where branches of a line leave a terminal pole in several directions. Here the potheads are installed directly in series with the line so that all but one of the branches may be "killed" to assist in locating trouble. As the system grows these test centers are often converted into emergency centers. Here again the simplicity of this type of construction becomes its outstanding feature, since the change can be made by merely changing pothead connections. It is a fact that as the loads shift and grow a certain pole may be now a test center, later an emergency center, and again a test center, without the necessity of cutting or splicing lines or depriving any customer of continuous service. By setting the regulators of the circuits which are to be rearranged on neutral points and placing the circuits upon the same bus, the changes out on the lines can be made at will by shifting the disconnecting potheads. Such an arrangement is found to make the distribution system really flexible. Moreover, it reduces to a minimum labor costs incident to keeping the distribution system in continuous operation.

Investigation of Conductor Heating

Since Motors Are Given Short Time Ratings, There Appears to Be No Reason Why the Feeding Wires Should Not Be Given Higher Ratings for Short-Time Loads than Those Given to Them for Continuous Loads

BY HENRY C. HORSTMANN AND VICTOR H. TOUSLEY

THE horsepower rating of a motor depends usually upon the temperature rise caused by the current necessary to develop the required torque and speed. Thus a motor which has a 100-hp. rating for continuous service may be given several times this rating provided that it will not be called upon to develop this horsepower for any great length of time. Since such a motor can be used only for short intervals, and as it does not cool so rapidly as the conductors which feed it, it seems reasonable to give the conductors the same rating as the motor. In other words, they should not be required to have a capacity sufficient to carry the motor current continuously.

The current in amperes which will cause a certain temperature rise in a given conductor in a fixed time can be found by the formula $I = i(\sqrt{T/t})$, where T equals the limiting temperature, t the temperature rise caused in the conductor by the current i in the time given, and I the current which will cause the rise to T deg. above the surrounding air. The values of t corresponding to the various sizes of wire and length of time considered are given in Table I and represent the temperature rises caused by the currents in amperes given in column i at the left.

The current given is that authorized by the National Electrical Code, and the values of t have all been experimentally obtained with the exception of those given for 300,000-circ.mil and 400,000-circ.mil cables. The figures given for these cables are based on the assumption that the carrying capacities given are in proper proportion. If this assumption is correct, the temperature rise of the two untested cables will be slightly more rapid than indicated. The more rapid rise is due to the greater relative surface for convection and radiation for the smaller conductors.

In Table II the currents permissible for short-time use have been calculated according to the formula given and for a temperature rise of 20 deg. C. As in previous

TABLE I—VALUES OF TEMPERATURE RISE

B. & S.	*i*	Time in Minutes 5	10	15	20	25	30	40	50	60
14	15	5.2	7.6	9.4	10.5	11.4	12.1	13.3	14.0	14.6
12	20	6.4	9.4	11.6	13.0	14.2	15.0	16.2	16.8	17.2
10	25	5.6	8.2	10.0	11.6	12.6	13.5	14.7	15.4	15.6
8	35	5.6	8.0	9.7	11.0	12.2	13.0	14.2	15.2	15.9
6	50	3.8	6.9	9.2	10.8	12.1	13.2	14.8	16.1	17.1
4	70	4.6	7.2	9.3	11.3	12.9	14.3	16.5	18.1	19.5
3	80	4.2	6.0	8.4	10.0	11.5	12.8	15.0	16.4	17.5
2	90	4.0	6.4	8.5	10.1	11.5	12.6	14.6	16.1	17.2
1	100	3.2	6.0	8.3	10.1	11.6	12.8	14.8	16.6	18.2
0	125	2.4	4.9	6.8	8.5	10.0	11.5	14.0	15.8	17.2
2/0	150	4.0	6.4	8.2	9.9	11.4	12.6	14.9	16.8	18.3
3/0	175	2.8	5.0	6.7	8.2	9.4	10.5	12.4	14.0	15.4
4/0	225	3.2	6.0	8.5	11.0	13.0	14.8	18.1	20.8	23.2
300,000	275	1.9	3.6	5.0	6.3	7.7	8.9	11.0	13.0	14.6
400,000	325	1.9	3.6	5.0	6.3	7.7	8.9	11.0	13.0	14.6
500,000	400	1.9	3.6	5.0	6.3	7.7	8.9	11.0	13.0	14.6

TABLE II—CURRENTS FOR 20 DEG. C. TEMPERATURE RISE

B. & S.	*i*	Time Rating of Motor in Minutes 5	10	15	20	25	30	40	50	60
14	15	29.4	24.3	21.9	20.7	19.8	19.2	18.3	18.0	17.5
12	20	35.4	29.2	26.2	24.8	23.8	23.0	22.2	21.8	21.6
10	25	47.2	39.0	35.2	32.7	31.5	30.5	29.0	28.5	28.2
8	35	66.1	55.3	50.0	47.2	44.8	43.4	41.6	39.9	39.2
6	50	114.0	85.0	73.5	68.0	64.0	61.5	58.0	55.6	54.0
4	70	145.6	116.9	102.2	93.1	86.8	82.6	77.0	73.5	70.7
3	80	174.4	139.2	123.2	112.8	105.6	100.0	92.0	88.0	85.6
2	90	200.7	159.3	137.7	127.0	118.8	113.4	105.3	104.4	97.2
1	100	250.0	182.0	155.0	141.0	131.0	125.0	116.0	109.5	104.8
0	125	360.0	252.5	213.7	191.2	176.2	165.0	148.7	145.0	133.7
2/0	150	334.5	264.0	234.0	213.0	128.0	189.0	174.0	163.5	154.2
3/0	175	463.7	350.0	302.7	273.0	255.5	241.5	222.2	209.2	199.5
4/0	225	562.0	409.5	344.2	303.7	279.0	261.0	236.2	220.5	207.0
300,000	275	891.0	649.0	550.0	489.5	442.7	412.5	371.2	341.0	280.0
400,000	325	105.30	767.0	650.0	578.5	523.2	487.5	438.7	403.0	331.5
500,000	400	1296.0	944.0	800.0	712.0	644.0	600.0	540.0	496.0	408.0

tables,* no attempt has been made to make corrections for change of resistance with temperature.

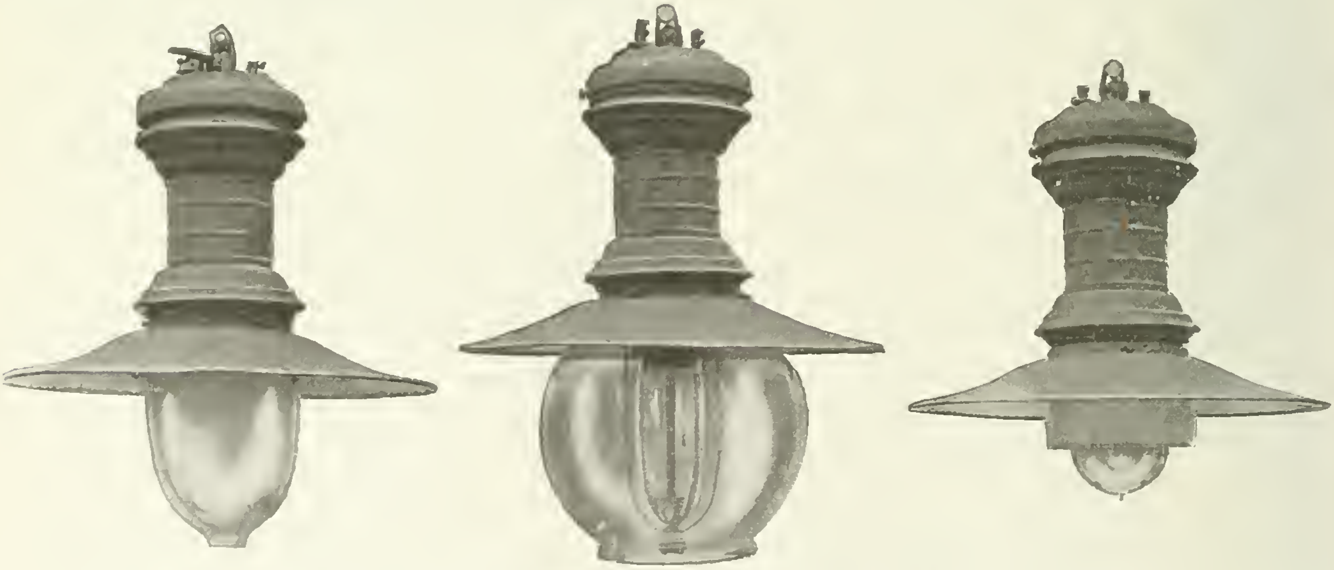
From the data in this and foregoing articles it seems quite evident that the tables of carrying capacities in general use could be improved by a careful revision aimed at listing currents which will cause the same maximum temperature rise in all conductors. In view of the present high price of copper, conduit and labor, it also seems advisable to consider carefully whether it is not permissible to give a materially increased current rating to conductors subject to intermittent loads of short duration. This, of course, would mean a modification of the old rule that wires must never be overfused.

EDUCATING ENGINEERS IN ENGLISH COLLEGES

Sir Henry Miers Describes Present Tendencies—Getting Into Closer Touch with the Industries an Important Object

Speaking at Boston, Mass., during the recent meeting to promote engineering education, Sir Henry Miers, F.R.S., vice-chancellor of the University of Manchester, England, commented upon the effect of the war and on present tendencies. He spoke of the calling of industrial specialists into the lecture room as most desirable.

Too much attention, the speaker thought, is being given to-day to the needs of the rank and file of the profession rather than to training men for the broadest and heaviest responsibilities. The universities in England are trying to get more closely in touch with the industries. Firms are introducing scholarships to train qualified young men for research. A strong demand for non-vocational training is now being met by the universities. The workers look with suspicion on any training which patently tends to increase their efficiency of production, but are seeking cultural education. Sir Henry Miers also emphasized the importance of training engineers in industrial history and social economics during their professional courses.



FIGS. 1, 2 AND 3—THE OLD ARC LAMP AND THE TWO NEW TYPES OF INCANDESCENT LAMPS MADE FROM SOME OF ITS PARTS

REBUILDING ARC LAMPS AS INCANDESCENT FIXTURES

Salvage of Useful Parts and Employment of Inexpensive Labor Brings Down Cost of Rebuilt Street Lamps to $8.73 Each

BY W. B. TURNER

When the Memphis Gas & Electric Company decided to change its street lighting from an arc-lamp system to a system of incandescent lamps it had in stock and in service about 1800 old 7.5-amp. General Electric inclosed-arc lamps. The past experiences of the company's engineering and operating departments in building all of the transformers used by the company gave rise to the belief that it might be possible to save money by rebuilding its street lamps as well, using parts of the old arc lamps. After investigating the characteristics and prices of several incandescent lighting fixtures then on the market, the engineers designed a lamp which was somewhat different from any of these and which would permit the use of parts of the old arc lamp. The new lamps were to be of two types, namely, a 7.5/20-amp., 600-cp. series lamp and a 400-cp. multiple lamp.

Construction of the latter was a comparatively simple matter. The work consisted merely of cleaning the operating mechanism out of the old lamps and inserting in its stead a "mogul" socket on a 6-in. (15-cm.) piece of iron pipe and attaching a new cast-iron ventilating shade holder. All of the parts required are shown in an exploded view (Fig. 4).

Since the series lamp was designed with a compensator in the hood its manufacture was somewhat more of a problem. The compensator required was to operate at 7.5 amp. on the primary and 20 amp. on the secondary. The laminated core was made of pieces of transformed iron too small to be of use in building larger transformers. They were, therefore, virtually scrap. The windings were made of magnet wire. The completed compensator was placed in a stirrup-shaped cast-iron frame, and the whole affair was dipped in a quick-drying varnish. Wooden wedges, which were then driven between the edges of the compensator and the stirrup, held the compensator in place and made a very rugged unit. The top of the casting, which had previously been tapped for machine screws, was then fastened to the head of the old arc lamp. To the bottom of this stirrup-shaped casting the receptacle for the gas-filled lamp was attached.

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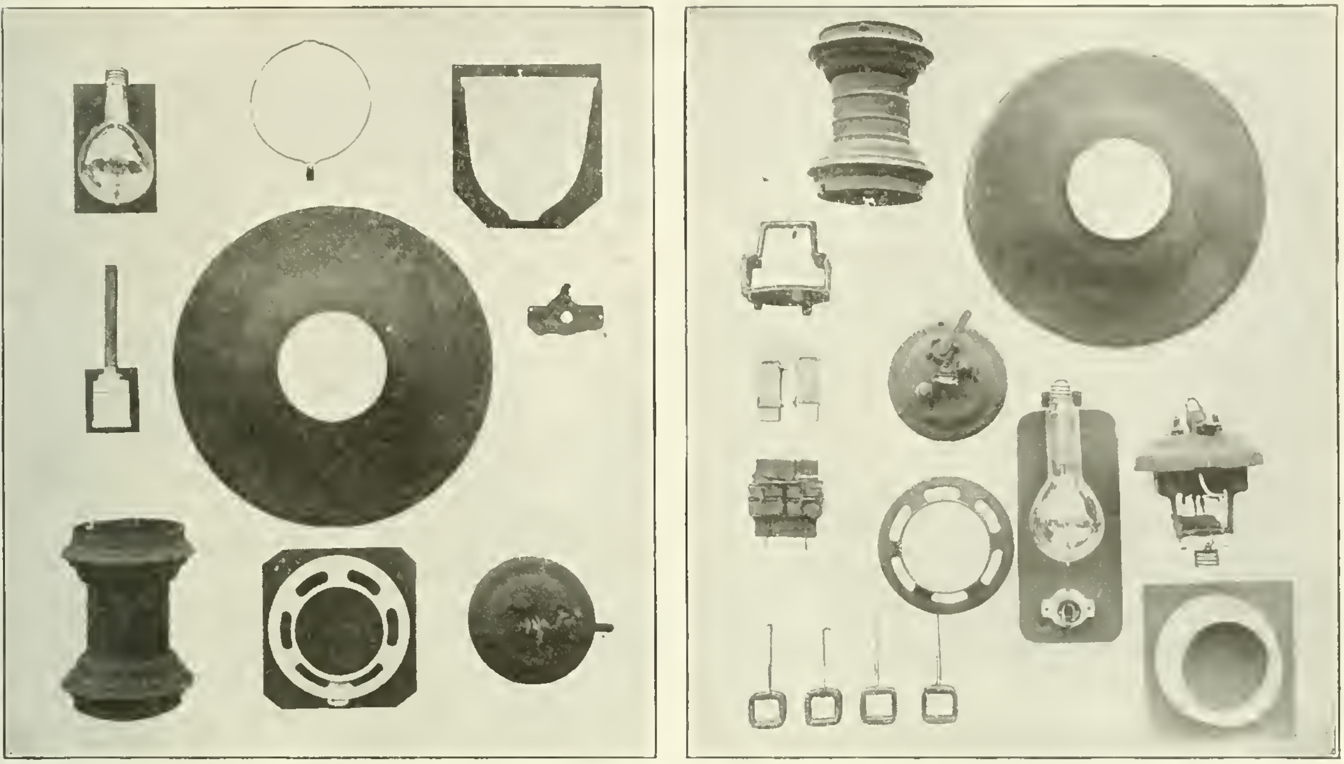
*See Electrical World, Nov. 14, 1918, p. 489, and Oct. 12, 1918, p. 690



FIGS. 4 AND 5—PARTS OF A 400-CP. MULTIPLE LAMP; DETAILED VIEW OF COMPENSATOR DISASSEMBLED AT THE LEFT IN FIG. 5 AND ASSEMBLED UNIT AT THE RIGHT

This design had the advantage that the casting required very little machining, and it permitted the use of the head jacket and porcelain shade of the old lamp. A cast-iron ventilating ring adapter of the same sort used on the multiple lamp was employed to hold the Holophane band refactor. The compensator as built has a high efficiency and gives regulation within limits closer than 1 per cent of the secondary with normal primary current. Of the 1600 lamps of this type only three have showed defects, and all have now been in service from six months to eighteen months.

ITEMIZED COST OF SERIES LAMPS

20 amp. gas-filled lamp.	$3.30
Holophane band refractor	3.15
Cleat receptacle	.41
Magnet wire	.82
Iron laminations	.33
Castings.	.35
Insulation, etc.	.50
Labor	1.82
Total	$10.68
Less value of scrap from old arc lamps	1.95
Cost per lamp	$8.73

The labor used in the manufacture of the lamps was the regular central-station shop force plus a few schoolboys employed in the summer months. Throughout the job it was the policy not to let the lamp reconstruction work interfere with regular routine operation. The saving effected by using the old lamps and the inexpensive labor, if it is taken into account that the company got $1.95 each as the scrap value of the parts of old lamps not used, was nearly 50 per cent of the best price at which lamps of equal quality could have been purchased by the company, even on a quantity basis. A detailed statement of the cost of the series lamps is given herewith.

SOME anxiously ask, "What has become of our form of government?" In saving the world have we lost our Republic? The astounding spectacle of centralized control which we have witnessed has confused many and turned the heads of some. But this, for the most part, has been the manifestation of the Republic in arms, fighting as a unit, with powers essential to self-preservation, which the Constitution not only did not deny but itself conferred. So far as we have harnessed our strength for war we were acting under the Constitution and not in violation of it. Wherever in the desire to take advantage of the situation for the purpose of fastening some new policy upon the country there has been resort to arbitrary power through acts unjustified by real or substantial relation to a state of actual war, such acts will receive the condemnation they deserve when they are brought to the determination of the proper tribunals.—*Charles E. Hughes.*

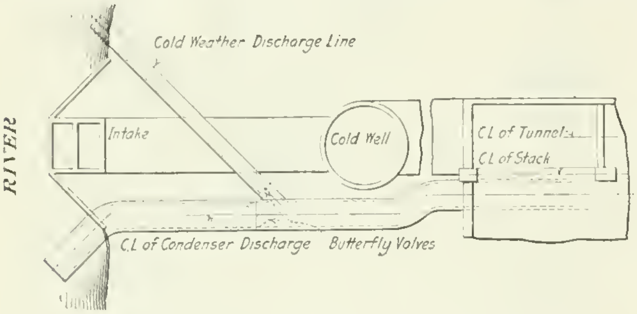
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

INTAKE IS DESIGNED TO REDUCE ICE TROUBLES

Warm Water Which Is Discharged Upstream in Cold Weather Passes Mouth of Intake Tunnel to Melt Ice Formations

A cold-weather by-pass to reduce ice troubles in the condenser intake has been incorporated in the discharge tunnel of the Mansfield (Ohio) Electric Light & Power Company new power station. The main intake and discharge tunnels are laid out in the usual manner with the intake farther up-stream than the discharge. Branching off from the discharge tunnel, however, is a cold-weather discharge line which can be operated to eject warm condensing water upstream above the intake. This is the feature of the installation.



LAYOUT TO MELT ICE FROM DISCHARGE TUNNEL

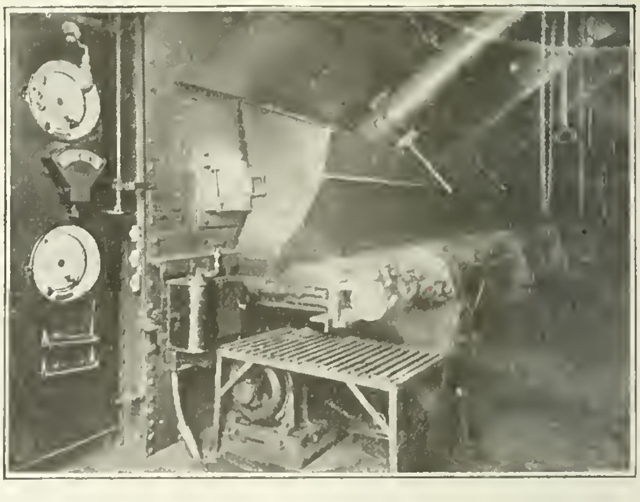
When anchor or fragile ice which might obstruct the intake is forming in the river this cold weather line is opened and butterfly valves in the main condenser discharge tunnel are partly closed. The warmer water passing the intake tunnel successfully clears the intake tunnel of objectionable ice.

FUEL-SAVING CAMPAIGN IN CONNECTICUT PLANTS

Kilowatt-Hours per Pound of Coal the Basis—Employees Share in Prize for Any Improvement in Economy Effected

An energetic campaign to save fuel is at present in progress in Connecticut, and a number of central stations are making regular reports to the state fuel administration upon which they are graded and which afford a basis for periodic comparisons of operating efficiency. A base figure expressed in pounds of coal consumed per kilowatt-hour of output is selected for each plant, and in some cases plant groups are daily exchanging operating data as a stimulus to more efficient service. The results of this interchange and friendly rivalry are not yet available, but the following data from the Hartford Electric Light Company are interesting as showing how plant performance is being improved under the incentives of up-to-date equipment and bonuses.

At Hartford a second 10,000-kw. steam turbine was placed in service about Aug. 1. The best monthly output previously secured from the company's Dutch Point station was 945 kw.-hr. per ton of coal. The management offered the station employees the following prizes for the month of August: For attaining 950 kw.-hr. per ton, $250; for reaching 1000 kw.-hr. per ton, $500, and for producing 1050 kw.-hr. per ton, $1,000. August operation resulted in the production of 1035 kw.-hr. per ton, and the station employees consequently received $500, divided according to the number of men on the payroll and without regard to the position, duties or time of service of any individual. No prize was offered for September, but toward the end of the month the station staff petitioned the management for another chance at cashing in upon efficiency gains, the September average having been about 1120 kw.-hr. per ton. This figure was established by the management as the base for October, and it was announced that if it was attained $1,500 would be awarded. The October figure was 1310 kw.-hr. per ton, a gain in efficiency of 38 per cent over the August base. From Nov. 1 to Nov. 20, 1918, this plant has produced 6,000,000 kw.-hr. with a coal consumption of 4400 tons, compared with 4,600,000 kw.-hr. for the corresponding period of last year, when 5400 tons of coal were burned.



BOILER-ROOM ACCESSORIES THAT HELP

On the panel at left, starting at the top, are steam-flow meter for superheated steam, indicating draft gage, steam-flow meter for steam supplied to auxiliaries, and two draft gages—one connected over fire and other to back. The underfeed stokers can be driven at any one of four speeds. It is the plan to mount the indicating draft gages higher on the panel so that they may be read without stooping. The recording auxiliary flow meter will be placed below draft gages in the future.

The November savings are in part due to a better quality of coal compared with 1917, but the improvement in efficiency since Aug. 1 is due partly to the utilization of the company's second 10,000-kw. turbine in place of one 2000-kw. and two 4000-kw. units now held in reserve. However, the effect of increased interest in station efficiency displayed by every one on the staff at Dutch Point, which is exhibited in close coöperation between the individuals and shifts in the interest of maximum economy of production should not be discounted.

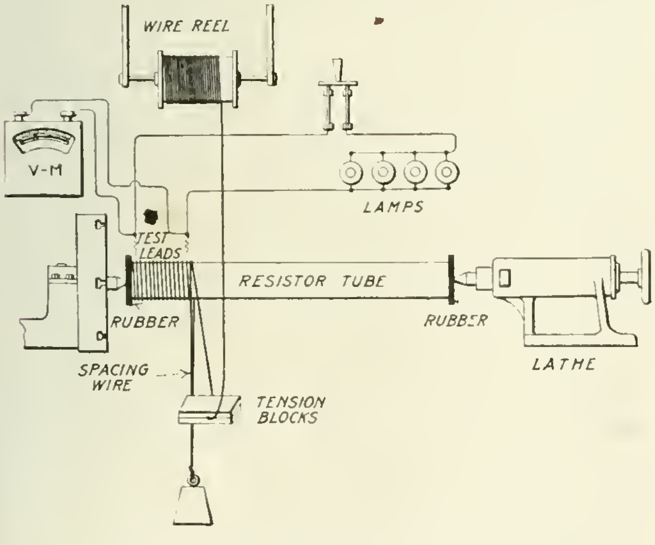
AVOIDING INTERRUPTION BY REPAIRING RESISTORS

How Size Is Easily Determined—Method of Spacing Turns Properly on Lathe—Spare Units Kept on Hand

BY H. S. RICH

Resistance coils for direct-current motor starters, mercury-vapor lamps, rheostats or almost any other purpose can be repaired without having to wait for new ones from the manufacturer. The writer has avoided many hours' delay and annoyance by following the method described herein.

Generally when a resistance coil in a starter burns out temporary operation is permitted by connecting the good coils on each side of the defective one. To replace the damaged unit the line current is shut off and a few lamps are connected to the cut-out in series with the terminals of a similar good resistance coil. With a low-reading voltmeter the exact drop in voltage across the good coil from end to end is obtained. Then as the defective coil is rewound with similar-size wire the same number of lamps at the same voltage are connected with the winding and the drop in voltage is tested to determine whether too little or too much wire has been applied. By winding on a few overlapping turns at each end and twisting them tightly the coil is ready for use.



METHOD USED FOR REPAIRING RESISTANCE COILS

When time permits, instead of winding only one coil, sometimes two or more are prepared, tagged and kept in stock. Regular resistance wire is more satisfactory than common iron wire.

To rewind the coils a small power lathe may be employed and run very slowly. Rubber packing may be used between the centers and resistor tube to form a cushion and avoid breaking the tube. The resistance wire can be fed from a suspended reel and run through two small blocks to keep it taut. It is first wound on one end with three or four turns crossing each other to make a tight start. A loop of similar-sized wire hung over the tube and held taut with a weight below the lathe will serve to space the resistance wire properly. As the tube is rotated the resistance wire being applied finds its place by running alongside the suspended loop, which in turn travels along the tube adjacent to the resistance wire already supplied. At the end a few tight turns can be made and the suspended loop removed, leaving the resistance wire evenly spaced by its own diameter and presenting a neat appearance.

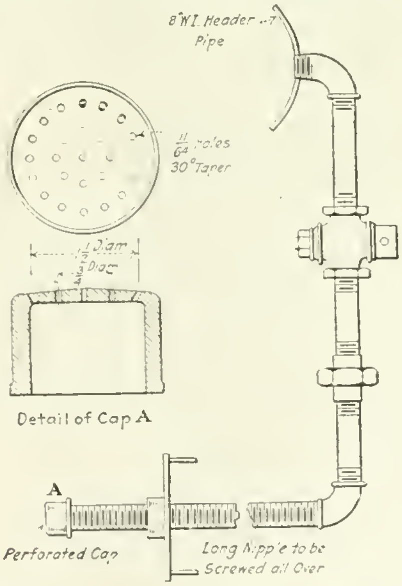
Tests for voltage drop can be made any minute by stopping the lathe and applying the lamp terminals, which should be all ready for instant use. Dollars and hours, which mean much to a busy concern, have thus been saved in one particular plant.

COMBINED COAL AND GAS FIRING

Coal Is Supplied by Underfeed Stokers in Front of Boilers, While Gas Enters at Rear

Both gas and coal are burned under the eight 512-hp. Stirling boilers in the plant of the Mansfield (Ohio) Electric Light & Power Company. Gas is the principal fuel, but coal is burned during gas shortages. The boiler room is laid out so that the boilers are in two parallel rows facing a central firing aisle. Westinghouse underfeed double-dump stokers front on this aisle. Gas is fired through specially designed burners installed at the rear of the boilers. A detail drawing of the gas burner is shown here.

The selection of a combination of fuels was dictated by unusual local conditions. The company has available new gas wells on its own station site and on adjacent land. From these wells gas is available in considerable supply. The provision for an emergency fuel was, however, felt to be necessary. An emergency supply of coal is kept available in a large semi-natural coal-storage pit.



SPECIALLY DESIGNED NATURAL-GAS BURNER

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management
Topics, Including Applications of Electric
Light, Power and Heat

EFFECT OF DAYLIGHT SAVING ON IOWA CENTRAL STATIONS

Cost of Saving Is Considered to Be Out of Proportion to Its Value When Patriotic Motive No Longer Exists

Indications are that the daylight-saving plan, as viewed in retrospect by Iowa central-station men, is not considered highly satisfactory. No extensive investigation of its effects has been made in Iowa, but numerous specific cases have come to light which show in general what has happened. The case of the Iowa Gas & Electric Company, Washington, Iowa, is typical. This is a company which operates in fourteen small communities. Its generator capacity is approximately 100 kw. For the week ended Nov. 2 the amount of electricity distributed over its territory was 9 per cent greater than for the week ended Oct. 26. The coal consumption was only 5⅜ per cent greater. The management figures that the net income has been reduced between 5 per cent and 5½ per cent by daylight saving, and that the actual coal saving in the seven months will not exceed 80 tons.

Again, take data collected by the Iowa Railway & Light Company of Cedar Rapids. At Marshalltown, which has a population of 16,000, the company's revenue has been reduced 11 per cent and its station output 8 per cent, and the belief is that the coal saving is negligible because of the small decrease in load as compared with station standby losses.

MEANS OF INCREASING INCANDESCENT LAMP SALES

New Orleans Utility Gets Good Results from Its Policy of Paying Commissions to all Employees on Lamp Sales

Some interesting figures are given by the New Orleans (La.) Railway & Light Company showing the result of the action of the Fuel Administration in requesting that except in special cases no further renewals of "gem" and carbon lamps be made.

As soon as the recommendations were made by the fuel board, the company began an intensive educational campaign for the purpose of bringing them to the attention of all lamp users in order to induce the adoption of tungsten lamps throughout the New Orleans territory.

As a result of this campaign, the sales of tungsten lamps for the month of October increased over 50 per cent, and a total of $3,248 worth were sold within the thirty-day period. With a volume of this kind the profit on the company's lamp sales now becomes a considerable portion of the total merchandising and jobbing business and contributes a very satisfactory amount toward the upkeep of the commercial department.

One influence which has resulted in greatly increasing lamp sales for the New Orleans company has been the paying of commissions on lamp sales not only to the members of the commercial department but to inspectors, metermen and linemen. This policy has been in effect about six months and has developed a surprising amount of business. Men of the other departments see in it an opportunity to increase their income and are turning in orders continually, secured from customers with whom they come in contact either in a business or social way.

Customers are permitted to pay for their lamps in three installments, and this has also proved of material assistance in increasing gross sales. This is all the more apparent when it is pointed out that the customers are urged to buy lamps by the carton rather than individually as needed.

STREET-LIGHTING REBATES IN CURTAILMENT PERIOD

Two Connecticut Utilities Used Different Methods, One Making Flat Return and the Other Basing Rebate on Fuel Saving

Rebates on street-lighting service were returned to the cities of Bridgeport and Hartford, Conn., during the recent period of lighting curtailment by the central stations operating there. At Bridgeport the United Illuminating Company operates about 350 4-amp. arc lamps of the "white-way" type and also supplies energy to a large number of series arc and incandescent lamps. The curtailment of service required shutting off 40 per cent of the "white-way" lamps, none of the other street-lighting units being cut off. For the regular series arc-lamp service, 4 amp., the city pays $65.70 per lamp per year, and for the incandescents, 80-cp. each, $20 per lamp per year. The rate on the ornamental arc lamps is $78.17 each.

It will be seen that for cutting off 40 per cent of the ornamental units the company rebated the city $500 in a three months' period, which expired shortly after the close of hostilities abroad. This rebate was agreed upon after conference with the city authorities, but it considerably exceeds the maximum saving possible to the company from service curtailment. In spite of the advance in the cost of labor and materials, the company has not increased its street-lighting rate, and it is estimated that not more than 33 tons of coal was saved during the ninety-day curtailment by the mere shutting down of lamps. Taking trimming, inspection, cleaning and repairs into account and omitting fixed charges, it is doubtful if the company could save over $1 per month per ornamental arc lamp, and it is unquestionably out of pocket by rebating. The rates for this service at Bridgeport are fixed by agreement rather than by a contract of stated term.

The Hartford Electric Light Company furnishes street lighting on a five-year contract terminating in 1919. There are no arc lamps in the city service. About $205 was rebated to the city during the first quarter of 1918, this figure being based upon a theoretical saving in fuel gained by cutting off about one-half hour of burning in the early morning.

COMMERCIAL OPPORTUNITIES OF THE CENTRAL STATIONS

Where There Are Heavy Load Conditions High-Rate Business Can Be Developed—Western Manager's Plan

Central stations which for long have not been especially active in seeking new business are now thinking over plans for commercial development. Many of the opportunities are to be found virtually everywhere and are summed up by H. E. Young, sales manager of the Minneapolis General Electric Company, as follows:

"We plan to take back as many of our old men as wish to return and have already received inquiries from several of them. When this is done, our sales force will undoubtedly be as large as before the war, if not larger.

"From present indications, we shall be able to use to advantage all these men, as at the present time we are unable to begin covering the many opportunities for investigating and getting new business on the lines which are in the field ready for salesmen to work on. Of course, to begin with, we will not attempt to get large quantities of power business on the lines until such time as our capacity has been developed to take care of a large amount of new business. We will confine our efforts to selecting the choicest and more profitable of this class of business.

"However, we will get the information on all power business which offers reasonably good prospective closing so that we shall have a complete analysis as to operating cost and sufficient information to prepare a comparison of cost for such a prospect when the proper time arrives.

"We shall undoubtedly do a considerable amount of work in developing commercial lighting business, which on account of the widespread curtailment propaganda has been considerably reduced and which we feel is worth some effort to get back at least to its former position. Besides this, the many commercial establishments which never were up to standard in the way of interior illumination, window lighting, signs, etc., offer another field for still further development

"We have never really let up in our house-wiring efforts, although we expected that the house-wiring campaign we conducted last fall would be our last one until after the war. We will now continue our efforts in this direction, as this is business right on our lines, requiring virtually no investment and paying the highest kilowatt-hour rate.

"In the way of merchandising of electrical appliances we will continue our present policy but undoubtedly will put forth still more effort than we have in the past.

"Our electric range department has been cut down for more than a year to a force of only one or two employees, which permitted of virtually nothing more than showing the ranges in the display room, no outside effort being possible with this small force. Furthermore, we have been selling all ranges on a strictly cash basis, charging full list price plus the full contractor's cost of doing the wiring in the house, and if any expense was necessary on our part in the way of outside construction work, the customer had this to pay also. Nevertheless, we have averaged from twelve to fifteen ranges per month during the year, although our rate for electric cooking has been increased 20 per cent in the meantime.

"We have no immediate plans for returning to the active promotion of the electric cooking and range sales as practiced two years ago, but this will doubtless come about gradually as conditions change."

RULES FOR FINANCING EXTENSIONS IN JOPLIN

By Plan Adopted a Deposit Is Required for Poles and Line Erected, Service Drop Not Included

The new rules for financing extensions during the period of heavy prices inaugurated by the Empire District Electric Company, Joplin, Mo., on recommendation of the State Public Service Commission, provide for a deposit of $30 for each pole and one span of line and $15 for each span of line without pole on all extensions of less than 5 hp. On power extensions of 5 hp. and more there is required a deposit sufficient to cover the entire estimated cost of the extension. No deposit, however, will be required for service drops of ordinary length.

Should the estimated cost of power extensions of 5 hp. or more exceed the actual cost, the difference is refunded to the customer upon completion of the line. Deposits are refunded to the customers at the rate of 25 per cent of the bill for each month for service of less than 5 hp. and at the rate of 10 per cent of the bill for power service of 5 hp. or more. In addition, provision is made for the semi-annual payment of interest on the unrefunded portion of all deposits at the rate of 6 per cent per annum.

In case an extension for service is made for a consumer and afterward other consumers are served from that extension, like percentages on monthly bills for service to such additional consumers are credited and paid to the owner of the deposit on the line originally until the whole deposit is refunded. The newcomers on the line are not required in this plan to make any deposit except as there is some necessary construction other than the regular service drop.

Provisions are made for refunding the balance of deposits on extensions with interest at the end of five years if not already taken care of. Provisions are also made for taking up with the commission the case of any extension where a difference of opinion arises between the customer and the company regarding the deposit.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Faults in Generators and Motors.—This is the third article of a series entitled "The Electrical Study Course" in which the discussion of open circuits in the field coils of motors and generators is concluded. In this article short circuits and grounds in armature and field windings are also taken up.—*Power*, Nov. 26, 1918.

Guarantees for Temperature Rise in Electrical Machinery.—A. E. DU PASQUIER.—The article has special reference to large turbo-generators. After critically discussing the British standardization rules and those of the American Institute of Electrical Engineers, the author comes to the following conclusions: That the British standardization regulations and the A. I. E. E. regulations require amendment in respect of total permissible observed temperatures and the correction factors to be applied as between the various methods of indicating temperatures; that the most accurate method of determining hottest-spot temperatures is by means of suitable thermocouples; that the increase of resistance methods be reserved for the rotating fields of modern turbo-generators; that in the larger units it is economical and reasonable to work the copper in a machine up to 150 deg. C.; that in such machines it is better to adopt as a guarantee of performance a maximum safe operating total temperature rather than a temperature rise. The rating of such machines should be the maximum kva. output obtainable without such total temperatures being exceeded.—*Transactions South African Institute of Electrical Engineers*, July, 1918.

Magnetization of Three-Phase Transformers.—A. MANDL.—The magnetization of the three-phase transformer with saturated limbs is investigated, with particular reference to the distortion of the wave-shape of the magnetizing currents in the three limbs by the hysteresis in the iron. The main subject that is discussed is the mode in which a transformer in star connection, without neutral conductor, can be magnetized by a voltage strictly following the sine law.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Elektrot. u. Maschinenbau*, April 21 and April 28, 1918.)

Heating of Machines and Transformers.—J. FISCHER-HINNEN.—At the present moment it is no longer the commutation but the heating that appears to give the greatest difficulty, and the object of the article is to collect the information available on this point and to supplement it where necessary. The reduction of heating by ventilation is effective, but demands expensive installations of blowers, filters, etc., without which the insides of the machines become contaminated with dust or with a mixture of dust and oil which is most destructive. On this account a machine giving a certain temperature rise with the least artificial ventilation is the preferable one. The author goes into details of the methods of calculating the temperature rise on continuous load, allowing for the radiation, convection and the chimney action in ventilating ducts, and discusses what should really be regarded as the radiating surface. Regarding the chimney action, tests are described on resistors inclosed in tubes, and a formula is found connecting the reduction of temperature caused by the chimney action of the ascending air. Regarding the cooling surface, it is pointed out that it is not of great importance to discuss what parts of the surface should be regarded as radiating, as the temperature rise can be correctly arrived at using any method of estimating the radiating surface, provided suitable constants are used. A table is given showing the radiating constants of various types of transformers, motors, field coils, commutators, generator windings, resistance coils, etc., for definite assumptions regarding the effective radiating surface. A discussion then follows on the calculation of the necessary volumes of air, oil or combinations of these two materials required for artificial cooling. The formulas obtained are applied to particular cases and the results compared with the values actually obtained on test. In conclusion the case of intermittent loading is considered in a similar manner. The article is a comprehensive survey of the methods of calculating temperature rises and should be of considerable use to designing engineers.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Elektrot. u. Maschinenbau*, May 5 and May 12, 1918.)

Lamps and Lighting

Some Modern Methods of Lighting.—GEORGE H. STICKNEY.—The author discusses the selection of lamps, fixtures and control devices for the lighting of factories, offices and store buildings. The demands as to intensity, diffusion, direction and color of light and the factors influencing the spacing of lighting outlets are indicated. Cost comparisons of different systems are also put down. —*National Engineer*, October, 1918.

Linking Science and Art in Lighting.—M. LUCKIESH. —In the third of a series of articles by the author on this subject particular attention is given to lighting fixtures. It is pointed out that lighting fixtures may be handled largely from catalogs by using a small demonstrating room equipped so as to illustrate general lighting schemes rather than the display of each individual fixture.—*Electrical Review*, Dec. 7, 1918.

Generation, Transmission and Distribution

Getting Along with a Smaller Coal Pile.—JOHNSON HEYWOOD.—It is said that economies approaching 50 per cent of the coal requirements in small steam plants of 200 hp. to 500 hp. can often be effected simply by putting the plants in good shape. The author calls attention to the necessity of covering all pipes with insulating material, properly insulating boiler and breeching, keeping scale out of tubes, preventing air leaks in the boiler foundations, returning all drips to the boiler, keeping joints steam-tight, avoiding the use of live steam for heating the building and at the same time making use of any exhaust steam, taking indicator cards to check the valve settings, and proper instruction of firemen.—*Factory*, October, 1918.

Cooling Losses in Internal-Combustion Engines.—C. A. NORMAN.—With the aid of a formula derived from results of Dugald Clerk and others the effect of varying dimensions, stroke-to-bore ratio, expansion ratio and piston speed is investigated. Great expansion combined with a low stroke-to-bore ratio is found in general conducive to best efficiency. Large size, as well as very high speed, will in general reduce efficiency—large size by necessitating a low number of revolutions and extremely efficient cooling, very high speed by delayed combustion. The best speed and dimensions to be used in every individual case can be estimated by the use of this formula. The formula, while requiring further experimental verification, is offered merely as a basis for estimating as closely as may be done at the present time the extent to which cooling losses depend upon engine speeds and dimensions.—Paper before A. S. M. E. Convention, December, 1918.

Some Experiences with Large-Capacity Reservoir Outlets.—JAMES M. GAYLORD.—The writer describes specially designed gates for controlling the discharge of volumes of water under pressures above 200 ft. (60 m.). He suggests some of the difficulties which have been encountered in installations of this sort and shows how these have been overcome.—*Engineering News-Record*, Nov. 1, 1918.

High-Pressure Gates in Dams for Waterworks and Irrigation Reviewed.—D. W. COLE.—One of the very early waterworks installations using valves under considerable heads is that of the Sudbury Reservoir of the Boston waterworks, where sluicegates were operated under 65-ft. (20-m.) heads. Here and in similar waterworks installations a considerable vibration in the valves was noticeable, causing joints in the piping through the dam to be jarred loose. The experience at the Shoshone Dam, the Pathfinder and Roosevelt Dams, built by the Reclamation Service, led to the development of a balanced valve which might be operated either partially or fully opened. Ten 58-in. (147-cm.) balanced valves operating at 105-ft. (32-m.) heads and each discharging about 1000 cu.ft. (28 cu.m.) of water are described as installed at the Arrowrock Dam in Idaho. This is the highest dam in the world, being 348 ft. (106 m.) from its lowest foundation point to the crest.—*Engineering News-Record*, Nov. 14, 1918.

Electricity as Factor in Reconstruction in France.—The new constitution of the economic life of the invaded regions of France will not be possible without resort to electricity. A committee has been formed representing the electric power companies in the invaded regions. In the great majority of cases the electrical machinery, boilers, transmission lines, often the buildings themselves, have been destroyed. It has been agreed that, having a clean slate so far as old plants are concerned, advantage shall be taken of the opportunity for securing as largely as possible the standardization of new equipment and transmission systems. The adoption of this principle of standardization would make it possible for those interested to help one another most effectively because the machinery available would be capable of being used in one place as well as another. This flexibility will be of decided advantage before the complete power requirements have been restored. Other questions taken up by this committee are where these new generating units shall be installed and how the electric energy will be distributed. The committee is also to work out a plan by which the many small plants operating previously will now be replaced by fewer large generating systems.—*Fortnightly Information Leaflet*, Sept. 15, 1918.

Hydroelectric Development in Ontario.—ARTHUR H. HULL.—The author showed how the system of the Hydroelectric Power Commission had grown until there is more than 700,000 hp. in hydroelectric development now available. The extensive use to which electric power has been put is evident when the population of the province, two and a half million, is taken into consideration. The scarcity of coal, natural gas and oil have made hydroelectric development necessary. In the paper complete statistical data regarding the power site, hydraulic and electrical features of each development are put down, together with a résumé of the load conditions.—Paper read before the three hundred and forty-fourth meeting A. I. E. E., Nov. 22, 1918.

Installation Systems and Appliances

Use of Electricity on Gold Dredges.—In the operation of gold dredges electricity is used almost universally as the motive power. The electrical equipment on these dredges usually comprises, in addition to the interior lighting and floodlighting, six or more motors having an average connected load of about 1000 hp. The largest motor now in use on any dredge is rated at 500 hp., but is capable of developing 700 hp. Owing to the severe strain to which the bucket motor is subjected when a boulder or hard ground is encountered, this motor has usually been belt-connected, but recent trials with a gear-connected motor using a large friction-disk clutch have been very successful. The pump motors are usually directly connected to centrifugal pumps, these pumps being used on account of the low head required and the large amount of water to be handled. Power requirements of typical dredges are given in cases where the motors are directly connected and also belted. Wherever possible central-station service is used by dredge companies in preference to manufacturing their own power. This is done not only on account of the lower power costs but also on account of the lower initial cost and because the use of this service takes much of the weight from the hull.—*Electrical Review*, Dec. 7, 1918.

An Inclosed Rectifier.—A rectifier suitable for use with alternating currents over a current and voltage range comparable to the capacity of a mercury-arc rectifier has been designed by G. S. Meikle. It differs from devices employing incandescent cathodes exhausted to a lamp vacuum in that an inert gas, usually argon, at a considerable pressure is injected into the inclosed medium.—*Wireless Age*, December, 1918.

Electric Drive in a Mat Factory.—Processes in the manufacture of fiber mats and matting are briefly set forth in this article, and it is shown that electric drive may be economically applied to the process of straightening out the compressed fiber, of drying the dyed yarn, for storing the matting and for driving the textile machines proper.—London *Electrical Times*, Oct. 10, 1918.

Electrical Equipment of Keadby Bridge.—The second installment of this article covers the generating-plant equipment and more particularly the electrical control for lowering and raising the bridge.—London *Electrician*, Oct. 25, 1918.

Electrophysics and Magnetism

Theory of Hysteresis by Magnetization.—K. HONDA and J. IKUBO.—It is shown how the loss for a given magnetizing field may be calculated, and the result is in agreement with the Steinmetz law. The theoretical deduction in the case of rotating fields conforms in character with the well-known experimental curves. Finally, the hysteresis loss in magnetite is considered and the results obtained agree with the experimental conclusions of Quittner.—*Science Abstracts*, April 30, 1918. (Abstracted from Tohoku University *Science Reports*, November, 1917.)

Standard of Mutual Induction.— A. GUILLET.—A description in detail of the method of construction of a standard mutual inductor with four lateral guard inductors. The calculation is given in full of the field due to a helical coil at any point along its axis. The end correction for the force in the interior of a helix of given dimensions and of finite length is then found, and it is shown that for work of high accuracy the method of end correction by successive displacements of the inductive winding is not sufficiently close.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Journal de Physique*, January-February and March-April, 1917.)

Electrochemistry and Batteries

Electrolytic and Electrothermic Processes and Products.—The science and application of electrolysis and electrothermics are so very extensive and are changing so rapidly that it is almost impossible to give a complete review of the subject, and many of the latest developments are secrets closely guarded. This article attempts only a very brief outline of the most common electrolytic and electrothermic processes and their products. The writer points out that the layman little appreciates to what extent we are indebted to this art for many of our every-day materials, much less the degree to which it serves the government in supplying the materials of war. The information in this article is derived from published works and from articles in the technical press.—*General Electric Review*, November, 1918.

Melting Brass in a Rocking Electric Furnace.—H. W. GILLETT and A. E. RHOADS.—In the issue of Aug. 24, 1918, of the ELECTRICAL WORLD a brief description of this rocking electric furnace for brass melting as developed by the Bureau of Mines was printed. In the article here noticed some of the test data showing the comparative economy of such furnaces are given. The following tables contain analysis of energy losses in a rocking furnace working on ten-hour and twenty-four-hour schedules. It will be noted that the furnace efficiency on the ten-hour basis is 56 per cent but on the twenty-four-hour basis 70 per cent is reached.

HEAT BALANCE OF ROCKING FURNACE WORKING ON TEN-HOUR SCHEDULE

	Kw.-Hr.	Per Cent
Loss in transformers and leads	222	9
Power used by motor for rocking the furnace	28	1
Loss in cooling water:		
7.5 kw. per hour for twenty hours (two days)	150	8
2 kw. (estimated) per hour for twenty-eight hours (two nights)	56	
Power usefully applied (theoretical), 15,650 lb. at 8 kw.-hr. per 100 lb. melted	1,252	51
Balance left for shell radiation losses, forty-eight hours, and door losses while charging—twelve charges	766	31
Total	2,474	100

HEAT BALANCE OF ROCKING FURNACE ON TWENTY-FOUR-HOUR SCHEDULE

	Kw.-Hr.	Per Cent
Loss in transformer and leads	374	8
Motor	43	1
Loss in cooling water (48 × 7.5)	360	7½
Power usefully applied (theoretical), 36,500 lb. melted at 8 kw.-hr. per 100 lb	2,920	64
Balance left for shell radiation losses, forty-eight hours, and door losses while charging twenty-eight heats.	889	19½
Total	4,576	100

Comparing the melting costs of the rocking electric furnace with the coke-fired furnaces, these results are attained:

Coke-Fired Furnaces:	Normal Cost	Present Cost
Coke	$1.20	$2.00
Crucibles	1.40	12.50
Total	$2.60	$14.50

Melting-cost comparison per ton of metal charged (labor cost omitted). Metal heated to 1160 deg. C.:

Electric Furnace:	Ten-Hour Hour Day	Twenty-Four Hour Day
Power	$3.40	$2.65
Interest and depreciation	1.50	1.00
Electrodes	.80	.80
Linings	.40	.40
Heating ladles	.25	.25
Incidentals	.25	.25
Total	$6.60	$5.35
Credit 1.5 per cent, or 30 lb. metal saved over coke-fired furnaces, at 15 cents	4.50	4.50
Total	$2.10	$0.85

Calculated saving:

Ten-hour electric melting over coke melting, present conditions, $14.50 — — $2.10 = $12.40

Twenty-four-hour electric melting over coke melting, present conditions, $14.50 — $0.85 = $13.65.

Ten hour electric melting over coke melting, normal conditions, $2.60 — $2.10 = $0.50.

Twenty-four hour electric melting over coke melting, normal conditions, $2.60 — $0.85 = $1.75.

—*Bulletin 171, Bureau of Mines.*

Telegraphy, Telephony and Signals

Static and Interference Eliminated.—An invention said to prevent the interference or crossing of one wireless message with another, regardless of the operation of any number of high-power stations, has been attributed to Roy A. Weagant of the Marconi company. It is said to reduce the amount of power usually required to operate a wireless station by about one-half. Among the revolutionary changes that the new system effects in wireless installations will be the disappearance of the huge steel towers heretofore built at great height to catch the incoming wireless waves.—*Wireless Age*. December, 1918.

Scientific and Industrial Research

(PRINTED IN THE THIRD ISSUE OF EACH MONTH)

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available, and Suggestions for Coöperative Work.

Conducted by PROF. VLADIMIR KARAPETOFF
Cornell University, Ithaca, N. Y.

FAVORS FEDERAL-AID IDEA FOR RESEARCH

Dr. W. R. Whitney of the General Electric Research Laboratory Says Federal Support Would Encourage More Research

"Federal support of engineering and scientific research in American colleges has interested me for several years," says Dr. W. R. Whitney of the research laboratory of the General Electric Company. "I want to aid in its development. I think I can see better than most people about how we stand and what we need. Any attempt to advance the stand of scientific work of the country should include all the generally productive sciences.

"Any original worker in research will appreciate how hard it is for men who have the natural gift of investigation to obtain that support and encouragement which would yield to the country the greatest return for their work. Talented investigators have been forced to combine valuable research work with executive or routine university duties and the editorship of journals. It ought to be possible for this country to support gifted researchers with just that natural amount of teaching which their development and the need for passing along to others their new work dictate.

"For our young men we must make our colleges as serviceable as any in the world. In order to complete his course or to acquire some experience in scientific experimental work, the student must not be forced to go abroad. We must arrange for the development, in widely separated parts of the country, of scientific specialists like those for whom many European cities have been famed.

"In foreign countries the research work of the teachers and their coterie of students rapidly advanced the industrial activities and broadened the horizon of the people. We ought to do as well here. Our colleges have always been forced to the limit in teaching the elements to large numbers of students, and there were no funds or teachers available for advanced scientific or research work. Many of those who became teachers because of their interest in scientific truth were soon prevented by this circumstance from developing those natural abilities which they may have had. Heretofore American genius or originality has too often been exposed in the Patent Office as devoid of experience and knowledge, or it has been forced to the ground after vainly trying to get aloft through advanced study and experiment and has had to devote ten hours a day to teaching elementary matters to large classes. The disadvantage of this system has long been recognized. The method of federal support has been well tested in Europe. Those men who rapidly developed ability in special scientific lines were freed from much of the work which less gifted men could do as well, and opportunity was given to them to carry on advanced research work and to develop at the same time the spirit of investigation in the minds of many of the abler students.

"President Maclaurin of the Massachusetts Institute of Technology has recently accepted the chairmanship of the national committee for the support of the Smith-Howard bill. This bill is intended to insure support by federal aid for scientific research in each state. It involves a small amount the first year ($15,000 per state), but this seems right, for it lessens the danger from what is usually, but improperly, called politics."

Research in Progress or Completed

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Technical Theory and Practice" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

HEATING OF HOUSES BY ELECTRICITY.

Experiments were made on heating six adjacent houses by air heated by electricity. Each house was arranged with ducts in the walls and registers in each room as for ordinary hot-air heating. A central heating plant was installed, consisting of two iron boxes containing heating elements that could be connected to a 550-volt, three-phase circuit. Arrangements for a wide range of heat variation were provided. One end of these boxes was connected with a long duct, which in turn connected with the heating ducts of the various houses. At the other end of each box was a motor-driven fan capable of forcing 2000 cu. ft. of free air per minute through the heaters into the houses. The following table gives the results of these tests, the average internal temperature of the houses having been maintained at 70.3 deg. Fahr. In computing the watts per cubic foot the volumes of basements and attics were disregarded:

Temp. (Fahr.) of Outside Air	Heating Temp. (Fahr.)	Watts per Cu.Ft. of Heated Space
—28	98	1.63
— 9	79	1.27
+10	60	0.93

—*E. R. Shirley, Peterborough, Ontario.*

Apparatus Available

VECTROMETER.

In solving alternating-current problems by means of complex quantities two forms are used, namely, $a + j^b$ and $A\epsilon^{j\theta}$. The first form is preferable for addition and subtraction, the second for multiplication and division. In many problems it is necessary to change from one form to the other, and to facilitate such changes a simple device has been constructed which, in principle, is a universal right-angle triangle. Knowing the two sides a and b, the hypotenuse A and the angle θ can be read off, and vice versa. The device saves considerable time in computations involving complex quantities.—*V. Karapetoff, Cornell University, Ithaca, N. Y.*

Suggestions for Research

HOIST.

It is desired to develop a 60-cycle, single-phase motor and control suitable for a small hoist, say 1 hp. to 2 hp. The motor must have the characteristics of a series-wound machine and stand the severe service of frequent starting and stopping. Such a hoist, if supplied with power from city mains, would be a great convenience for hardware and other stores which handle heavy materials.

SYNCHRONOUS CONDENSER, OSCILLATING TYPE.

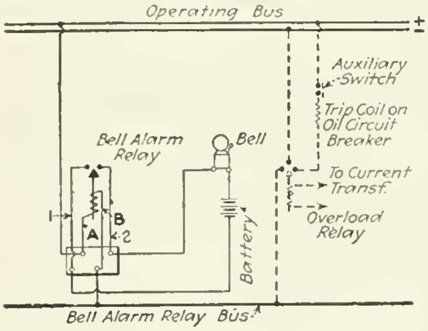
Some years ago P. Boucherot suggested and built a synchronous condenser (oscilla) in which the direct-current exciting field oscillated synchronously in front of the armature instead of rotating (*Bulletin* of the Société Internationale des Electriciens, 1908, p. 731). The necessary elasticity of the oscillating system is either provided by means of springs or the magnetic circuit itself is made of elastic steel sheets. When overexcited such an oscilla takes in a leading current and may therefore be used for correcting the power factor of a circuit. Ordinary electrostatic condensers have been recently proposed and used for compensating the lagging current in moderate-size city installations, and it would be of interest to compare their size, cost and weight with that of an oscilla designed with all the modern experience, with forced ventilation, and with high specific electric and magnetic loading of the materials. The oscilla has an advantage over an ordinary synchronous motor in that it has no shaft and no bearings to be looked after and may be designed for kilovolt-ampere outputs for which static condensers would be prohibitive.—*Editorial Suggestion.*

Readers' Views and Comments

Bell-Alarm Relay Switches

To the Editor of Electrical World:

Sir: In the Nov. 9 issue of the Electrical World appears an article on "Safety Features in Switchboard Installations," with particular reference to alarm systems. The authors have criticised some of the existing methods and have suggested other means of accomplishing the desired results. While the schemes suggested by the authors are operative, there are others which are less expensive and also better electrically and mechanically.



BELL-ALARM SIGNAL CIRCUIT INDEPENDENT OF CIRCUIT-BREAKER TRIP COILS

The authors have outlined the existing method for bell alarm where air circuit breakers have lever switches in series with them, this scheme utilizing a circuit-closing auxiliary switch on the air circuit breaker and a circuit-opening auxiliary switch on the lever switch. Where air circuit breakers alone are used on circuits without lever switches in series, the authors, in order to effect an automatic resetting of the bell circuit, suggest the use of a double-pole auxiliary switch, circuit-closing and circuit-opening, and in addition a three-way snap or push switch for each circuit breaker. With this arrangement the resetting of the bell circuit is not automatic.

The authors have evidently overlooked the fact that there is on the market a circuit-closing bell-alarm switch for use on air circuit breakers which closes the bell circuit when the breakers open, which can be opened by hand, stopping the ringing of the bell, and which is automatically reset when the breaker is closed. Such a switch appears to be more desirable than the combination suggested by the authors.

The authors have described the very common scheme of using a hand-reset bell-alarm relay operated through the contacts of the protective relays and a relay bus to ring a bell. It is pointed out that with this scheme every trip coil on the various breakers is in series with the one-bell-alarm relay coil.

The authors have suggested the use of a passing contact auxiliary switch on the circuit breaker, closing only during a short period sufficient to energize a bell-alarm relay, the contacts of which would stay closed until the operator reset it by hand. Operators or manufacturers who have had experience with passing contact auxiliary switches are likely to object to this scheme, which is quite expensive and mechanically a rather difficult and troublesome proposition.

The bell-alarm relays on the market are of very substantial construction and have given no trouble. However, if there is an objection to this scheme, it is a very simple matter to provide the protective relay on the circuit with two-circuit contacts and operate the coil of the bell-alarm relay entirely independently of the trip coils of the circuit breaker. This scheme has frequently been used and is shown on the drawings inclosed. The two schemes described seem to be better and less expensive than those suggested by the author.

E. H. Beckert.

Switchboard Department, General Electric Company, Schenectady, N. Y.

Senator Weeks Explains His Reconstruction Measure

To the Editor of Electrical World:

Sir: I note in the issue of the Electrical World of Nov. 2 an article written by Wingrove Bathon relating to the two propositions pending to investigate and consider reconstruction measures. While it is true that the one I introduced did not stipulate that the commissions should be made up very largely of business men, that was the purpose of the plan proposed, and it was so stated in a speech I made at the time I introduced the resolution. Of course, it would be physically impossible for twelve men to investigate any considerable part of the activities which must be given consideration, and my intention was that each of the Congressional members should be the head of one of the twelve divisions into which I had divided the activities, and that he should associate with himself experts in such activities.

If Senator Overman's plan prevails, it would mean turning over to the bureau chiefs who happen to be in office in Washington these matters of great importance, and there would be no assurance that the plans developed by such an investigation would receive the approval of Congress; while if twelve members of Congress, holding leading positions, selected from both sides of both chambers, should agree on a recommendation, it would be almost certain to receive early and favorable consideration. It does not mean because members of Congress are to do this investigating that politics of any kind will become involved. It might, and yet not the slightest development of a political character has entered into some of the investigations which have been made by Congress during the last ten years. I think a further examination of the Overman plan as compared with mine will demonstrate that on the whole my proposition would be much more likely to bring about speedy and wise results.

John W. Weeks.

Senate Chamber, Washington.

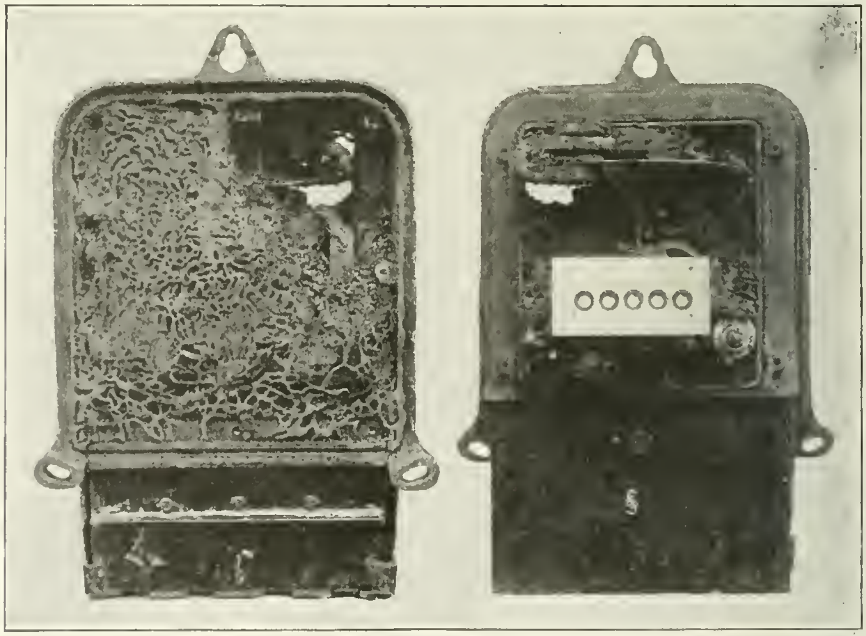
Meter Attacked by White Ants

To the Editor of Electrical World:

Sir: The two accompanying illustrations of one of our service meters may be of interest to you. The meter has been attacked by white ants. Our meters are read monthly and evidently in this case the insects have done their job within this period. They fill the meter up with earth and deposit, entering through the cover packing, which they eat away. They strip the meter of every bit of insulation, leaving only the bare copper and iron.

Siam Electricity Company, Ltd.

Bangkok, Siam.



NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

INTERNATIONAL TRADE MEETING IN NEW YORK

Committee of the Associated Manufacturers of Electrical Supplies Works on Problems Connected with Upbuilding of Foreign Business

A meeting of the international trade committee of the Associated Manufacturers of Electrical Supplies was held at the association headquarters, New York, on Dec. 11.

Much discussion took place on "standardization in exports," centering on the suggestion of a recognized standardization of material under some code in foreign countries similar to the National Electrical Code here. It was decided that the matter should be investigated further and receive consideration at the next meeting of the committee with suggestions as to the best course to be followed under existing conditions.

William Burgess, adviser to the committee, reported that several members of the committee and he had worked on the classification schedule, including apparatus as well as supplies. Conferences were held also, he said, with members of the Electric Power Club in regard to the classification. A tentative schedule was agreed upon for consideration by the Electric Power Club and for such final action as may be decided to be the best course to obtain satisfactory results. Copies of the parts of the schedule in which they are specially interested will be sent to those who are following the work of the committee.

The next meeting will be held on Jan. 16.

STILL NO REPORT UPON WATER-POWER MEASURE

Senate and House Conferees Unable to Advance Bill Owing to the Absence of Leading Committee Members—Goes Over Till Next Year

An agreement has been reached between the conferees of the House and the Senate who are in charge of the water-power bills now pending in Congress to take no action in conference until after the first of the year.

Only one meeting of the conferees on the water-power bills has been held since the election in November. This took place a few days ago, but two of the principal members of the conference—namely, Senator Shields and Representative Ferris—were absent and their colleagues agreed not to proceed until they can be present. Senator Shields is confined to his home in Tennessee by illness. At the meeting of some of the conferees a few days ago, it is reported by the Washington correspondent of the ELECTRICAL WORLD, Judge Sims, chairman of the House conferees, again strongly urged that action be taken by the conference so that its report may be brought before the House and Senate as soon as possible, especially as it is expected there will be extended debate on the report in both houses as soon as it is brought in. But Judge Sims, who has labored long and assiduously in behalf of water-power legislation, was unable to do more at the meeting than again call the attention of the conferees to the importance of the proposed measure.

CONVENTION OF THE DOHERTY ORGANIZATION

Meeting in New York of Representatives of the Properties Brings Out Points on Training, Lost Electrical Energy, Safety and New Business

A convention of the Doherty Organization was held in New York last week. From 250 to 300 attended the various sessions and the banquet, which was held at the Hotel Waldorf-Astoria on the evening of Dec. 12 and at which Henry L. Doherty and others connected with the organization spoke.

Dr. Howard B. Shaw, in discussing the training schools, said in part: "In training technical men I believe we should first train them to be practical, and I also feel that the practical men should be teamed to benefit by technique. The graduates of technical schools are generally well grounded in the theory and have some hearsay about practice in one line of engineering, but few of them know organization team work or business except as they have got some of it incidentally. I take it that we need, and will continue to need, in increasing numbers men in all phases of the business in the organization—not only managers and executives, but in larger measure operators and engineers, men to get new business, men to see that renewals are collected and men to do all the various tasks."

At a meeting of the public utility section, lost and unaccounted-for electrical energy was first taken up in conjunction with the problem of keeping meters in shape.

Fred C. Pratt, of the engineering department of the New York office, in telling of electric energy losses in the Doherty Organization for the twelve months ended October, 1918, said that while the generation had been 640,000,000 kw.-hr., the losses had been 95,000,000 kw.-hr., the recovery being 85 per cent. He thought that losses were divided into the legitimate and the others, and that there should be some determination as to what proper losses should amount to. He saw great possibilities of saving through frequent meter tests.

George E. Hayler, Jr., gave it as his opinion that the average meter department was not fitted to handle large power business. The power meter, he said, certainly needs attention as the possibilities of losing a large amount of electric energy are always to be reckoned with.

R. L. Baker, engineer for electric operations of the Doherty Organization, asked if the managers would favor having a separate department for meter testing under Mr. Pratt, which probably would include a school for metermen and repairmen. The vote was almost unanimously affirmative. T. O. Kennedy, general superintendent of the Denver Gas & Electric Light Company, stated that that concern had suffered largely through theft of energy, but that enough of the lost energy had been located to pay for the cost of the investigation.

Promoting Safety in the Organization

George Oliver Smith, commissioner of safety of the organization, produced some interesting figures to prove the value of that work. In considering safety work from the cash standpoint alone he cited an example of one company which had saved $60,000 during the last year. He admitted that the number of accidents in all companies of the organization had shown an increased total during the war period because of the abnormal conditions. Taking the Doherty public utilities as a group, a decrease in accidents of 18 per cent was shown in the last year as against the previous twelve months. At the same time the days of lost time were reduced 17 per cent, which would probably mean a net saving in money of about $4,800 a year. Mr. Smith cited one company that in four years had doubled its gross earnings yet showed a decrease in the amount of accident claims.

The new-business section discussed at great length putting fitting departments under the control of new-business departments. This resulted in the appointment of a committee to consider the matter, consisting of S. C. Irby, Hattiesburg, chairman; B. H. Jardine, Knoxville; C. N. Stannard, Denver; R. E. Landers, Tonawanda, and Luther Gaston, Spokane. All the new-business managers recorded themselves as against continuation of the loaned appliance account. The meeting also decided in favor of having one or two available new-business substitutes in each company for emergency work.

THE ELECTRICAL WORLD

STREET-LIGHTING TABLES

FOR 1919

Following its practice for thirty consecutive years, the Electrical World has prepared tables showing the proper time for lighting and extinguishing street lamps. The 1919 tables are now ready, and a copy will be sent free to any reader upon request to the Electrical World, Tenth Avenue at Thirty-sixth Street, New York. For more than one copy a charge of 10 cents per copy is made.

NEW BELL SYSTEM OF MULTIPLEX TELEPHONY

Theodore N. Vail Announces Result of Work of Technical Staff Which Will Increase Manyfold the Capacity of Long Wires

In a letter to Postmaster-General Burleson Theodore N. Vail, president American Telephone & Telegraph Company, announces the most recent practical application of the work of the technical staff of the Bell system. After several years of intense effort they have invented and developed a practical system of multiplex telephony and telegraphy by the use of which it is now possible to increase manyfold the message-carrying capacity of long telephone and telegraph wires, especially of the open-wire type.

An installation of the multiplex telephone system, Mr. Vail says, has been made between Baltimore and Pittsburgh and has been in service for more than a month. Mr. Vail says in part:

> With this new system four telephone conversations over one pair of wires are simultaneously carried on, in addition to the telephone conversation provided by the ordinary methods. Thus, over a single pair of wires a total of five telephone conversations are simultaneously operated, each giving service as good as that provided by the circuit working in the ordinary way.
>
> Heretofore the best telephone methods known to the art provided only one telephone conversation at a time over a single pair of wires. A number of years ago we developed the "phantom circuit" arrangement by which three telephone circuits are obtained from two pairs of wires, an important improvement of which we have made extensive use. Now by our multiplex method we are enabled to obtain five telephone circuits over one pair of wires; that is, ten simultaneous telephone conversations from the two pairs of wires, which formerly could be used for only three simultaneous telephone conversations. This represents an increase of more than threefold in the telephonic capacity of the wires as compared with the best previous state of the art and a fivefold increase under conditions where the phantom circuit is not employed.
>
> In telegraphy as well as in telephony sensational results have been attained by the new system. By combining two telegraph wires into a metallic circuit of the type used for telephone working and by applying our new apparatus and methods to this metallic circuit we have enormously increased the capacity of the wires for telegraphic messages. As applied to high-speed printer systems we can do eight times as much as is now done, and as compared with the ordinary duplex telegraph circuit in general use we can do ten times as much. These increased results are attained without in any way impairing the quality of telegraph working.
>
> The nature of these developments is such that if desired wires may be used partly for telephone and partly for telegraph. A pair of wires is available either for five simultaneous telephone conversations or for forty simultaneous telegraph messages, or partly for one and partly for the other.

While giving the credit of the new developments to the technical staff of the Bell system acting as an organization, Mr. Vail mentions particularly the work of O. B. Blackwell, G. A. Campbell, H. S. Osborne, J. R. Carson, Lloyd Espenschied, H. A. Affel and John Davidson, Jr., of the engineering department of the American Telephone & Telegraph Company, and E. H. Colpitts, H. D. Arnold, B. W. Kendall, R. A. Heising, H. J. Vennes, E. O. Scriven and H. F. Kortheuer of the engineering department of the Western Electric Company, the manufacturing division of the Bell system.

Development of Research a Vital Necessity

A. I. E. E. Speakers Insist that Industrial Supremacy Cannot Be Maintained by Any Nation Unless It Rests on a Foundation of Scientific Progress—Universities Should Have Responsibility of Training the Investigators

THE time is ripe for launching a movement to improve or make over our research agencies so that they may take a responsible part in the industrial life of the nation. The war has given us a broader view of the part this country should take in its industrial and commercial relations with the other nations of the world, and our experience has been such that revolutionary changes impossible five years ago may now receive practical consideration. Both Dr. W. R. Whitney and Col. R. A. Millikan, who addressed the three hundred and forty-second meeting of the American Institute of Electrical Engineers at Philadelphia on Dec. 13, insisted that the universities of the country should have the responsibility of developing research men. They said that the greatest need at this time is not laboratories or apparatus but men trained to carry out systematic scientific development work.

NEED FOR ENGINEERING RESEARCH

Dr. Whitney called attention to the need for greater efforts to develop research work and workers in his paper entitled "American Engineering Research." "We have been so keen in engineering that American engineering is unsurpassed in the world," said Dr. Whitney, "but we never made a fair start in American engineering research. Moreover, we have no plan for producing research men, though we have plenty of plans for consuming them. We are inclined to be so elated by our apparent successes in industry that we imagine that there is some way to build without foundation, to practice without experience, to reap where we have never sown."

Before we can expect to take our place as a first-class nation in scientific achievement some comprehensive plan for the training of research men must be devised. Dr. Whitney believes our present institutions of higher education should undertake this work. He said: "Now there is one defect in this system of rapid utilization of our resources. It does not produce any new material, though it may organize the old. We needed organized engineering research long before the war; we needed it more during the war, and we shall certainly need it after the war. It is the duty of engineers to study this matter and take active steps to correct it. The problem is, how shall we insure the preparation of plenty of American men of science by some system which will make us independent of foreign assistance? My belief is that it can well be done in our existing colleges by greater attention to new material truth. Experimental work in the sciences best prepares and preserves those desirable qualities in teachers, interest and enthusiasm. Any plan which would insure properly supported investigators whose vocation was experiment and whose avocation was teaching, where students could *work* with them, would be a most natural development. It is a way already thoroughly tested abroad and would be a step of the greatest value to this country."

In describing the system of education abroad, where research in the pure sciences has been encouraged to the unmeasurable advantage of those nations where it has been fostered, Dr. Whitney spoke as follows:

"They were the result of a policy almost identical in all cases. Each was freed by some planned system to evolve himself and follow his studies along the lines he chose, and he was given the assistance of students who were at the same time learning the value and rare power of careful thought and painstaking investigation. They created atmospheres of scientific pioneering. The teacher was the leader. He was exploring. His interest was transferred to others by that most direct way—close contact. The lines of scientific endeavor were not chosen by some remote director or committee of experiment, but the subject itself led the investigator along, and new truth was the sole aim. The professor then became the leader in the university, because he was following a new line of action and not because, at the request of a faculty committee, he was perhaps trying to solve some particular indigenous problem or reducing the cost of some existing factory product. He was being led by Nature, instead of trying, as our industrial laboratories so often do, to force Nature along lines which we think most desirable.

"Some one has suggested that possibly our industrial research laboratories could supply the country's deficiency of scientific research and its teaching. Many industrial laboratories have been established recently, but, to my mind, there does not seem the slightest possibility of thus meeting the real need of the country. It is neither natural nor desirable, and most recent writers on the subject have been clear on this point."

Of our own needs Dr. Whitney said: "Central bureaus of science and research have been repeatedly advocated and many are still being planned. None of these is probably perfect. Most of them would consume (possibly ossify), but not produce, men. Perhaps all of them should be studied by engineers and some of them developed, but if many were carried out, it would immediately become evident that our crying need is for general college research work, to prepare trained investigators."

At the present time the colleges are occupied with giving a limited training to a large number of students, and it is well understood that the support of these institutions is generally insufficient to maintain the necessary instructional staff for a broad system of training a great number of men for advanced research work. The Smith-Howard bill, now pending in Congress, seems to be the most satisfactory suggestion yet made, though it provides only enough funds to fairly start the work, $15,000 per year for a college in each state.

PUBLIC SHOULD APPRECIATE SCIENTIFIC WORK

In discussing his subject, "Research in America After the War," Colonel Millikan also voiced the opinion that the colleges comprise the best agency through which to develop "researchers," but he says that much educational effort will be necessary to gain public support for this work. "What we need," he declared "is, first, the development of men, of more trained men than we have. We have not anything like the number that corresponds to our population. Next we need the development of a public opinion in the United States, and an appreciation of what science is and what it can do. We need a better educated, scientific intelligence than we have at the present time."

Colonel Millikan said that the day of the individual research worker is past, as shown by our experience in the war. Great numbers of trained men will hereafter be used for organized research.

"If there is anything that has been demonstrated by the experiences not only of America but of all other countries in this war, every one of the Allied countries, of the major belligerents, at any rate," he said, "it is that you cannot depend upon the so-called undirected inventive genius of a people to get results. You have got to get results by getting trained groups of competent men on the problems. In other words, you get results by the strict scientific method, the engineering method, of approach.

"You have had in every one of the major belligerent countries your boards of inventions, and they will all tell you, every one of them—Italy, France, England and the United States—that not one suggestion in more than ten thousand is any good that comes in that way, and that ninety-nine out of a hundred of those that are good have already been thought of and worked upon by the groups of trained men who have been giving their attention and skill to these research matters.

"I would not cast any dampness over the luster of names like Franklin and Henry and men of that type whom we produced before that time," Colonel Millikan went on, "but, after all, these were individual geniuses, and we have passed from the stage when you can depend on individual geniuses for advancing the wheels of progress. If you want to do it rapidly, you have got to do in peace exactly as we did in war. You have got to call together your groups of research men in your industries, in centers—I do not care where—and give them the problems, and let them push the thing forward, because they will do it, and they will do it ten times as fast—yes, a hundred times as fast—as your wheels will move if you depend on the exceptional inventive genius of the country."

The Smith-Howard Bill

In speaking of amendments to the Smith-Howard bill effected through the advice of the National Research Council, Colonel Millikan said:

"These types of modifications are these—and these seem to be the essence of the whole thing—if you are going to stimulate research, if your motive is to stimulate research in the United States, as much as you can, instead of allotting funds to any particular institutions, which will become a part of the budget of these institutions, the suggestion was that the federal government allot these funds in each state to a board, composed of at least five of the most eminent scientists and engineers inside the state, for distribution to the educational institutions inside the state upon the basis of programs of research submitted annually by these institutions to the central board.

"Now, if you can get the allotment of research funds to men who know what research is and get that kind of rivalry between institutions, you are going to develop the atmosphere of research in many institutions throughout the country, and you will never, in any way, be able to develop research men except by creating that kind of an atmosphere, and you must have in every institution where men are going to be developed men who are creating this atmosphere and devoting most of their time to it, and that kind of a scheme makes it possible to plant men all over the country. I think with that kind of a scheme you can get a stimulation of research throughout the country in industrial lines and pure science lines much better than by any other scheme I have seen discussed at any time."

Colonel Millikan then outlined proposed changes in the organization of the National Research Council to convert that body from a war to a peace footing. He predicted that if the Smith-Howard bill did not pass, the National Research Council would attempt to get funds for the development of research work in the various states. Another possible source of support is indicated as follows: "I look for the establishment by philanthropists of research professorships. Funds that are donated to colleges and universities for research work must be devoted by the terms of gift to research purposes and cannot be put into a merely educational budget, and the National Research Council has had at the start as one of its chief aims to stimulate that sort of thing. But I agree with Dr. Whitney that in a country like this there is no reason whatever why the federal government should not get behind the development of research just as well as, and in addition to, private enterprises."

Electric Power in Anthracite Mines

The technical session was devoted to two papers on electric drive in the coal-mining industry, namely, "The Use of Electric Power in the Mining of Anthracite Coal," by J. B. Crane, and "Drum Shapes as Affecting the Mine-Hoist Duty Cycle and Motor Rating," by F. L. Stone.

Based upon the experience in mines coming under his observation, Mr. Crane estimated that the output of the anthracite mines could have been increased by 10,000,000 tons by the general use of electric drive. He stated that the average expenditure of energy in mining a ton of anthracite coal is 12 kw.-hr., whereas the average required per ton of bituminous coal, as shown by the records in fifty mines, is 3.57 kw.-hr. This discrepancy is accounted for by the much greater depth of the anthracite mines, which vary from 300 ft. to 1000 ft. (90 m. to 300 m.), thus taking more energy for hoisting coal and pumping water, and by the heavier duty put on breaker motors. In the case of steam-engine drive as much as 400 tons of coal has been required for the mining of 1000 tons, and the speaker pointed out that in 1917 electric drive in the anthracite mines would have resulted in the production of 8,000,000 tons more than was mined and the saving of 2½ per cent in man power would have released men enough to mine 2,000,000 tons, making the probable added production of anthracite coal by the use of electrical energy about 100,000,000 tons in 1917. From the central-station operator's point of view this would be a very desirable load, and, according to Mr. Crane's estimate, the business could be made to yield an income of 38 per cent on the investment.

Hoisting Drums of Conical Shape

Taking the case of coal mines from 300 ft. to 500 ft. (90 m. to 150 m.) deep, Mr. Stone showed that by using a lower speed to which the hoisting motors must accelerate the load in starting smaller motors could be used. This can also be accomplished without slowing down the output of the mine by so shaping the hoisting drum that the speed of the load increases after the driving motor has reached normal speed. Cases were worked out showing the improved duty cycle obtained by using conical drums and also combination cylindrical and conical drums. It was pointed out in the discussion that the cylindrical drums are lighter than those investigated by Mr. Stone and that conical drums entail greater wear on the ropes.

WILL NOT INTERCONNECT SPRINGFIELD (ILL.) PLANTS

Controversy Between Officials of the City and the Fuel Administration Is Brought to an End Without a Decision Having Been Reached

The signing of the armistice terminated a decidedly tense situation which had arisen between the United States Fuel Administration and city officials of Springfield, Ill., and brought to an end repeated efforts that had been made by representatives of the Fuel Administration to interconnect the Springfield municipal light plant with the central station of the Springfield Gas & Electric Company.

In June last the federal administration commenced an investigation to find out which of the two plants temporarily could discontinue with the larger saving of fuel. The fact that the business center and a considerable portion of the residential section of Springfield obtain steam and hot-water heat from the company's central station, coupled with the fact that over 17,000,000 kw.-hr. are delivered each year by that station as against some 2,500,000 kw.-hr. by the city plant, the major portion of which is for street lighting and other municipal purposes, rendered it certain that if there were to be any discontinuance it must be by the municipal plant.

After considerable correspondence between the Fuel Administration and the managements of the two plants Joseph W. Harrington, administrative engineer of the Fuel Administration, visited Springfield and made a detailed investigation. He made the recommendation that the plants be interconnected, stating that, on a conservative estimate, between 4000 tons and 5000 tons of coal would be saved. The only investment required would be the copper wire on pole stations already built between the company's power house and the city's substation, five blocks distant. The company agreed to make the extension and, subject to the approval of the state public utilities commission, to carry the added load at the present cost to the municipal plant, such cost to be determined by the engineers of the Fuel Administration.

On the investigation made by Mr. Harrington and other representatives of the Fuel Administration, Harold Almert of Chicago, federal Director of Conservation, recommended that steps to bring about the proposed interconnection be taken without delay and suggested that a meeting be held between representatives of the Fuel Administration, the city and the central-station company. Manager Mackie acquiesced in the suggestion for such a meeting, but the Mayor stated that he would not call such meeting until consultation with the city's advisory engineer. The identity of the latter was not stated, but he was understood to be E. W. Bemis of Chicago.

The meeting was never called. Instead, Commissioner Spaulding, who has charge of the combined municipal water and light plants, issued a long statement to the daily newspapers declaring that there was "a plot on foot" between the federal Fuel Administration and the company "to swallow up the municipal light plant." Mr. Spaulding declared that there would be no saving in such interconnection as there would be an increase in coal consumption to pump the city's water if the electric load were taken away from the municipal plant. The city commissioner has contended for several years that the municipal light plant is operated by "surplus current" from the waterworks.

Asserting that the statements of the federal Fuel Administration's representatives were wrong, the municipal authorities appealed to Dr. Garfield, and the latter interposed an order that there should be no closing of the plant without instructions from him. The armistice brought the matter to a conclusion.

QUARTERLY CONFERENCE OF SOUTHWESTERN ASSOCIATION

Fuel, Labor and Rates Are Discussed at the Gathering at Houston, Tex., and the Date for the Annual Convention Is Fixed

The second quarterly conference of the Southwestern Electrical & Gas Association was held at the Bender Hotel, Houston, Tex., on Dec. 9. Two sessions were held, morning and afternoon, with a luncheon intervening, the luncheon being given by the association as a compliment to all attending. Executive representatives of all the larger utilities and groups of utilities in Texas were present as well as those from the medium and smaller utilities, gas, electric light and power and street and interurban railways being all represented.

The topics discussed were the following:

Fuel—Its present and future problems in the Southwest, with especial reference to the continuance of a certain supply of fuel oil and natural gas and the probability of their replacement in the near future by Texas lignite.

Labor—The new conditions to be met during peace readjustment, with especial reference to the reëmployment of those former employees who left their positions to enter the government service. Under this head the topic of employees' benefit associations such as those to provide sickness and death insurance, coöperative buying, building and loan associations, etc., were discussed.

Rates and Fares—Their stabilizing and the standardization of their bases throughout Texas as a whole. The best method of obtaining increases in rates and fares as derived from the actual experiences of those who have made such attempts was also discussed in an interesting manner.

In regard to fuel it was decided that, while the present supply of gas in the northern portion of the state and the present and future supply of Mexican oil and residuals in the Gulf Coast section show no sign of early diminution or increase in price, there is in the interior of the state a great need for a cheaper fuel and one whose continuity of supply for a long time in the future may be relied on. While Texas has within its state lines and lying contiguous to its principal fuel-using sections over 6,000,000,000 tons of lignite which can be cheaply mined and carried, the character of the raw lignite is such as to make it an inefficient and unsatisfactory substitute for coal, fuel oil or natural gas at the present time. It was shown, however, that the experiments now being made are virtually solving this question and that, by the "carbonization" of lignite, by changed methods of distilling it for gas and residuals, it could be made a very close competitor with all the other available fuels in efficiency, with the further vital requisite of an uninterrupted continuity of supply for a century or two in the future.

With reference to the problems of the employees returning from government service it was unanimously agreed that they would be immediately reinstated in their former positions where such positions had not been abolished under the exigencies of war times, and that under the latter condition other equal positions should be open to them, their seniority in service being preserved, and that in all cases preference would be given to those who returned maimed, wounded or in any way injured while serving their country in government service.

Standardization of Rates and Fares

The matter of the standardization of rate and fare bases throughout Texas was fully discussed, and action was taken to have the association office make this a matter of immediate action. Respecting the best method of obtaining increase of rates and fares, the consensus of opinion, based on the experiences of those who had made attempts of this kind with varying degrees of success, was that no hard-and-fast rule could be laid down to guide others in this matter, as each case presented such particularly local conditions as to make it a unit problem. The only point definitely settled was that both the public and its representatives should be approached on this matter with the utmost candor and that all statements made, data and figures offered and reasons adduced for the increase should be strictly true, proved and uncontrovertible.

At the subsequent meeting of the executive committee of the association it was decided that a convention of the association would be held at Galveston, Tex., between May 15 and June 10, 1919—the exact date to be determined after conference with other public utility organizations as to their proposed conventions so that there may be no conflict between dates either as to the national association or those of neighboring states. There will be no other "conference" of the association before the 1919 convention.

CONSOLIDATION OF EASTERN NEW YORK UTILITIES PROPOSED

Adirondack Electric Power Corporation Seeks Permission to Absorb Franchises and Property of Six Power Corporations

The Public Service Commission, Second District, New York, gave a hearing on Dec. 4 upon the proposed consolidation of hydroelectric and steam-power properties, estimated value $9,500,000, operating in the Mohawk Valley and the East Canada Creek watersheds with other hydroelectric properties in the upper Hudson Valley.

The formal hearing was upon the joint petition of the Adirondack Electric Power Corporation and the Schenectady Illuminating Company of Schenectady for authority to the Adirondack company to take over the property and franchises of the Schenectady Illuminating Company. The sale by the Schenectady Illuminating Company also involved the transfer to the Adirondack Electric Power Corporation of these corporations, to be acquired by the Schenectady Illuminating Company by merger: The Mohawk Gas Company, Schenectady; the Schenectady Power Company, operating a hydroelectric plant at Schaghticoke; the Edison Electric Light & Power Company of Amsterdam, and the East Creek Electric Light & Power Company, operating two hydroelectric plants on the East Canada Creek.

The Adirondack company also petitioned the commission for authority to issue $1,800,000 of 7 per cent preferred stock, $2,500,000 debenture bonds or preferred stock and a certain amount of two-year notes necessary to carry out the proposed purchase. Steps to bring about a unification of the corporate interests were first started about three years ago.

Francis E. Frothingham, chairman of the executive committee of the Adirondack Power Corporation, told the commission in detail about the unification of the power companies. He explained a map giving the sources of supply of the companies and the transmission systems which it is intended to hook up by consolidation. There was a transmission line from Spiers Falls and Mechanicsville to Glens Falls, Schenectady, Albany, Troy and intermediate towns and a line from the Hudson River plant to Amsterdam and then to Little Falls and Utica, electricity to be turned on in the section from Amsterdam west within a few weeks.

The Edison Electric company is connected with the East Creek company, which supplies the Mohawk Valley and operates cars from Amsterdam to Johnstown and Gloversville. Electricity is supplied to Albany and Troy, to the trolley lines in both cities, there is a general lighting and power business in Amsterdam, light and power in Schenectady for companies there, and from the Utica substation cars are operated from Little Falls to and in Utica and then west to Canastota, with transmission lines to Oneida and Canastota. The merger, Mr. Frothingham explained, will do away with duplication and waste and would result in a saving of between $400,000 and $500,000 in a year in coal.

Mr. Frothingham said the company would secure continuation of steam-power service at Mechanicsville, Albany, Schenectady, Tribes Hill and Utica, where contractual relations exist in part. Under the consolidation a good twenty-four-hour service could be given.

COMMONWEALTH EDISON'S RE-EMPLOYMENT POLICY

Honorably Discharged Soldiers and Sailors to Be Taken Back Immediately—Success of Women in the Distribution Engineer's Office

The problem of man power in the office of the distribution engineers of the Commonwealth Edison Company, Chicago, was solved by employing girls who were or had been students at the Art Institute. Working from rough sketches, these girls produce finished tracings that are entirely satisfactory from both the electrical and the drafting standpoint. Incidentally it is such efficient and satisfactory women employees as these that present a part of the reconstruction problem. This is the way the Commonwealth Edison Company will solve that problem.

Former employees of the Commonwealth Edison Company who have left the company's service to enter the service of the army or navy in this war, and who come directly to the company after honorable discharge from the United States military service and apply for reinstatement, are to be taken back into the company's service immediately. This is in brief the policy which the company has now adopted at the direction of President Samuel Insull. All heads of the departments and the employment bureau have been notified that this policy is now in effect, and they are already governing themselves in accordance with it.

WOMEN EMPLOYED IN DISTRIBUTION ENGINEER'S DEPARTMENT

The rule, as adopted by the advisory committee, states that these men will be reinstated in the same position if possible or in some other suitable position in the same department in which they were formerly employed, and that, if there are no vacancies in the position or department in which a man was formerly employed, then, wherever necessary, the employee now filling the position may be transferred to another department where his services can be utilized to make room for the returned soldier; and also that the present employees, if efficient, shall be retained in the service of the company, even if it is necessary to thus transfer them. This includes women.

Another point covered is that it is the company's intention not only to place the men returning from the military service of the United States in their former positions, but also that they shall be given the present rates of pay of the positions in which they are placed. This latter provision is a very important one in many cases, as will be understood when it is remembered that the scale of pay is now higher in general than it was in 1917.

SHORTAGE OF ELECTRICITY IN PHILADELPHIA EXPLAINED

President McCall Issues a Statement Giving the Facts in the Case for the Information of the Company's Customers

A short while ago there was quite a controversy over the shortage of electric power in the Philadelphia district. It was maintained by the president of the local Chamber of Commerce, who also was appointed to make a power survey, that the Philadelphia Electric Company had actually a surplus of power instead of a shortage. Considering the restrictions imposed by the state fuel administrator to alleviate the power shortage, this statement, said to be based on a report reputed to have been made by Milo Maltbie, ex-public service commissioner of New York, naturally created a sensation among business men. Mr. McCall's statement dealing with the situation follows:

> The trouble which developed in the big 35,000-kw. turbogenerator on Saturday, Nov. 9, and which caused the shutting down of that big unit for repairs, brought to a focus a situation which has existed for more than a year—namely, the lack of spare capacity with which to safeguard our service to the government and to the community.
>
> This unfortunate condition has brought hardship to many of our customers and to the public generally. The fortunate fact that peace is assured alone prevents the danger which would have resulted if slowing down in war work in this district had come to be obligatory instead of desirable.
>
> In the fog of controversy that has existed there are a few outstanding facts of importance: First, we knew that the excessive power demands for war work had deprived us of spare capacity essential for proper operation of this great property; second, we gave the most positive warning of this fact; third, we did all that was humanly possible to obtain the funds necessary to install capacity which we had been forehanded enough to order in advance; fourth, our budgets, prepared several years in advance and based on accurate estimates of the normal growth in our business, covered ample generating and distributing capacity for more than normal needs.
>
> I am stating these facts to our customers, not because I desire controversy, but because I think they are entitled to the truth and because I feel keenly the responsibility resting upon a public utility company's personnel in the matter of furnishing adequate and efficient service to the community—a character of service which can be furnished only by wise forethought for the future and intelligent, unceasing endeavor all the time.
>
> I think it due the organization of the Philadelphia Electric Company to call attention to the fact that, in spite of the great handicaps under which we have labored during the past twelve months, we have furnished a very high grade of service.
>
> The generous coöperation which we have received from our customers during this critical period is a source of great gratification to us all and confirms my belief that the relationship between the Philadelphia Electric Company and its customers is of a more friendly nature than is usually found between a public utility company and the community which it serves. My belief that entire frankness upon mutually important topics is essential has prompted me to make the above statement.

FUTURE MILITARY TRAINING OF STUDENTS DISCUSSED

Experiment with Students' Army Training Corps Has Been Too Short to Justify Conclusions as to Its Value

At a convention of the Association of American Universities held at Boston on Dec. 5 a session was devoted to the consideration of "Problems Presented by the Students' Army Training Corps and the Future Military Training of Students." Brig.-Gen. Robert I. Rees, U. S. A., stated that at the time of the armistice 141,000 men were enrolled in 562 institutions, with an additional vocational detachment of 38,000. Four thousand officers were required to command this force. General Rees said that the response of the colleges to the S. A. T. C. program was most patriotic, and if the institutions had not rendered this service it would have been disastrous to the successful outcome of the war. The demand for supplies created by the offensive in France hampered the organization of the S. A. T. C., and the influenza epidemic was another adverse factor.

The cessation of hostilities destroyed the motive of the S. A. T. C., and has introduced much confusion into the colleges. The principal problem now, however, is to effect a settlement with the colleges which shall be financially equitable to them, and the War Department is at work on a settlement plan which it is hoped will lead to a satisfactory termination of the whole matter. The chief difficulty arises in connection with compensation for instruction, the questions of remuneration for subsistence, buildings, etc., being less troublesome.

A settlement bulletin is about to be issued by those in charge of the S. A. T. C. program. The War Department has just authorized the restoration of the Reserve Officers' Training Corps in institutions which voluntarily desire it. The equipment of the S. A. T. C. is to be utilized under the care of a responsible officer, pending the appointment of the R. O. T. C. command. General Rees said that a vast amount of data and information has been accumulated at Washington which the War Department plans to make available for the colleges, including both thesis and lecture material and embracing economics, production, transportation, sociology and almost every branch of educational training.

President Richard C. Maclaurin of the Massachusetts Institute of Technology reviewed the history of the S. A. T. C. development and said that the experiment was too short to justify conclusions as to its value. The difficulties arising from placing the students on active service, from dual control by the army and by the collegiate authorities, by the passage of the manpower bill and the program to have four or five million men in Europe by July 1, 1919, were formidable.

The process of induction was delayed by the failure of local boards to return the necessary papers quickly; the epidemic further complicated the situation; authority to spend money on publications was withheld until a time when most of the colleges expected to be well under way, and supplies were late in arriving. In spite of all the difficulties a self-sacrificing spirit was observed in all who directed this effort, and good intentions were manifested by practically all the army officers.

With time it appears that most of the difficulties would have been overcome. In future, except in case of actual war, there must be far greater freedom of academic control and far less military control, something more nearly approaching the system that has prevailed for over half a century in the land-grant colleges, with the possibility of a more intensive military training in camps during the summer. "The provision of work in summer camps would present some special difficulties to technical students," said Dr. Maclaurin, "but the problem of these students is special anyway and would call for special treatment. It should never be permitted to happen again that the country shall be called upon suddenly to provide a large army of technical experts for the needs of war. If we are optimistic enough to believe that war is to be abolished, then there is no problem for us to discuss to-day; but if war is to remain a possibility, we must face the fact that it would tend more and more to be a war of applied science, and the nation that does not take that lesson to heart by training man to apply science to warlike ends, should necessity demand such an application, would surely go down in the next great conflict."

In the discussion which followed there was general recognition of the importance of military training, arranged, however, to interfere as little as possible with a full academic program.

What Makes Water Power Costly

To increase the water supply in low-water periods the Western States Gas-Electric Company has created a new reservoir above its Placerville plant. This station has an available rating of about 4500 kw., but at low-water seasons not enough water is available to produce this energy. The engineers foresaw, however, that by creating pondage above the plant the period during which full rating would be available could be extended. Medley Lake was the site of one such pond. To build the several dams necessary to create the pondage was a more difficult task than it might appear. Medley Lake lies 8200 ft. above sea level. Snow always lies on the mountains around it. No roads reach it. The nearest highway at Echo Lake is 7 miles (11 km.) away. But in spite of these difficulties and by laborious painstaking methods there has been created an 8200-acre-foot (10,200,000-cu.m.) pondage. Needless to state the work has cost money. And this money must enter as a part of the capital charge of the hydroelectric plant and become a factor in the water-power rates.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Canadian Electrical Association, Toronto Section.—A program for the year was outlined at the meeting Nov. 7 of the Toronto Section, Canadian Electrical Association.

The Electric Club of Chicago.—At a meeting of the Electric Club of Chicago held Dec. 12 H. A. Porter, district manager Century Electric Company, was elected president and H. V. Coffy secretary.

New York Jovian League.—The annual meeting for electing officers and directors for the ensuing year will be held by the New York Jovian League at the Hotel McAlpin on Tuesday, Jan. 7, 1919, at 12.30 p.m.

Electrical League of Cleveland.—M. Luckiesh of the Nela Research Laboratory spoke at the regular Thursday noon meeting of the Electrical League of Cleveland on the subject "Five Thousand Miles in the Air."

New York Electrical Society.—On Thursday evening, Dec. 19, Ensign C. L. McCrea, U. S. N. R. F., gave an address before the New York Electrical Society on "The 14-in. Naval Railway Gun." The lecture was supplemented by moving pictures.

A. S. M. E., Atlanta Section.—At a recent meeting of the Atlanta Section, American Society of Mechanical Engineers, it was proposed to present a bill to the Georgia Legislature requiring the adoption of the A. S. M. E. boiler code for the State of Georgia.

Electrical Estimators' Association.—The Chicago Electrical Estimators' Association held a conference recently at which it invited the attendance of all electrical contractors in Chicago. The new estimating forms which the association has developed were explained by A. Uhl of the Henry Newguard Company.

Western Society of Engineers.—At the last meeting of the Western Society of Engineers, held in Chicago on Dec. 19, M. Luckiesh, chairman of the committee on camouflage of the National Research Council, gave an illustrated lecture on "Camouflage," with especial reference to marine and air service.

San Francisco Electrical Development League.—At the meeting on Dec. 2 Arthur D. Carvalho, president of Carvalho & Company, Hongkong, gave a talk on the electrical trade in the Orient. At the weekly luncheon of this league on Dec. 9 George B. McDougall, State Architect of California, spoke on "Construction Problems."

N. E. L. A., Philadelphia Electric Company Section. — The Christmas meeting of the Philadelphia Electric Company Section of the National Electric Light Association was held on the evening of Dec. 3, the speaker being Albert L. Moise, whose subject was "Reconstruction."

Portland (Ore.) Sections, N. E. L. A. and A. I. E. E.—At a joint meeting on Dec. 3 W. L. Morrison, manager and metallurgist of the Western Reduction Company, addressed the Portland Sections of the National Electric Light Association and the American Institute of Electrical Engineers on "Electric Smelting."

Society of Automotive Engineers.—The Society of Automotive Engineers will hold its winter meeting in New York, Jan. 12-14, 1919. The technical sessions will be devoted to war and postwar subjects, such as post-war automobiles, thermodynamics of internal-combustion engines, road tractors and commercial motor trucks.

N. E. L. A., Philadelphia Section.—William H. Berry, collector of the Port of Philadelphia, and his son, Major Benjamin S. Berry, of the United States Marines, spoke before a recent meeting of the Philadelphia Section, National Electric Light Association, Mr. Berry on war activities in this country and Major Berry on personal experience on the firing line.

A. I. E. E., San Francisco Section.—In San Francisco there has recently been established an "Engineers' Service Bureau" which is intended to serve as a clearing house (1) through which engineers in search of employment may get in touch with prospective employers and (2) through which employers may find technical men promptly as they are needed. This bureau is being conducted at the San Francisco Engineers' Club through the joint council of San Francisco engineering societies. In this organization are represented local sections of the American Society of Civil Engineers, American Institute of Electrical Engineers, American Society of Mechanical Engineers, American Institute of Mining Engineers and American Chemical Society.

National Automotive Electric Service Association.—The National Automotive Electric Service Association has been organized to promote and improve service on electrical equipment of automotive vehicles in the United States by coöperation between its members and others interested in the same line of business. The membership will be by firms rather than individuals, each one being entitled to two representatives with one vote for each. Any firm whose entire business or a fair proportion of whose business is devoted to service on the electrical equipment of automotive vehicles will be eligible to membership in this association. Officers elected were: President, Arthur Jones, president of the Arthur Jones Electric Company, Chicago; secretary, John W. Rusicka, manager Motor Electric Equipment Company.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Extensions for Compliance with Safety Act.— More time has been granted by the California Railroad Commission to the Coast Valleys Gas & Electric Company, the Sierra & San Francisco Power Company, the California-Oregon Power Company, the San José Railroads, the Peninsula Railway Company, the San Joaquin Light & Power Corporation and the Midland Counties Public Service Corporation to comply with the provisions of the state law known as the safety act.

Responsibility for Making Wiring Changes Is Placed on Customer.—Maurice L. Rothschild, Chicago, recently complained as to the method of the demand measurement used by the Commonwealth Edison Company. The Edison company, through the installation of demand indicators of a type known as "M-2" and the institution of a clause in the rate schedule providing definitely for thirty-minute maximum demand, has changed from its former practice, in which a Wright instrument measured the maximum demand over a shorter period. The result of the change was to the consumer's advantage, since it reduced the maximum-demand measurement. It appears that the "M-2" type instrument is a type that must be associated with a single watt-hour meter for its proper operation, and to have initiated this type of demand measurement would have required the installation of five demand meters, one for each watt-hour meter. In the opinion of the respondent company this would have incurred an unwarranted expense, and it averred that if the complainant wished to avail itself of the advantages of the new measurement, it would be necessary that the services be combined at one point, so that one watt-hour meter might measure all energy furnished under the contract. The complainant did not so combine its wiring until November, 1917. It then sought reparation for the difference in bills rendered in the period 1915 to 1917, when the demand was measured by the Wright instrument. The Illinois Public Utilities Commission held in its opinion that the defendant company, through notification to the consumer of the possibility of the saving, fulfilled its obligation at least for a reasonable period of time, and any loss which the con- sumer experienced on acc[illegible]ure to make nece[illegible] not be ca[illegible] defe[illegible] Public Util[illegible]sion therefore dismissed [illegible] complaint.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

City of Cleveland Appeals.—The city of Cleveland has carried its 3-cent rate case to the Ohio Supreme Court. Recently the Public Utilities Commission issued a ruling to the effect that 10 cents per kilowatt-hour shall be the maximum rate, with a sliding scale below this rate after a certain number of units have been used. The city has taken an appeal from this order, and twenty alleged errors have been cited to form a foundation for its case.

International Power Economy Conference.—At a meeting held at the City Club, Chicago, at which the principal manufacturers of power plant equipment were represented by delegates or proxies, a resolution favoring the continuation by the United States Bureau of Mines of the work of the National Fuel Administration was unanimously adopted and it was further resolved that the executive committee be instructed to communicate with the Director of the Bureau of Mines advising him of this organization of power plant equipment manufacturers and offering the assistance and coöperation of the association in his work of fuel conservation.

Ohio Rate Ordinance Upheld.—The Ohio Supreme Court last week reversed the Public Utilities Commission in an appeal from a rate order made by the city of Washington C. H. It seems that the Washington Gas & Electric Company had been operating several years when in January, 1914, it filed its schedule of rates with the Public Utilities Commission. The city had enacted an ordinance the previous year with the terms of which the company had complied, although it had not formally accepted it. On Jan. 15, 1918, a new schedule was filed with the commission and allowed. From this the appeal was taken. The court ruled that the actual acceptance of the ordinance was in effect the legal acceptance and that the rates may be modified only at the time the original ordinance expires.

Accident in Defiance, Ohio.—A series of unfortunate incidents accompanied the installation of a new 2500-kw. turbine at the station of the Defiance (Ohio) Gas & Electric Company, one of the plants controlled by the Auglaize Power Company, while at the same time a large unit was being installed at Maumee. It was thought that the Auglaize power dam would be able to carry the load while these installations were being made, but the water ran low and the load was thrown on the Maumee plant. There the transformer burned out. Another transformer sent from Bay City, Mich., suffered a like fate. As a last resort the big transformer at the Auglaize dam was torn out and sent to the Maumee plant, and after its installation Defiance, with a number of other towns, received light after being dark and without power for six days. The new turbine at the Defiance station was due to start on Dec. 14.

Idaho Investigation of Electric Heating.—On its own initiative the Idaho Public Utilities Commission is now investigating the feasibility of generation of electrical energy for heating purposes by large hydroelectric power plants in that state, thus assisting in solving the fuel problem. Some of the companies formerly tried to supply electric power for heating but abandoned the service, holding that it was not profitable or even feasible. It has since been claimed by others that with the vast amount of water power along the Snake River and its tributaries it is possible to furnish electric energy in such quantities that heating can be made not only feasible but profitable to the operating companies. At the first hearing the forty-three power companies represented held that heating by electricity is not physically or financially possible and that the contrary impression was due to misinformation sent broadcast. The cost of heating by electricity is five times the cost of heating by coal, it was contended. Electrification of railroads, it was held, is practicable and would do more to solve the coal question than anything else.

Manufacturers Favor "Democracy of Commerce."—At the annual convention of the American Manufacturers' Export Association, held shortly before the armistice was signed, the following resolution, moved by W. W. Nichols, was adopted: "Resolved, that in the midst of a war between democracy and autocracy the American Manufacturers' Export Association in convention assembled desires to place itself on record in favor of a democracy of commerce which signifies: A full condemnation of those methods of selfish indifference to the rights of others by which a blind autocracy precipitated a world war which cannot end until that autocracy is destroyed; a determined opposition to the Germanic system of insidious commercial propaganda which sought confidence only to destroy it and injected its poison into the commerce of every nation whose hospitality it enjoyed, and a decided stand upon the firm foundation of justice and fair dealing, in order that the foreign trade of the United States may enjoy that permanent prosperity which can be assured only by the respect and friendship of an enlightened world; and further resolved, that, in sympathy with these sentiments, Congress be urged to give careful attention to foreign trade measures already in the making in France, Great Britain and elsewhere and to encourage by its influence coöperation for commercial reciprocity."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Contract for Public Lighting.—Specific performance of a valid existing contract to do public commercial lighting in a city will be granted where damages are not an efficient or adequate remedy for loss due to breach, the Supreme Court of Wisconsin held in Oconto Electric Company versus City of Oconto (169 N. W. 293). A stipulation entered into before the railroad commission between plaintiff, having permit to do public lighting in city, and a rival company, being binding and in the nature of a contract, was held subject to enforcement. Where defendant city accepted benefits of that stipulation and the fruit of plaintiff's action, prosecuted in reliance thereon, it would be unconscionable to permit the city to repudiate plaintiff's established right, to which it cannot be restored and for which it cannot be awarded an adequate remedy at law. Injunction is the proper remedy for enforcing right of plaintiff public service corporation to do public commercial lighting in defendant city, the facts and circumstances presented tending to show an irreparable injury.

Manufacturing Plant Selling Energy.—A manufacturing concern doing public and commercial lighting without having been authorized so to do by its charter exercises such powers in violation of law, the Supreme Court of New York ruled (172 N. Y. S. 498). A corporation organizezd under the manufacturing corporations act of 1848, and not under the transportation corporations law, not having a franchise to use streets, highways and public places for purpose of furnishing electricity to inhabitants for light and power, has not acquired an implied franchise to use streets for such purpose by reason of long usage where such usage was in violation of law. The Public Service Commission, having authority to institute proceedings against an electric corporation doing anything in violation of law, may bring proceedings against a manufacturing concern not incorporated under the transportation corporations law that was using streets without having franchise to furnish electricity for light and power, where the furnishing of such electricity was in violation of the law, not being authorized by its charter. A manufacturing concern furnishing electricity to persons other than its tenants off its own premises for compensation, using public highways for such purposes, and operating an electric plant within the Public Service Commissions law defining "electric plant," is under the jurisdiction of the commission.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Franklin L. Hall, formerly assistant secretary and auditor of the Narragansett Electric Lighting Company, Providence, R. I., has been recently elected secretary and treasurer of the company, succeeding the late William G. Nye.

Arthur H. Kimball, who recently retired from the managership of the Fall River (Mass.) Electric Light Company, is one of the best known central-station executives and engineers in New England. Mr. Kimball was one of the first central-station men in that section to appreciate the importance of improving the load factor through cultivation of power business and of the economic benefits of such business when maintained at rates responsive to local conditions. A native of Fitchburg, Mass., Mr. Kimball was educated in the local schools and entered the electrical field in 1881 as an employee of the Lowell District Telephone Company in Fitchburg. He was made manager of the company in 1883. From 1885 to 1886 he was engaged in the electrical contracting business at Fitchburg, becoming superintendent of the Wachusett Electric Light Company of that place in the latter year. In 1888 the property was purchased by the Fitchburg Gas Company, and the two companies were consolidated as the Fitchburg Gas & Electric Light Company. Mr. Kimball remained with the company until 1908, having full charge of the construction work and operations of the electrical department. He then became general manager of the Fall River company. During his incumbency the gross earnings of the company were increased from $227,000 to $632,026 per year and the output from 5,320,770 to 26,260,000 kw.-hr. Mr. Kimball was a pioneer in the application of central-station energy to textile mill driving. This class of load has been developed most successfully at Fall River under his direction. Mr. Kimball has been identified with the New England Section of the National Electric Light Association since its earliest days. His future plans look toward the establishment of a New England agency to distribute manufactured products of value to central stations and other engineering-industrial consumers. His present address is Newtonville, Mass.

A. H. KIMBALL

C. B. Mills has resigned as mechanical engineer in charge of the industrial drafting department of the Westinghouse Electric & Manufacturing Company to become assistant chief engineer of the Sperry Gyroscope Company of Brooklyn.

Frank G. Frost, formerly superintendent of the Houston (Tex.) Lighting & Power Company, has been transferred by the United Gas & Electric Company to the New Orleans (La.) Railway & Lighting Company, as superintendent of power.

Brigadier-General George H. Harries, who in civilian life is a vice-president of H. M. Byllesby & Company, was, according to Associated Press dispatches, the ranking officer of the three American officers first to reach Berlin since the signing of the armistice. General Harries and his aides arrived in Berlin on Dec. 10 as members of the American commission for the repatriation of war prisoners.

J. H. Mustard of the educational department of the Westinghouse Electric & Manufacturing Company has recently been appointed head of the department of electrical engineering of the University of North Carolina. Mr. Mustard was graduated from the University of Michigan in 1902 with the degree of electrical engineer, and immediately afterward joined the Westinghouse company as a graduate student in the apprenticeship course. He has been continuously connected with the company in different capacities since that time, and in 1911 became associated with its educational work.

Willis H. Booth, chairman of the board of the Edison Electric Appliance Company, has been elected vice-president of the Guaranty Trust Company of New York. Mr. Booth established the Hotpoint Electric Heating Company in 1914, this company later being consolidated with the General Electric and Hughes heating appliance interests to form the Edison Electric Appliance Company. Mr. Booth's banking career began in 1905 as vice-president of the Equitable Savings Bank of Los Angeles. In 1912 this institution was consolidated with the Security Trust and Savings Bank, of which Mr. Booth became vice-president. He was also made vice-president of the Southern Trust Company. Since 1914 he has been vice-president of the Security National Bank.

B. F. Fortner, formerly with the Public Service Commission of Oklahoma, has been appointed superintendent of distribution of the Okmulgee (Okla.) Ice & Light Company.

John L. Harper, who for the last sixteen years has been chief engineer of the Hydraulic Power Company of Niagara Falls and who has been chief engineer of the Cliff Electrical Distributing Company of the same city since its inception, has been appointed chief engineer of the new Niagara Falls Power Company, formed by the consolidation of the Niagara Falls Power Company, the Hydraulic Power Company and the Cliff Electrical Distributing Company and their subsidiaries. Mr. Harper will be in charge of operation under the general manager, Paul A. Schoellkopf. Prior to his connection with the Hydraulic Power Company, Mr. Harper was associated with the Twin City Rapid Transit Company, Minneapolis, Minn., and with the St. Croix Power Company, Apple River, Wis. Mr. Harper is a graduate of Cornell University and a member of the American Society of Mechanical Engineers, American Society of Civil Engineers, American Electrochemical Society, American Ceramic Society, American Society for the Advancement of Science, National Geographic Society and American Civic Alliance and a fellow of the American Institute of Electrical Engineers.

J. L. HARPER

Obituary

Dennis E. Whipple, who for the last seven years had charge of the Central Western distribution of the "Detroit Electric," manufactured by the Anderson Electric Car Company, died suddenly on Dec. 8 from pneumonia. He was thirty-eight years old at the time of his death and for the last ten years had been associated with the producers of the "Detroit Electric." Mr. Whipple was particularly well known in the electric vehicle field not only for his achievements in the promotion of the pleasure electric car but also for the strength of his personality and his integrity of character.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber
of Electrical Equipment and Supplies—
Notes on Industrial Activities and Business Methods

CENTRAL STATION TO FURNISH FIRST BUSINESS

Importance of Appliance Business in Future Market Emphasized at Cleveland Meeting of Electrical Jobbers

While some apprehension was expressed at the meeting of the Electrical Supply Jobbers' Association at Cleveland last week in regard to the possibility of declines in prices, thus affecting values of stocks, opinion as a whole indicated an expectation of good business, and it was held that the active business which the jobbers have enjoyed has put them in a position to meet any conditions that may arise and has strengthened their ability to give service of increasing value.

On the question of steel the statement was made by one representative that, while prices may decline, no great quantity of steel can be obtained under present conditions. There is a demand to-day, and will be for at least three or four months ahead, for a greater quantity of steel than the mills can produce. While cancellations in steel lines have been received and are still being received, there is a bright spot in the horizon in the speeding up of movements to develop foreign trade, and manufacturers, it was said, are humane enough to feel that wages cannot be lowered unless the cost of living is reduced.

Electric heating appliance prices, the opinion was expressed, will not show much change. The increases had been based absolutely on cost. While there is a hope that prices will be lowered, no prophecy was made as to when this change would take place. Great faith was felt in the probability of increased demand for heating appliances. Tremendous strides have been made in the industrial heating business, even more, it was pointed out, than in domestic lines. There was some discussion of the question of the conservation program of the manufacturers, and it was brought out in this connection that the reduction of lines, if continued as a peace measure, will reduce the amount of stocks carried by jobbers and will mean substantial economy.

That not much in large construction in the big Eastern centers will be done for six months was one of the views advanced, although some special projects are under way and are certain to go ahead. The general opinion is that after that business will be very good. A great part of the government work has been stopped, and what construction work is being done at present is government work which is being continued. In electrical construction the wage rate has been increased very little, but the total pay has increased largely because of an enormous amount of overtime.

The jobbers were urged by another speaker to give careful attention to the cost of materials. He asked how the stocks of materials accumulated by the government are to be absorbed without disturbance of the market. He thought that an enormous amount of materials produced by the government remained to be absorbed and, if not taken into normal channels, would demoralize the market.

The thought was expressed by one speaker that the almost unanimous opinion was that both prices and wages would recede gradually, that foreign demand would tend to delay this movement, and that there would not be any great amount of business until prices should be fairly stabilized. It was pointed out that there has never before been so much money in the pockets of wage earners and farmers, that the wheat crop will make the West prosperous and cotton will do likewise for the South. The underlying agricultural conditions in this country are sound, and so are retail conditions. It was stated by the speaker that central stations have expanded in the central districts to serve war factories and that the decrease in demand from these consumers will make it necessary for central stations to extend their lines to provide markets for their surplus energy. The first business, it was prophesied, would come from central stations. Already these properties are beginning to buy wire, cross-arms, poles, etc. Their next interest will be in getting the public to buy appliances. If the jobbers did not meet the opportunity in this line, they were warned that they would have competition. The demand, it was held, will be large for washing machines, vacuum cleaners and heating devices. The sales will be in small quantities, but the jobbers will buy in carload lots and will find markets for the goods. This field is bound to be a big one if it is developed intelligently. Instead of looking at disappearing business, the jobbers should look at the new business awaiting them in these lines. It was recalled to the members that the growth of the electrical business is greater than ever before and the industry has survived everything that has taken place. Before 1914 there had been no fat years. Now the jobbers have had three good years.

SCHEDULE MANUFACTURERS NOW PREPARE FOR TRADE EXPANSION

Market Is Dull at Present, but Larger Business Is Confidently Looked for—Development Work Again Going Ahead

Switch and socket manufacturers are looking forward to peace conditions with confidence, though they are feeling their way along at present as regards stock accumulation. Many of these plants have been very active in filling the wants of the army, navy and shipping board, and the signing of the armistice naturally brought them face to face with important questions of future policy. A number of such manufacturers seen within the past few days by a representative of the ELECTRICAL WORLD are of the opinion that a temporary period of dullness would not be surprising, though the resumption of activities in the building trade is expected to quicken production before the winter is ended. Meanwhile, the more energetic concerns are studying the possibilities of foreign trade with might and main, and apparently firm foundations for a lasting business in other countries are being laid upon the two important bases of superior quality and ability to deliver products to customers, who are at present practically unable to secure the cheap and inferior material and designs with which the enemy attempted to flood the foreign market. For the last six weeks there has been a serious dearth of shipping facilities for this pioneer work, but it is not believed that this condition will last much longer in view of the release of vessels from munitions transportation and the speed with which the American shipbuilder is putting new craft into commission.

In conformity with the government's orders, and also because of the pressure of war demands, manufacturers of schedule material have not stocked up to any great extent at the factories. Industrial material has been shipped practically as fast as it could be produced, and such stocks of wiring supplies as are in hand represent in considerable part reserves from earlier production. Development work has been strictly curtailed during the war, but it is now being taken up afresh in some cases, particularly along the line of creating a satisfactory socket switch for controlling appliances consuming several hundred watts. Raw materials are still quite hard to obtain in sufficient quantities, although the supply of brass is said to be easier. Porcelain is coming through better.

Some cancellations are reported, especially in connection with cantonments, but it has not been necessary as yet to cut down the personnel of the schedule material factories to any great extent. In fact, one of the leading manufacturers emphasized his desire to obtain additional labor of high quality even while anticipating a period of readjustment. Overtime, of course, is likely to be taboo for the present in plants of this kind. It appears that the factories are now pretty well caught up with their government orders, though the shipbuilding industry is likely to call for a considerable amount of wiring material during the next year, and if the naval program sponsored by Secretary Daniels is carried out, the market for marine fittings will be correspondingly enlarged. Prices remain firm so far, with little disposition to forecast reductions.

METAL MARKET SITUATION

Copper Men Unite Against Foreign Combinations for Export Trade—Spelter and Tin Dull

Announcement of the formation of the Copper Export Association, Inc., to represent American producers of copper in foreign markets was formally made on Tuesday, following the first meeting of the organization.

The plan is purely a mutual one and provides for no advantage on account of size or location of any contributing organization, and it is hoped will fulfill the expectations of its promotors and firmly unite all American exporters of copper. For a number of years it has been possible for foreign consumers to obtain copper from American producers for about 14 cents per pound less than the American consumer paid. It is believed the export association will remedy this situation and will not permit the foreign combinations to secure such undue advantage.

Business here continues at a standstill, but resales of carload lots of electrolytic ingots by consumers have been made at under 22.75 cents. Such sales apparently represent the best that sellers can get in the present unsettled state of things and with the fear of the prices that may rule after Jan. 1, when all government control ceases.

The spelter market still continues very dull, and there is a complete absence of inquiry and business. There are reports that a good export business has been done with France. Prices remain barely steady.

Tin remains practically unchanged, and no indication has yet been received by the trade as to what plan is to be followed in restoring a free market and free importation of tin. Consumers as a whole are well supplied, and those who have no stock are only buying against their actual requirements.

Old metals still show a falling tendency.

NEW YORK METAL MARKET PRICES

	Dec. 10	Dec. 17
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26.00
Casting	Govt. price 26.00	Govt. price 26.00
Wire base	28.75	28.75
Lead, trust price	7.05	7.05
Antimony	8.62½	8.00
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	15.00	15.00
Spelter, spot	8.67½	8.67½
Tin	72.50 (official)	71.75
Aluminum, 98 to 99 per cent	Govt. price 33.10	Govt. price 33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	18.50 to 19.00	18.50 to 19.00
Brass, heavy	10.50 to 11.00	10.50 to 11.00
Brass, light	8.50 to 9.00	8.50 to 9.00
Lead, heavy	5.25 to 5.50	5.25 to 5.50
Zinc, old scrap	5.25 to 5.50	5.25 to 5.50

THE WEEK
IN TRADE

HOLIDAY business, with the exception of certain isolated districts, fell off considerably this week. From a condition of shortage of stocks a few weeks ago the market has suddenly changed to one where dealers are apparently well supplied but with a very low consumer demand.

Several indications this week point to the tottering of peak prices. Iron and steel products are lower, inquiries for 24-cent copper are coming into the market, some concerns have reduced the price of wire base 2 cents or more, and distributers in a number of lines are freely predicting lower prices in the near future.

Jobbers' stocks are in pretty fair condition. No. 14 rubber-covered wire appears to be the most difficult material to obtain. Conduit supply is fairly easy now. Standard lamp stocks are much better than they were a year ago.

Fewer new credits are being given than for some time, and the tendency seems to be to exercise more caution than ever before.

NEW YORK

Business is still dull. The Christmas trade, which showed some signs the week before of getting back to pre-war conditions, has fallen flat, and retailers are stocked with electrical goods the week before Christmas. Some stores are beginning to shade prices on appliances in order to stimulate trade.

Real estate began to show signs of life in the past week, two or three large transactions having taken place, but the outlook for much new building next spring is poor. Lack of money obtainable for building purposes is going to be one of the greatest drawbacks. At a recent meeting of the New York Building Managers' Association a representative of the leading source of money on real estate mortgages during the past fifteen years in New York City stated that he saw no early prospect for any softening of the present tension in the mortgage money situation.

CONDUIT.—Owing to government cancellation of contracts, conduit is coming into the market more freely and can be had now in carload lots in two to three weeks' delivery. The demand, however, outside of replenishing depleted stocks up to some semblance of normal is not great. Buyers, owing to the general cut in nearly all lines of iron and steel, are showing hesitation in taking on large stocks of conduit at present price levels and the poor building outlook. As yet there are no warehouse supplies. Metal molding for interior wiring has not been in much demand lately. The reason for this is said to be the great shortage of No. 14 wire; hence the demand for interior wiring has been almost at a standstill. Supplies on hand are good.

WIRE.—Better jobbers' stocks of Nos. 10, 12 and 14 rubber-covered wire are reported. Some manufacturers have no supplies of No. 14 single-braid. It is learned that wire base has been cut by producers here and there from 2 cents to 4 cents.

LAMPS.—The demand for lamps still continues excellent and is expected to remain so until after the holidays, when a slight falling off may be looked for. Supplies on hand are liberal and warehouses well stocked. There is a shortage of automobile lamps, particularly of the Ford type, and deliveries are four and five weeks behind.

MOTORS.—The market for motors of the larger sizes still remains quiet, with small sales reported this week. Fractional-motor business, on the other hand, appears to be reaching very large proportions. There is an inquiry in the market for 50,000 small motors for washing machines, and the demand is so brisk that a change in price upward is contemplated by one of the leading producers next month. Supplies on hand are good and shipments are prompt.

RADIATORS.—While the jobbers are pretty well sold out of the best-known makes of radiators, purchases by the public the past week have shown a marked decrease. This undoubtedly is due to the present mild weather, it is reported. Retailers are loaded up, and one well-known and popular make which advanced in price 20 per cent a few weeks ago is being offered by many stores to-day at the price which formerly prevailed.

PORTABLE LAMPS.—The very large demand looked for from the Christmas trade has not materialized yet, and sales have been disappointing. Stocks on hand are large.

HEATER CORD.—The situation in heater cord is beginning to show some signs of improvement. For weeks past it has been impossible to obtain cord in any quantity. Shipments on back orders are now coming in.

CREDIT.—Since the signing of the armistice credits are being very carefully scrutinized by producers. Payments in this territory are 50 per cent slower than they were a year ago.

CHICAGO

Three big developments in the twelve-year campaign of Chicago city planning and of actual city rebuilding took definite shape last week. The Illinois Central electrification ceased to be a battle and became a proposition within a measurable distance of realization. The Chicago Plan Commission sent to the Mayor and City Council its reconstruction platform, comprising twenty-three urgent proposals. The executive committee of the commission placed in the hands of the finance committee of the City Council a resolution unanimously recommending that the finance committee include in the 1919 municipal budget appropriations required to enable the board of local improvements to accomplish the Ogden Avenue extension and to provide for preliminary work on the Western Avenue, Robey Street, Ashland Avenue and South Water Street improvements. Every phase of the development either marked a definite advance in long pending issues or gave definite impulse to further procedure.

A deduction to be made from the comments heard among both copper producers and consumers is that the new year will be likely to start off with a lower copper price basis, and it would not be surprising if offerings under the 26-cent level became frequent during the rest of the month.

The labor supply about equals the demand in the Middle Western States, according to the first of a series of weekly reports obtained by the United States Employment Service from important industrial centers.

In Chicago a canvass of 175 employers shows the supply and demand to be about the same, but a heavy increase in requirements is expected in the coming week. This situation holds good as a general rule in Illinois, Indiana, Minnesota and Missouri. A shortage of labor is reported from South Bend, Ind.

A second epidemic of influenza is affecting manufacturers in this territory considerably. Many manufacturers report that as much as 40 to 50 per cent of their help is off work because of this epidemic. Medical men predict that next week the epidemic will be at its peak.

VACUUM CLEANERS.—A new low-priced vacuum cleaner will soon be put on the market by a manufacturer in this territory, to sell for about $25 retail.

WASHING MACHINES.—It is rumored that there will be no lowering in price for washing machines for at least the next six months.

INDUSTRIAL LIGHTING FIXTURES.—Now that a large number of industrial plants have got back to their normal running basis, they are taking steps to rebuild their plants and install new lighting units.

TRANSFORMERS.—A new transformer for industrial electric furnace work will be announced to the trade shortly.

INDUSTRIAL CONTROL EQUIPMENT.—The demand for this type of equipment continues heavy, but in spite of the heavy demand deliveries are getting better.

BOSTON

Trade is marking time this week, in a sense. New orders are a little less active pending the turn of the year. Collections continue good. Some improvement is to be seen in deliveries, owing to the release of manufacturing facilities formerly largely absorbed by war work. Prices show little change, although copper wire is being shaded a cent or so a pound in some cases. Appliances are in good demand for the Christmas trade. Stocks are still relatively large, and aside from filling gaps due to the diversion of material for war requirements jobbers are ordering little. The labor situation is not as yet so disturbing as was apprehended in many quarters at the conclusion of hostilities. Jobbers' staffs are not being enlarged much at this time. The outside solicitation of business is being taken up with renewed vigor.

Gradually business is changing toward peace conditions, and the transition has so far been happily free from revolutionary upheavals. The central-station loads hold up well despite curtailment of government production in industrial centers.

WIRE.—Prices are being shaded slightly in some cases, owing to stocks of copper on hand. The softening tendency does not exceed 1 cent or 2 cents per pound so far as can be learned. Stocks are fairly large with the exception of smaller sizes which have been held back by government orders in the past few months. Weatherproof is quoted around 30 cents base, and rubber-covered wire at about 33 cents list.

WASHING MACHINES.—The market is still sold ahead of production, but deliveries are improving. Until the factories make more progress, however, in filling orders now on the books intensive solicitation will have to be discouraged among retailers. Prices hold firm.

VACUUM CLEANERS.—Trade continues brisk, with firm prices. Forehanded accumulation of material and reasonably satisfactory labor conditions have made it easier to meet the demand than might have been expected.

LAMPS.—Stocks are increasing steadily, and it is said that the shortage in miniature lamps is likely to be relieved in another two months. There is an excellent lamp business now being handled, and the relaxation of lighting restrictions is being felt in the trade.

MOTORS.—The motor market is a trifle quiet, and some accumulation of stocks can be seen. Underlying conditions are sound, it is believed, and nothing beyond a temporary slowing down is anticipated.

COMMUTATORS.—The demand is heavy, and a Connecticut manufacturer specializing in these equipments sees excellent business ahead.

FIRE-ALARM TELEGRAPH APPARATUS.—Manufacturers and agents speak optimistically as to the trade prospects. Municipalities will soon be preparing estimates for protection development work, and increased interest in fire protection is counted upon. Factory stocks are in good order and prices are steady with little prospect of further advances. Maintenance orders are being handled with promptness.

RANGES.—Central stations are not quite ready to push these outfits hard, but a turn for the better is expected within a very few weeks. Where generating units have been commandeered by the government the result has been in many cases to tie down the commercial program to meeting demands for service with as little outlay as possible, and high-powered appliances have suffered accordingly.

ELECTRIC PASSENGER CARS.—The demand is increasing steadily in fields cultivated through genuine sales service. Deliveries are improving and carload shipment days have returned. Just before the signing of the armistice it looked as though local agencies for pleasure cars would have to suspend operations.

APPLIANCES.—Light, portable units for table service are in good demand. The holiday trade is materializing well.

FRICTION TAPE.—Stocks are increasing somewhat. Prices still hold firm.

ATLANTA

There is very little change to be recorded in the electrical field of the Southeast this week. The volume of business in general appears to be well maintained. Buyers are still marking time and purchases are made on the basis of small quantities for quick turnover. The propaganda which is being carried on throughout the South by certain political elements urging farmers and others to hold cotton for a much higher price is tending to curtail normal activity in the usual commercial channels and retard collections, which will in turn be reflected in the electrical trade.

No drastic fluctuations are anticipated as a result of an open market after Jan. 1. The feeling prevails that even if industry at large is able to make its own price, the present high cost of labor will preclude any startling recession during the transition period at least. Estimates of the time required to return to a normal peace basis vary, some authorities naming the middle of 1919 as the earliest possible date for a full change.

All electrical construction at the officers' training camp at Camp Gordon has been stopped, and material on hand at this point and at Camp McClellan is being shipped to Camp Benning, Columbus, Ga. It looks now as if this would be a permanent school.

The merger of the Southern Bell Telephone & Telegraph Company and the Atlanta Telephone Company has been ratified by the City Council. No action by the Atlanta City Council has been taken on the War Labor Board recommendation for a 6-cent street-car fare, following the award of 25 to 50 per cent increase in wages to platform men.

CREDITS AND COLLECTIONS.—Manufacturers report that collections in general are good. The small central stations, jobbers and dealers are showing up exceptionally well, and outstanding paper is slowly decreasing. Although the credit reins have been tightening for the last few months, dealers and contractors have been prompt for a much longer period, as they have enjoyed a profitable business. Collections from the utilities are spotty. Those that have been granted increases in rates and fares are doing much better than last month, but those that have not received increases are having great difficulty in meeting obligations. As the accounts of these companies normally run into large figures, the complexion of collections and the credit viewpoint of distributers depends to a large extent on how these accounts are taken care of from month to month.

FARM-LIGHTING OUTFITS.—Manufacturers estimate that business in the Southeast for the first eight months of 1918 was about 50 per cent greater than the last eight months of 1917. There is no indication at this time that prices will drop off for at least six months. Accessories, however, and wiring material declined from 5 to 15 per cent recently. The freeing of raw materials and increasing factory facilities have brought shipments of complete outfits down to three weeks. The greater portion of inquiries are for the ¾-kw. sets. Jobbers and dealers have done a big business in fixtures, appliances and wiring material through the purchasers of these sets, and such a latent market exists for this class of goods that the manufacturers of these outfits are putting in substantial stocks of lamps, portables, etc., in order to handle the demand direct through their own distribution points.

SEATTLE—PORTLAND

While not pessimistic as a whole, Seattle electrical jobbers and dealers are not over-enthusiastic about this year's Christmas sales, which so far have been light. Optimistic ones believe sales will spurt during the week and that the total holiday business will be respectable and quite satisfactory. Puget Sound cities report like conditions with sales much lighter than for last year. Dealers in Tacoma especially state that the bottom has dropped out of holiday sales and that there is no indication of improvement between now and Christmas. In Seattle washing and sewing machines have been the best movers in the appliance line, while electrically heated goods have not moved nearly so well as was predicted. Electric warming pans are still expected to equal sales of last year owing to early cold weather. Sales of Christmas-tree outfits so far are negligible. A slight movement in socket-device heaters has been noticed and is expected to increase, especially if the cold weather continues during the week.

Sales to shipyards and industrials have decreased during the past two weeks, but this is explained by over-buying by some of the yards. It is fully expected that the shipyards' volume of sales will remain at normal for some time to come, as the yards have not slackened in their constructional program since the signing of the armistice. Building in Sound cities, Seattle and Tacoma especially, has shown a slight decrease. The authorities believe this decrease will be more pronounced until spring, when it is thought prices of materials and labor will experience a decided drop. Prospective builders apparently are holding off for better weather and lower prices. Large architects' offices in Seattle have considerable work of importance in prospect, such as apartments, hotels and several business blocks. These jobs are not expected to materialize until the first of March or perhaps even later. The Portland territory reports that the final decision of the government to cancel wooden-ship contracts has naturally had a disheartening effect upon business. A number of concerns the output of which has been going exclusively to wooden shipyards will have to readjust their entire business and seek new outlets unless new ship contracts are forthcoming immediately from another source. Steel yards in the Portland district are progressing in very satisfactory manner, and the usual sales volume is sustained. In general, business is marking time and trying to adjust itself to a peace basis. The feeling is that there will be five or six months of readjustment before conditions become really stable again, although this in no way means that the present condition is panicky.

Seattle jobbers report that collections are keeping pace with sales and are satisfactory in spite of the approaching holidays, when collections are usually smaller. Very few new credits are being placed. Enterprises apparently are waiting for the passing of the transition period. Out-of-town collections are easy to make and new and important credits are negligible.

SAN FRANCISCO

Included in the after-war building program for San Francisco public buildings are extensive additions and a new school bond issue of $3,500,000 providing for twenty-three new school buildings. One school building contract for about $190,000 has just been let, and plans for others are in the course of construction. In other municipal departments appropriations for deferred extensions of facilities include hospital and health department buildings, fire and police buildings as well as smaller structures. The State Council of Defense in ceasing its activities announced last week that the value of building permits denied was one-third the value of permits granted during the period of its control over such activities. Much of the forbidden construction will be undertaken this year it is believed. The sale of $1,000,000 of Hetch Hetchy bonds last week with option on $8,000,000 more has assured continued construction activity on that project. The present program contemplates an expenditure of $200,000 per month.

Electric welding equipment, including both large and small motor-generator sets, balancer sets and alternating-current sets, is in demand. Moving-picture machines of small size motor-driven and using lamps instead of a carbon arc have recovered rapidly in the last few weeks. With this has come a notable increase in the time-demand for 400-watt lamps, which are used in such machines. Incandescent lamps will continue to be in demand, it is believed. The call for 20, 40 and 50-watt sizes is being strengthened by the discontinuance of free renewals in Gem lamps which two large lighting companies have recently announced. The production of lamps on the Pacific Coast has been increased recently as a reason of the marked improvement in labor conditions.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B & S. Size	List per 1000 Ft.
No. 14 solid	$61 00
No. 12 solid	71 00
No 10 solid	90 00
No. 8 solid	106 00
No. 6 solid	145 00
No. 10 stranded	95 00
No. 8 stranded	115 00
No. 6 stranded	160 00
No. 4 stranded	205 00
No. 2 stranded	266 00
No. 1 stranded	315 00

Twin-Conductor

No. 14 solid	104 00
No. 12 solid	135 00
No. 10 solid	185 00
No. 8 stranded	235 00
No. 6 stranded	370 00
No. 4 stranded	575 00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10%

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+30% to +20%
Coil to 1000 ft	List

	No. 12 Solid
Less than coil	+30% to +20%
Coil to 1000 ft	List

Twin-Conductor

	No. 14 Solid
Less than coil	$115.00
Coil to 1000 ft	100.00

	No. 12 Solid
Less than coil	+30% to +20%
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0 22 to $0.30 each.
Standard packages from 100 to 250

DISCOUNT—NEW YORK

Less than 1 5 std pkg	+20%
1/5 to std pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std pkg	+30% to List
1 5 to std pkg	+5% to 20%
Std. pkg	18% to 30%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No 6 Ignitor
Less than 12	$0 45—$0 46	$0 45—$0 47
12 to 50	40	40— .41
50 to barrel	35— 36	.36 37
Barrel lots	32— .329	33— .339

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12.	$0.40 to $0 45	$0 40 to $0.45
12 to 50.	.35 to 38	35 to 38
50 to barrel.	319 to 35	.329 to .35
Barrel lots.	.289 to 32	299 to .32

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5 00
⅜	250	7 50
½	100	10 00
¾	50	13 00
1	50	21 00
1¼	50	26 00
1½	25–50	35 00
2	25–50	45 00
2½	25–50	52 00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip.	$75.00	$63 75— 69.75
⅜-in double strip	75 00— 82 50	72 00— 75 00
½-in. single strip	100 00	85 00— 93 00
½-in. double strip	100 00—110 00	96 00—100 00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75 00	$63 25 to $63 75
⅜-in. double strip	78 25 to $78 75	71 25
½-in. single strip	100 00	75 00 to 85 00
½-in. double strip	105 00	93 00 to 95 00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
7/32	$0 05½	1	$0.25
¼	06	1¼	.33
⅜	09	1½	40
½	12	1¾	47
⅝	15	2	55
¾	18	2½	65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in —	$25 00–50.70	$24 00–35 20	$23.00–30 25
¼-in.—	30 00–56.40	28 00–38 40	26 00–33 00

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in —	$60 00	$30 00	$26 00–29 15
¼-in.—	65 00	33 50	29 00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
¼	$0 08½
⅜	.08½
½	.08½
¾	11½
1	.17
1¼	.23
1½	.27½
2	.37½
2½	.58½
3	76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
¼	$0.05	$0 19
⅜	.06	.19
½	.07	.19
¾	.10	25
1	.13	.37
1¼	.17	45
1½	.21	.50
2	.28	1 10
2½	.40	1 80
3	.60	4 80

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	7% to 7 1%	9% to 9 1%
2500 to 5000 lb.	10% to 10 1%	12% to 12 1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In
Less than 2500 lb.	+5.5% to 3 5%	+3.5% to +1.5%
2500 to 5000 lb.	+2.5% to +0.5%	+5% to 1.5%

(For galvanized deduct six points from above discounts)

FLATIRONS

NEW YORK

List price	$6.00 to $6 50
Discount	20% to 25%

CHICAGO

List price	$6.00 to $7 00
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg	List
3-amp. to 30-amp	100	$0 25
35-amp to 60-amp	100	35
65-amp to 100-amp	50	90
110-amp. to 200-amp	25	2 00
225-amp. to 400-amp	25	3 60
450-amp. to 600-amp	10	5 50
600-Volt		
3-amp. to 30-amp	100	$0 40
35-amp to 60-amp	100	60
65-amp to 100-amp	50	1 50
110-amp. to 200-amp	25	2 50
225-amp. to 400-amp	25	5 50
450-amp to 600-amp	10	8 00

DISCOUNT—NEW YORK

Less than 1 5 std. pkg	30%
1/5 to std. pkg	41%

DISCOUNT—CHICAGO

Less than 1 5 std. pkg	30%
1 5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1 5 std pkg.	$6 00 to $3.75
1/5 to std. pkg	5 25 to 7 00

Standard packages, 500. List, each, $0 07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8 00
1/5 to std. pkg	7.00

Standard packages, 500. List each $0 07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

	Std. Pkg	List, Each
Regular, Clear:		
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	85
75-watt—C	50	70
100-watt—C	24	1 10
200-watt—C	24	2 20
300-watt—C	24	3 25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4⅜-in., Frosted:		
100-watt—G 35	24	1 15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30 47—$40 77
Coil to 1000 ft	27 42— 32 98

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$38 00
Coil to 1000 ft	28 00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24 00 to $33 00

CHICAGO

Net per 100	$23 93 to $30 00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30 00
102—B.A., 6200, S.E., 300, A X, 1½, 4 S.	30 00
103—C.A., 9, 4R, B 1½	25 00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%	20%
$10.00 to $50 00 list	36%	31%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20%	10%
$10.00 to $50.00 list	30%	20%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	5%
1/5 to std. pkg	15%
Std. pkg	25%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std pkg	$20 00 to $21 00
1/5 to std. pkg	17 00 to 17 85

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$21 00
1/5 to std. pkg	17 85

Standard package, 2200 List per 1000, $20.00–21 00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.	Std. Pkg. 4000 Solid Nail-it—N.C
Less than 1/5 std. pkg	$16 00	$32 00
1/5 to std. pkg	13 60—	27 20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.	Std. Pkg. 4000 Solid Nail-it—N.C.
Less than 1/5 std. pkg	$13 00	$32.00
1/5 to std. pkg	11 50—	27 20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0 33
½-in. cap keyless socket	500	30
½-in. cap pull socket	250	60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List
1/5 std. pkg	10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0.80
60-amp. S. P. S. T	1 20
100-amp. S. P. S. T	2.25
200-amp. S. P. S. T	3.48
300-amp. S. P. S. T	5 34
30-amp. D. P. S. T	1 20
60-amp. D. P. S. T	1 78
100-amp. D. P. S. T	3 38
200-amp. D. P. S. T	5 20
300-amp. D. P. S. T	8 00
30-amp. 3 P. S. T	1 80
60-amp. 3 P. S. T	2 68
100-amp. 3 P. S. T	5 08
200-amp. 3 P. S. T	7 80
300-amp. 3 P. S. T	12 00
Low Grade:	
30-amp. S. P. S. T	$0.42
60-amp. S. P. S. T	.74
100-amp. S. P. S. T	1 50
200-amp. S. P. S. T	2 70
30-amp. D. P. S. T	68
60-amp. D. P. S. T	1 22
100-amp. D. P. S. T	2 50
200-amp. D. P. S. T	4 50
30-amp. 3 P. S. T	1 02
60-amp. 3 P. S. T.	1 84
100-amp. 3 P. S. T	3 76
200-amp. 3 P. S. T	6 76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15% to +10%
$10 to $25 list	2% to 5%
$25 to $50 list	5% to 10%
	Low Grade
Less than $10 list	+5% to list
$10 to $25 list	8% to 15%
$25 to $50 list	15% to 20%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+ 15%
$10 to $25 list	List to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15% to 16%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0 28
5-amp. single-pole, ind	250	32
10-amp. single-pole	100	48
10-amp. single-pole, ind.	100	54
5-amp. three-point	100	.54
10-amp. three-point	50	76
10-amp., 250-volt, D P	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp single-pole	100	$0 45
10-amp. three-way	50	.70
10-amp. double-pole	50	70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List to 10%
1/5 to std. pkg	10% to 16⅔%
Std. pkg	18% to 25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0 34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list.	Net to 18%	Net
$2.00 to $10 00 list.	10% to 28%	5%
$10.00 to $50.00 list.	20% to 45%	10%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list.	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6 00 to $6 50
Discount	20% to 25%

CHICAGO

List price	$6 50 to $7 00
Discount	20% to 30%

WIRE ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0 55–$0 66
No. 18, full spools	53– 56

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0 65 to $0 75
No. 18, full spools	55 to 635

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$20 00–$25 00	$13 50–$17 00	$12 50–$15 00
12	25.00– 27 09	22 50– 23.22	18 75– 23 22
10	31.26– 32 40	28 66– 32.40	25.00– 27 45
8	43.92– 45 72	40 26– 45 72	35.14– 38 10
6	63.69– 72.36	57 90– 60 30	55 58– 57 88

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$25 00	$18 00–$25 00	$15 50
12	$29 46– 31 44	29 46– 31 44	$25 54– 31 44
10	41 10– 43 84	41 10– 43 84	34 62 38 36
8	57 00– 61 76	57 00– 61 76	50 18 54 04
6	85 31– 97 68	85 31 85 47	77 21– 85 47

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4 0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$39 75
25 to 50 lb	39 75
50 to 100 lb	38 75

CHICAGO

	Per 100 Lb. Net
Less than 25 lb	$39 76 to $41 00
25 to 50 lb	38 76 to 40 00
50 to 100 lb	37 76 to 39 00

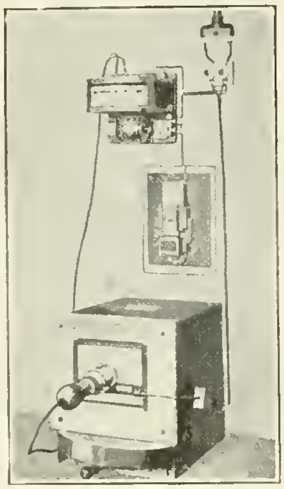
NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Automatic Control of Furnace Temperature

Control of furnace temperature within 1 per cent is attained by the use of the Brown automatic temperature-control pyrometer, according to the maker, the Brown Instrument Company of Philadelphia.

The temperature indicator has a pointer which is depressed by a small motor at intervals of ten seconds, upon platinum contacts, although no current passes through the needle itself. These contacts complete a relay circuit, which in turn affects the main control switch or valve to raise or lower the temperature. The contact-making device is adjustable along the temperature scale, and the high and low contacts are insulated by a very short distance, equivalent to 1 per cent of the scale.



TEMPERATURE CONTROL WITHIN 1 PER CENT

The illustration shows an automatic control instrument with relay and switch for controlling electric furnace temperatures. The pyrometer shown is of the high-resistance type, of 600 ohms, and is operated either by a base metal or platinum-rhodium thermocouple installed in the furnace. By the use of electrically operated valves gas-furnace temperatures may likwise be controlled.

Non-Water-Tight Round Outlet Box

A recent addition to its line of marine lighting and signaling apparatus is the non-water-tight 3¼-in. (8.25-cm.) round outlet box manufactured by the Benjamin Electric Manufacturing Company, 806 West Washington Boulevard, Chicago. Plunger key or keyless receptacles having a base of high-heat-molded insulating material are furnished with these boxes, which have a rating of 600 watts, 250 volts. The boxes have one side boss which is regularly tapped for ½-in. (1.27-cm.) conduit while the boxes for keyless receptacles will, if specified, be tapped for ½-in. (1.27-cm.) outlet in the bottom. The outlet box itself is 1½ in. (3.81 cm.) deep, 3¼ in. (8.25 cm.) in diameter and made of brass or iron as specified while the cover is of heavy sheet brass finished with emery bronze. Standard marine black finish is used with the iron boxes and may be obtained on the brass boxes when desired, although these are regularly supplied unfinished.

Spark-Principle Cable-Fault Finder

An electric cable fault-finding apparatus has been recently developed by Norman Stell & Company, Bradford, England, using a high-potential and high-frequency discharge or spark for fault indicating, the conductor of the cable being connected to one terminal or earth, and the cable itself run through a hand clip which is connected to the high-tension terminal by flexible leads.

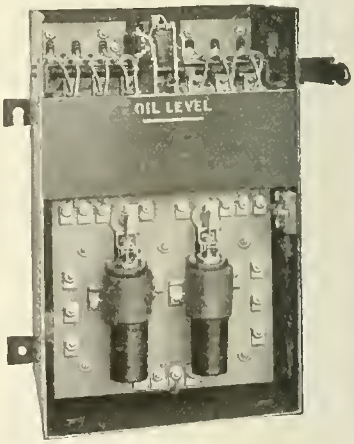
The apparatus consists of an induction coil controlled by specially arranged instruments, energy being derived from any commercial alternating-current or direct-current lighting supply. For general work a "Standard" outfit is supplied fitted with four sets of fault finding, each being separately controlled. The twenty ranges of regulation in this apparatus give a large field of use. The apparatus is arranged for connection to a lamp socket or a wall plug, and everything but leads and clips is contained in an easily portable wooden case. A smaller model fitted for two sets of findings with sixteen regulation ranges is also obtainable.

A number of distinct advantages are claimed for these fault finders by the makers. Cables may be kept perfectly dry so that better repairs are more easily made, and finished wires and cables which would be injured by water or dampness can be examined for faults. Also cores may be examined before vulcanization, thus obviating separate curing of the cables. Since no batteries or vibrators are used, the detecting spark, which is both audible and visible, remains constant, thus eliminating expensive renewals. Being static, the spark is also said not to damage insulation as an ordinary high-tension alternating current sometimes does. Faults of comparatively high resistance are said to be easily detected, hence avoiding the customary and often damaging "break-down" of faults.

Self-Contained Compensator

An auto-starter has been so designed that the entire device, including the switch mechanism, transformer, no-voltage release and time-limit overload relay, is inclosed in a single dust-tight steel housing which is arranged for wall or floor mounting. This is a considerable departure from the usual construction having drum-switch arrangement and removable oil tank. The switch mechanism, which consists of two three-pole quick-break sliding contact switches, operates within a stationary oil tank situated toward the top of the casing, the mechanism being arranged so that it may be readily raised from the oil tank for inspection and repair by revolving about the operating shaft.

The transformer element of the compensator is attached to the back panel of the casing and mounted directly below the oil tank. At the front of the transformer there is attached a panel containing time-limit overload relays, terminals for the line and motor leads as well as transformer taps. An interesting feature which the manufacturers claim for this compensator is that all transformer taps are brought to terminals on this panel so that for changing transformer taps it is necessary only to remove the casing cover and change the leads from one terminal to another.



ALL MECHANISM INCLOSED IN DUST-TIGHT HOUSING

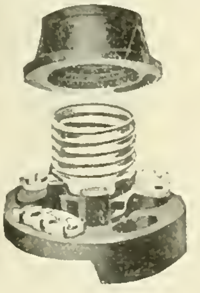
These compensators are arranged for conduit wiring, the casing being fitted with knock-outs for conduit connections at the sides and at the bottom. A conspicuous stop button is placed at the side of the casing for stopping the motor, and it is possible to arrange for several buttons for stopping the motor at remote points when this is desirable. The device is known as the I-C compensator, manufactured by the Industrial Controller Company of Milwaukee.

Ready-Made Multiple Clamps

Any group of cables or conduits may be supported on ceilings or walls by a ready-made multiple clamp. It has been customary, the makers say, for contractors and construction men to make up such clamps on the job, according to the particular requirements, but they may now be obtained in all sizes ready-made from the Diamond Expansion Bolt Company, 90 West Street, New York City. By quantity production they should also be cheaper.

Receptacles for Branch Circuits and Receptacle Switches

Additions to the marine lighting apparatus manufactured by the Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, are the branch circuit receptacles recently placed on the market. The receptacles may be had with six and eight binding screws and have switch terminals and a rating of 660 watts and 250 volts. The extra binding screws make provision for taking taps from the terminal plates, thus avoiding soldered connections.


NO SOLDERED JOINTS REQUIRED

Combination receptacle switches have also been developed by this firm. Although a keyless receptacle and a single-pole switch of the quick-make-and-break type having a plunger control are mounted on a common base, they are used independently of each other. The receptacle may be used with a lamp when fitted in a fixture or to hold an attaching plug if used in an outlet box, while the switch may be used for controlling the branch circuit receptacle mentioned above. These receptacle switches are furnished with either three or five binding screws and have the same receptacle rating as the branch circuit receptacle and a switch rating for 5 amp., 125 volts.

High-heat-molded insulation material is used for the bases of all these devices, which have bayonet slot holes for supporting screws, spaced 1¾ in. (4.5 cm.) on centers. Lamp grips and caps are supplied or omitted in different catalog numbers of these receptacles and receptacle switches.

Adjustable Light Brackets for Industrial Use

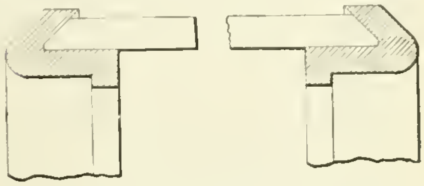
The No. 6 adjustable electric light holder and bracket manufactured by the Faries Manufacturing Company of Decatur, Ill., and particularly adapted to the lighting of individual machines in industrial plants and factories has been recently improved so that it may now serve as a floor fixture in addition to its use from ceilings and walls. In this fixture three horizontal and two vertical points of adjustment are provided, making it possible to focus the light rays from a Faries steel reflector at any point within a circle of space 10 ft. (3 m.) in diameter. Finishes of black japan and brushed brass are supplied on these brackets.

Ornamental Bowl for Lighting Fixture

A new opal glass ornamental bowl has been recently developed by the Beardslee Chandelier Manufacturing Company, 237 South Jefferson Street, for use with its "Denzar" indirect-lighting unit. The conventional border around the upper portion of the bowl is hand-colored in red and green, the colors being baked in to insure permanency. According to the manufacturer, the ornamentation does not cause shadows and does not interfere in any way with the quality of light. The new bowl is said to be particularly adaptable for installation in churches, club rooms, public buildings and other places where artistic and ornamental lighting fixtures are desired.

Induction Motor Rotor Bars Clamped in Place

One of the unique features of the "Uniframe" alternating-current motors being manufactured by the B. A. Wesche Electric Company, Cincinnati, Ohio, is the absence of solder in the construction of the standard squirrel-cage rotor for constant-speed service. It is said by the maker that perfect mechanical and electrical contact is secured between the rotor bars and the rings, at the same time eliminating the disadvantages connected with the use of solder. As can be seen in the accompanying illustration, there is a triangular slot in the rings into which the rotor-bar ends are shaped to wedge in snugly.


ELECTRICAL CONTACT PROVIDED WITHOUT SOLDER

A single frame is used interchangeably for alternating-current motors and direct-current machines of the same approximate rating, and the same end bracket serves either for the slip-ring induction motor or the direct-current motors or generators. Both the alternating-current and direct-current motors may be had in ratings from ¼ hp. to 50 hp.

Notes on Recent Appliances

Electric Furnaces

Small and large electric furnaces in which the current is passed through a carbon metal-holding crucible are being made by the Bario Metal Corporation, 167 West Eighteenth Street, New York City.

Conduit Bender

A machine which makes standard elbows, goose-neck offsets and odd-shaped bends in conduit is being made by the Trans-Com Lighting Products Corporation, 508 Broome Street, New York City. The bender is portable and may be attached to benches.

Cut-Out Hanger

A cut-out hanger which disconnects the circuit from a reflector lighting fixture hung high above the floor when it is desired to lower the reflector for renewing the lamp for cleaning has been developed by the George Cutter Company of South Bend, Ind.

Wiring Devices for Industrial Use

A three-phase wiring support having cleats with one of the upper corners removable, an anchor for mounting outlet boxes on concrete ceilings, columns and walls, and an adjustable clamp for securing conduit or other pipe lines to I-beams are being manufactured by the Efficiency Electric Company of East Palestine, Ohio.

Duplex Volt-Ammeter and Volt-Wattmeter

A line of portable direct-current duplex volt-ammeters furnished with readings of 1, 2 or 3 volts and 1, 2 or 3 amp. has been recently placed upon the market by the Reliance Instrument Company, 1135 Van Buren Street, Chicago. Duplex volt-wattmeters for testing lamps and appliances usually connected to lamp sockets are also being manufactured by the Reliance Instrument Company.

Trade Notes

Foreign Trade Opportunities

The Bureau of Foreign and Domestic Commerce, Washington, D. C., reports under No. 27,766 that a mining engineer in France desires to obtain an agency on a commission basis for the sale of tools and machinery, among which are the following items of electrical equipment: Transformers, motors, meters, insulators, wire and high-tension and low-tension apparatus. Correspondence in this case should be in French.

A company operating in Canada (No. 27,779) desires to purchase or to secure an agency for electrical motors, lamps and all kinds of electrical goods. Terms, cash against documents for either purchase or agency.

An agency is desired by a man in Switzerland (No. 27,776) for the sale of electrical motors and supplies and material for electric lines and electrification of railroads.

A. Stauble, dealer in electrical and industrial equipment, 76 Foro Bonaparte, Milan, Italy, informs the ELECTRICAL WORLD that he wishes to extend the range of electrical and mechanical machinery products now sold by him. He states that at the present time there is a good market for American products in Italy.

Fred A. La Grange, engineer for the Argentine government railways, is in the United States placing orders for equipment for the steam roads of Argentina. Mr. La Grange is of the opinion that the construction of electric roads will be taken up soon but may be delayed on account of the enormous capital required for the transformation of the lines which run into the capital of Argentina. During the last four and one-half years some of the roads in the Argentine Republic have been unable to receive materials, and therefore they are at present in great need of materials. It is estimated that during the two coming years the importation of these materials will amount to more than $100,000,000. They will be used exclusively to replace that which has been used up and for accumulation of the indispensable reserve. Mr. La Grange has at the present time the disposal of orders amounting to roughly $50,000,000. In the past 95 per cent of the materials purchased for the Argentine railroads came from Europe.

A Greek merchant (No. 27,758) wishes to secure agency for electric motors.

An importer and commission agent in southern Italy (No. 27,762) desires to secure an agency for electric motors and supplies.

A firm of contractors in Canary Islands (No. 27,805) desires to secure an agency for the sale among other things of electrical material and machines and house meters.

J. J. McKee, formerly New York manager of the C. A. Dunham Company, has resigned to become associated with the Machinery Utilities Company of 501 Fifth Avenue, New York City.

Western Electric Sales Changes

GEORGE E. CULLINAN, who since 1909 has been manager of the Western Electric Company at St. Louis, has been appointed manager of the Chicago house of the company and central district sales manager, succeeding Frank A. Ketcham, who was recently promoted to be general sales manager of the company. Mr. Cullinan began to work for the company in 1901 as an employee of the accounting department in New York. He became head of the billing department in 1902, was advanced to a similar position in charge of the apparatus stock in 1904, was made chief of the shipping and traffic departments in 1905. In 1906 he became employment agent and in 1907 head of the service and merchandise department. In October of the same year he went to St. Louis as assistant manager, becoming sales manager in April, 1909. Six months later he was promoted to the managership. He held this position up to the time of his promotion, with the exception of a few months as assistant manager at Chicago, the house to which he now goes as manager. Since November, 1916, Mr. Cullinan has been the Western district manager.

HARRY N. GOODELL succeeds Mr. Cullinan at St. Louis. He has been advanced from the position of manager of the Omaha house. He was employed by the company as a clerk in the billing and voucher department of the Chicago house in January, 1906. A month later he was made general clerk of the shipping department and in the following year assistant clerk in the office. He remained with the Chicago house, being promoted at intervals of about a year, until February, 1912, when he was transferred to New York to undertake special studies. In April of the same year he was appointed manager of the Omaha house and held that position until his selection last month to succeed Mr. Cullinan.

MARCUS A. CURRAN replaces Mr. Goodell as manager of the Omaha house. Mr. Curran began his career with the company in the credit department in January, 1911, and remained there for seven years. In 1912 he was transferred to the credit department in Chicago and later in the same year became credit manager at Minneapolis. In June, 1913, he was promoted to the position of general credit manager, which he held until last July, when he was appointed manager of the line-material department. A month or two later he went to Philadelphia as assistant manager, and he leaves that position to take up his new duties in Omaha.

ASBESTOS CAN NOW BE EXPORTED.—The War Trade Board announced, effective Dec. 5, the removal of asbestos in its different forms from the export conservation list.

DAY NURSERY FOR CHILDREN OF WOMEN OPERATORS.—The New Departure Manufacturing Company of Bristol, Conn., some months ago established a day nursery for the children of its women operators. In the beginning the number of children cared for was very small, but at the present time more than twenty daily attend. The children are received in the early morning, entertained, fed and properly cared for during the day, even to the extent of providing a comfortable couch upon which they can take a nap, and are returned to the mother at night. A scheme of this nature has been found to make it much easier for factories to secure competent and reliable women operatives.

DEALERS' STOCK ASSORTMENTS.—In the current issue of *Mohawk News Service*, A. M. Little, president of the Mohawk Electrical Supply Company of Syracuse, N. Y., makes a special effort to guide the purchases of dealers along constructive sales lines. One paragraph from his interesting letter is here quoted: "The important point is to select your line of electric gift appliances to take advantage of the present trend of popular preference. What you want is a small assortment of best sellers, rather than a bigger variety of designs that will confuse the shopper." To guide the dealer the Mohawk company selected from the market a number of devices which it recommended for quick and profitable selling in the coming holiday week.

ELECTRICAL MATERIAL FOR BRAZILIAN GOVERNMENT.—There has been received by the Bureau of Foreign and Domestic Commerce a sample board containing samples of the various iron, steel and copper wires used by the Department of Telegraphs, Rio de Janeiro, Brazil, which it is necessary for the department to purchase abroad. Accompanying the board are three tracings of the posts that have been standardized by the Department of Telegraphs, one tracing of the arms and pins, and five photographs showing iron arms and fittings, wooden arms and fittings, porcelain insulators and pins, and miscellaneous tools. Up to the present time all the material except the wire, and the greater part of that, has been bought in Europe from firms that solicited the business through their connections in Rio de Janeiro, according to Philip S. Smith, who has recently returned from South America, where he was studying the market for electrical goods as special agent for the Bureau of Foreign and Domestic Commerce. The Brazilian Department of Telegraphs desires to purchase in the United States if it can obtain the material required, and an opportunity is thus afforded American firms interested to compete for business that heretofore has been closed to them. In taking this matter up it should be noted that the only condition under which dealings can be had with the Department of Telegraphs is that the manufacturer offering his goods be in a position to deal with the Brazilian government direct and not through agents or commission houses, so as to give the government the benefit of the customary terms of payment obtaining in ordinary business transactions. The samples, tracings and photographs may be seen at the New York office of the Bureau of Foreign and Domestic Commerce, Room 734, Custom House. Refer to file No. 40,134.

WORLD HOLIDAYS.—Under the title "Bank and Public Holidays Throughout the World" the Guarantee Trust Company of New York has printed a book which should be of considerable interest to concerns engaged in or proposing to engage in foreign trade.

ONE HUNDRED AND TWENTY THOUSAND FLOODLAMPS FOR PROTECTION.—More than 120,000 incandescent floodlighting projectors for series circuits are in use for the protection of government and other plants, according to a memorandum of the supply department of the New York office of the General Electric Company.

GERMAN ELECTRICAL MANUFACTURING DIVIDENDS.—That the German electrical manufacturers are not in such poor shape as might be supposed is borne out by the fact that the directors of the Allgemeine Elektricitäts Gesellschaft of Berlin estimate that the company will be able to pay 14 per cent dividend for 1917-1918 as compared with 12 per cent for the preceding year.

SYSTEMATIC USE OF MAZDA NUMBER.—Every regularly manufactured Mazda miniature lamp is now designated by a Mazda number. In ordering Mazda lamps the manufacturers are urging buyers to indicate this number. As a further step in standardizing the use of such numbers new carton labels have been designed and will be printed in black and red. Black labels indicate vacuum lamps and bed labels indicate gas-filled lamps. These labels will be used on all cartons of regular Mazda miniature lamps and will be much more legible than the previously used rubber-stamp labels. Each label contains the number and the complete specification of lamps contained in the carton as well as the number of lamps contained. This feature, it is claimed, makes for greater convenience in taking inventories.

THE DOMESTIC TUNGSTEN LAMP COMPANY, formerly at 575 Bergenline Avenue, West New York, N. J., has moved to 418-420 Tenth Street, that city.

PRESCOTT C. RITCHIE, Western representative of the Westinghouse automobile equipment department, moved his headquarters from Indianapolis to the Conway Building, Chicago, on Dec. 1.

THE CENTURY STORAGE BATTERY COMPANY, 948-950 East Jefferson Avenue, Detroit, Mich., is the new name and address of the Michigan Storage Battery Company, formerly of 57 Atwater Street.

THE AMERICAN LAVA COMPANY, Chattanooga, Tenn., a concern manufacturing among other things electric insulation, will to the extent of 800 shares of common stock of $100 par value be offered for sale at auction on Dec. 23 by the Alien Property Custodian.

ENGLISH RESTRICTIONS ON VACUUM CLEANERS LIFTED.—The controller of import restrictions of London, England, has temporarily suspended all import restrictions on vacuum cleaners. Prior to the war almost all vacuum cleaners sold in the market were of American manufacture.

THE McCLINTIC-MARSHALL CONSTRUCTION COMPANY, New York City, it is reported, has submitted the lowest bid to the Navy Department for the construction of twenty steel radio towers at Monroe, N. C. The tenders were for a little over $2,000,000. Each tower is to be 820 ft. in height.

THE BUSHNELL ELECTRICAL COMPANY has recently taken over the business and assets of the L. B. Lincoln Electric Company of Chicago, with factory at Bushnell, Ill. The Bushnell Electric Company has moved the factory back to Chicago, and it will be temporarily at 1062 Glenlake Avenue, the former address of the L. B. Lincoln Electric Company.

THE SOUTHERN ELECTRIC SUPPLY COMPANY, 31 Peters Street, Atlanta, Ga., has been incorporated to conduct an electrical supply business and is an outgrowth of the National Telephone Supply & Development Company of Atlanta. R. L. Stewart is president of the company and Carl D. Boyd sales manager. Traveling salesmen will cover the states of Georgia, Florida, Alabama, North and South Carolina and portions of Mississippi and Tennessee. A catalog is being compiled which, it is understood, will be ready for distribution about Feb. 1, 1919.

RIEGEL BROTHERS, Spokane, Wash., distributers of Dodge automobiles and trucks, have taken the agency for the Lalley electric light and power plant.

THE AMERICAN TRANSFORMER COMPANY, Newark, N. J., has moved into its new and larger factory at 178-182 Emmet Street, just two blocks northeast of its former location.

THE STORAGE BATTERY COMPANY expects to build a garage for general electric truck and battery service at Boston in the coming year. It is expected that a structure of about 30,000 sq.ft. will be provided at first.

FRED G. BELL has resigned as sales manager of the Electro Dynamic Company, Bayonne, N. J. His present plans are to represent several well-known products through a sales agency in either the New York or the Philadelphia district.

THE CONLON ELECTRIC WASHER COMPANY, which supplies washing machines to the Western Electric Company, is preparing to build on the west side of Chicago a washing-machine factory which the company says will he as large as, if not larger than, any other in the Central West.

THE McKENNEY & WATERBURY COMPANY, Boston, has just received a number of good-sized fixture orders, including the equipment of the new Revere Sugar Refinery, Charlestown; the equipment for the Christian Science Benevolent Association, Brookline; that for the Commonwealth Golf Club, Chestnut Hill, and also for various high-class residences in Greater Boston.

THE CROUSE-HINDS COMPANY, Syracuse, N. Y., has recently opened a new industrial school at its plant for the use of its employees. It is understood that classes will be held three times a week for instruction in various branches. E. P. Fessinger, welfare manager of the Solvay Process Company, is chairman of the committee on instruction. Mr. Fessinger will be assisted by five teachers supplied by the Department of Public Instruction.

THE YARNALL-WARING COMPANY, manufacturer of power-plant devices, Philadelphia, has acquired a three-acre tract at Mermaid Lane and Devon Street, Chestnut Hill, Philadelphia, adjacent to the Mermaid Lane station, Chestnut Hill division of the Philadelphia & Reading Railway. The tract contains a three-story stone mansion which is being converted into general offices, and a one-story modern machine shop has been erected in which manufacturing is now being carried on.

C. A. HENDERSON has resigned as chief engineer of the Submarine Boat Corporation and is now established in New York, acting as chief engineer of the Hercules Engineering Corporation and president of the Electrolytic Engineering Corporation. Prior to being identified with the Submarine Boat Corporation, he was general manager of the Niagara Smelting Corporation at Niagara Falls and prior to that acted in various capacities with the Cutler-Hammer Company.

E. Y. STIMPSON of Boston has taken the agency in that district for the Ward electric commercial vehicle. Mr. Stimpson is well known in the New England electrical field and for several years has energetically represented the Detroit Electric Car Company at Boston. He will continue both representations, with headquarters on Commonwealth Avenue. Mr. Stimpson is highly optimistic as to the future of the electric vehicle within its field, and he reports an increasing demand for cars of all classifications. Factory shipments are now coming through well.

THE ROLLER-SMITH COMPANY, New York City, announces the promotion of N. Frankel, now manager of the Chicago office at 740 Monadnock Block, to the position of assistant sales manager. Mr. Frankel's headquarters will remain in Chicago, from which point he will supervise the activities of the Roller-Smith Company's Cleveland and Detroit offices as well as the Chicago office, of which he is now and for several years has been in charge. In addition, Mr. Frankel will have direct charge of all the company's automobile instrument business, including the states of Michigan, Ohio, Wisconsin, Illinois, Minnesota and parts of Pennsylvania and Iowa. His close familiarity with the Roller-Smith Company's products has been gained through his connection with the company for the past six years or more.

THE BOSCH MAGNETO COMPANY'S Springfield (Mass.) plant was sold at auction, with patent rights, Dec. 7, for $4,150,000, to H. C. Griffiths of 220 Fifth Avenue, New York. The sale included 250 shares of capital stock of the company listed at $100 par value. The price bid was subject to the approval of A. Mitchell Palmer, Custodian of Alien Enemy Property, who has been in charge of the factory for about a year. The plant was originally owned by interests exceedingly friendly to the former German Emperor. During the present year it has been engaged in intensified production and has furnished a large amount of equipment for the United States government's war requirements under the supervision of the federal authorities.

Trade Publications

SALINE HEATER.—A recent mailing folder from Reid Brothers of Seattle, Wash., has for its subject the Thomas electric saline heater designed to replace hot-water bottles.

FLOOR-TYPE GRINDERS.—The Webster & Perks Tool Company, Springfield, Ohio, in Bulletins Nos. 9 and 10 gives specifications of its No. 1 and No. 1½ electrically driven ball-bearing floor-type grinders.

LIGHTING FIXTURES.—The Cincinnati Artistic Wrought Iron Works, 2941 Eastern Avenue, Cincinnati, Ohio, has distributed a catalog showing designs of lighting fixtures and accompanying wall brackets.

RADIO APPARATUS.—Catalog bulletins S-1, S-2, S-3 and T-1 of the Kilbourne & Clark Manufacturing Company, Seattle, Wash., have been issued. They deal with radio installations and apparatus and radio-telegraph apparatus.

LAMPS.—A statement of the advantages of Franklin Mazda lamps and pictures of buildings where they are installed make up a mailing folder now being sent out by the Franklin Electric Manufacturing Company of Hartford, Conn.

WIRE.—Asbestos and enamel insulated wire for switchboards, heaters, motion-picture machines and other uses is the topic of a new catalog issued by the Independent Lamp & Wire Company, 1737 Broadway, New York City.

HEATING DEVICES. — Pictures of homes, military camps, industrial and shipbuilding plants and other places where its electric heating devices are used have been printed in a broadside of the American Electrical Heater Company, Detroit, Mich.

FRESH-WATER SYSTEMS. — Dealing with fresh-water systems for use in farmhouses and other places where there is no running water system, a sixteen-page booklet has just been distributed by the United Pump & Power Company, Milwaukee, Wis.

FITTINGS.—Electrical boxes and conduit fittings, railway and other electrical appliances and water-tight fittings form the topic of an eighteen-page booklet prepared by the Trans-Com Lighting Products Corporation, 508 Broome Street, New York City.

TERMINAL LUGS.—An illustrated leaflet listing all sizes and styles of "Circle T" terminal lugs for front and back switch connections has been prepared by the Trumbull Electric Manufacturing Company of Plainville, Conn., and is known as Circular No. 33.

WATER HEATER.—The advantages of the "Therm-Elect" immersion and circulation water heaters for attachment to kitchen boilers without extra plumbing are set forth in a two-color leaflet with illustrations issued by the Electric Sales Service Company, 109 Stevenson Street, San Francisco.

HEATING AND COOKING APPLIANCES.—"Westinghnuse Electric Ware" is the title of the twenty-five page catalog section 8-C published by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., to tell about its radiators, heaters, irons and table appliances. Prices and illustrations are included in the catalog.

HEATING UNITS.—Many uses of its standardized heating units are given in a four-page pamphlet prepared by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis. A blue-print accompanying the pamphlet gives dimensions of the units which may be used on either aternating current or direct current in all kinds of factories, industrial plants and other places where electric heat is required.

LIST OF INSPECTED MECHANICAL APPLIANCES.—The Underwriters' Laboratories, Inc., 207 East Ohio Street, Chicago, maintained by the National Board of Fire Underwriters, have issued a list of the mechanical appliances inspected by these laboratories. The appliances are grouped according to types with the labels used illustrated in original colors. Manufacturers' names and addresses are given together with a brief description of the apparatus.

SMALL TOOLS.—Catalog No. 40 is a new 288-page publication of the small-tool division of the Greenfield Tap & Die Corporation, Greenfield, Mass. Superseding catalog No. 37, the new catalog, which is well illustrated, gives descriptions and prices on taps and dies, screw plates and reamers as well as containing a number of pages of useful information and tables. While this catalog is about 4¾ in. by 7¼ in., a pocket edition is being supplied to jobbers and dealers for general trade distribution.

ELECTRICAL SUPPLIES.—The Watmore-Savage Company, Boston, has recently issued a new catalog of electrical supplies, numbered 16 in the company's series and comprising 1408 pages. A large number of engineering data are included in the catalog with the listings, and at the end of the book are printed standard wiring symbols, units of measure, equivalent values in different units, wire tables, pulley and gear data, motor tables, comparisons of thermometers, general wiring and transmission formulas, and wiring data for three-phase motors. A thumb index is provided to facilitate the use of the catalog.

New Incorporations

THE FRANKLIN COUNTY POWER COMPANY of Little Falls, N. Y., has been incorporated with a capital stock of $60,000, by A. H. McCann, H. S. Lavery and P. S. McCaghey of Little Falls.

THE NEW JERSEY LAMP COMPANY, 4 Paterson Street, Hoboken, N. J., has been organized to manufacture electric lamps. Nathan Wise, 368 Broome Street, New York, N. Y., is interested in the company.

THE SOMERSET ELECTRICAL COMPANY of Philadelphia, Pa., has been incorporated with a capital stock of $10,000 to manufacture electrical specialties by Roy L. Crover and associates.

THE MAGNOLIA (DEL.) ELECTRIC LIGHT & POWER COMPANY has been incorporated with a capital stock of $10,000 by John B. Lindale, James Martin and George W. Collins, all of Magnolia.

THE SCHWEYER ELECTRIC & MANUFACTURING COMPANY of Easton, Pa., has been chartered with a capital stock of $100,000 to manufacture electrical equipment. Alvin H. Butz of Allentown is treasurer.

THE PROFESSIONAL X-RAY LABORATORIES COMPANY of Brooklyn, N. Y., has been chartered with a capital stock of $10,000 by J. A. Trimble, R. A. Barton and H. McGrath, 2218 Eighty-fourth Street, Brooklyn, N. Y.

THE EUREKA MANUFACTURING COMPANY of Cleveland, Ohio, has been incorporated with a capital stock of $10,000 by L. N. McShane, T. C. Lawless, C. M. White, A. B. Curtuss and N. J. Brewer. The company proposes to manufacture and deal in electrical machinery.

THE VICTOR WATER MOTOR CORPORATION of New York, N. Y., has been incorporated by A. F. Andrews, A. and V. Prager, 419 West 129th Street. The company is capitalized at $25,000 and proposes to manufacture hydraulic motors, engines and power-generating machinery.

THE HUTCHINSON STORAGE BATTERY COMPANY of Trenton, N. J., has been incorporated by John E. Hutchinson, Roy Skelley and Herbert F. Backes. The company is capitalized at $50,000 and will take over the business operated under this name at 230 South Warren Street.

THE RATIOMETER CORPORATION of Rochester, N. Y., has been incorporated by I. Lungaard, Landing Road, Brighton; L. P Willsea, 175 Seneca Parkway, Rochester, and W. K. Smith, 818 Dewey Avenue, Rochester. The company is capitalized at 25,000 and proposes to manufacture machinery, boilers, engines, motors, feeding and adjusting mechanism meters, etc.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

BOSTON, MASS.—Plans for establishing a new machine shop at the Charlestown Navy Yard, for which an appropriation of $900,000 was set aside, it is reported, will be carried through.

BROCKTON, MASS.—Work has begun on the installation of the new street lamps to replace the present lighting system, under the terms of the new contract entered into a year ago with the Edison Electric Illuminating Company. The lamps have been delayed owing to war-time conditions. On the outlying streets 60-cp. nitrogen lamps will be used to replace the 16-cp. lamps now in use. Most of the large lamps will be of 600 cp. About 314 large lamps will be installed, replacing 206 arc lamps. The ornamental lamps will be of 1000 cp. mounted in crystal globes on standards similar to those used for the lighting system at the Panama-Pacific Exposition in San Francisco, which will be installed as soon as war-time restrictions are removed. This may be six months or more.

MARLBORO, MASS.—Work on the construction of a power house, to cost about $20,000, and manufacturing building, to cost about $30,000, for the Koehler Manufacturing Company of Marlboro, it is understood, will be suspended for the winter.

TURNERS FALLS, MASS.—Further important changes, it is announced, are to be made to increase the power resources of the Turners Falls Power & Electric Company. It is proposed to raise the entire canal wall and the embankments to a height of 2 ft. This will greatly increase the amount of water delivered to the wheels from the Connecticut River. The company will enlarge the capacity of the Montague City power house in proportion. The present capacity of the power house is 48,000 kw. daily. Engineering work in connection with the project has been completed, and it is expected that the contract will be let in the spring.

WEBSTER, MASS.—Preparations are being made by the Webster & Southbridge Gas & Electric Company to install a 5000-hp. turbine as a reserve in the new section of its plant, which, it is expected, will be completed early in January.

WORCESTER, MASS.—Plans are being prepared by Frost & Chamberlain, architects, 390 Main Street, for the erection of a trade school for girls on High and Chatham Streets, to cost about $200,000. L. E. Buckley is trustee.

LEESVILLE, CONN.—Bids, it is understood, will soon be asked by the Central Connecticut Power & Light Company of East Hampton for construction of addition to power house on Salmon River, to cost about $26,000. C. P. Perry of East Hampton is engineer.

NEW HAVEN, CONN.—The merchants and residents on Grand Avenue beyond Railroad Avenue have petitioned the Board of Aldermen to extend the ornamental lamps on that thoroughfare from the railroad crossing to the Quinnipiac River.

NEW HAVEN, CONN. The New York, New Haven & Hartford Railroad Company, it is reported, has awarded contract for changing the power in the classification yards in the Cedar Hill district from steam to electricity. The electric system will probably be extended as far as East Haven in the Cedar Hill district and to the North Haven station on the Hartford division.

Middle Atlantic States

BROOKLYN, N. Y.—Contract has been awarded by Beswick Brothers, 272 Kent Avenue, manufacturers of electrical appliances, etc., to Richard D. Von Lehne Sons, 2701 Avenue G, for construction of an addition to their plant on Erasmus Street, near Lott Street.

BUFFALO, N. Y.—Plans have been prepared by the Delaware, Lackawanna & Western Railroad Company for the construction of a machine shop, 135 ft. by 659 ft., one story, at East Buffalo, to cost about $100,000. G. J. Ray of Hoboken, N. J., is chief engineer.

NEW YORK, N. Y.—The New York Central Railroad Company, Grand Central Terminal, is considering the construction of a new engine plant at Lake Tupper.

NEW YORK, N. Y.—Arrangements are being made by the Lion Brewery, Columbus Avenue and 108th Street, for converting two floors of its building into an ice-manufacturing plant. Electrical equipment and ice-manufacturing machinery, to cost about $100,000, will be installed. Friedmann, Robertson & Keeler, 90 West Street, are engineers.

BAYONNE, N. J.—The City Commissioners have instructed James Benny, city attorney, to ascertain what steps can be taken by the city to acquire and operate a municipal lighting plant and what could be done by the city in acquiring the lighting system of the Public Service Electric Company in Bayonne.

JERSEY CITY, N. J.—Bids will be received by the Hudson County Boulevard Commissioners, Jersey City, until Dec. 27 for furnishing and installing one 90-kw., 60-cycle, 2300-volt generator; one 2½-kw., 125-volt alternator exciter, directly connected; one blue Vermont marble switchboard for 125 kva., two-phase, 60-cycle, 2400-volt generator; one blue Vermont marble exciter panel with ammeter, main switch, hand wheel for controlling exciter, rheostats mounted on pipe supports to line up with generator panel; one blue Vermont marble constant-current transformer panel controlling two 2200-volt, 30-kw. transformers, equipped with two primary ammeters, secondary plug switch receptacles mounted on pipe supports for connection to transformers they control, but not necessary to line up with generator panel, etc. C. Van Keuren is city engineer.

NEWARK, N. J.—The Board of Education has engaged John H. and Wilson C. Ely, Fireman's Building, architects, to prepare plans for the proposed new industrial school, to cost about $400,000. The building will be 170 ft. by 225 ft., three and four stories, and will be provided with machine shop, metal-working and other industrial departments.

NUTLEY, N. J.—The Town Commission is considering the installation of new street lamps of larger candlepower.

PATERSON, N. J.—Plans are under consideration by the City Council for improvements to the street-lighting system on a number of streets in various sections of the city.

PERTH AMBOY, N. J.—Contract has been awarded by the Water Board for the erection of a new pumping station at South River, to cost about $14,850.

BROCKWAYVILLE, PA.—Plans are under consideration by the Erie Railroad Company of Jersey City for the construction of a new engine terminal at Brockwayville, to include machine shop, engine shop, power house and other buildings.

MILTON, PA.—Announcement has been made by the War Department, Washington, D. C., that work has been abandoned on the construction of the proposed power plant in Milton.

PHILADELPHIA, PA.—The Department of City Transit is planning the construction of twelve passenger stations, 20 ft. by 60 ft., to cost about $15,000 each, on the new Frankford Elevated Railway.

PHILADELPHIA, PA.—Contract has been awarded to William H. Eddleman & Sons, 453 Green Lane, Roxborough, for the proposed improvements to the engine plant and dye house of the Freeland Manufacturing Company, Freeland Street and Walnut Lane.

PITTSBURGH, PA.—The West Penn Power Company has authorized an issue of $3,000,000 in bonds, the proceeds to be used to increase its generating, transmission and distribution systems.

PITTSBURGH, PA.—The Duquesne Light Company has announced that the construction of the proposed addition to its power station on Brunots Island, near Pittsburgh, has been indefinitely postponed.

PITTSBURGH, PA.—Plans have been prepared by the Union Steel Casting Company for the construction of a new crane runway, to cost about $22,000, to provide for the operation of an electric traveling crane.

READING, PA.—Plans are under consideration by the Carpenter Steel Company for the construction of a power plant, 60 ft. by 175 ft., on the River Road, to cost about $110,000. The plant will have a capacity of about 2500 hp. and will be driven by steam power. The company will also erect a one-story shop, 30 ft. by 40 ft., to be used for steel-clipping operations.

BALTIMORE, MD.—The Magneto & Machine Company, 1034 Cathedral Street, is considering the construction of a new machine shop.

CHARLESTON, W. VA.—The Eagle Gas Coal Company has recently installed a new power plant.

CHARLESTON, W. VA.—The New River Company is erecting a power house at its Cranberry mine and a substation at its Sprague works. S. A. Scott with headquarters at Mount Hope and Macdonald is general manager.

WHEELING, W. VA.—The Council has approved the contract awarded to the Steam Electric Company for the installation of new equipment at the Nineteenth Street substation.

HAMPTON ROADS, VA.—The power plant at the local navy yard was destroyed by fire on Dec. 10, causing a loss of about $50,000.

RICHMOND, VA.—The Virginia Railway Power Company is reported to be considering the construction of a large dam at the falls of the Appomattox River for the purpose of developing the water power there and supplying electricity for lamps and motors in tidewater cities of eastern Virginia, including Richmond. The cost of the work is estimated at $2,000,000, and it is intended to secure the aid of the federal government.

North Central States

BAY CITY, MICH.—Ground has been broken for the erection of a machine shop for the Industrial Works in Bay City, to cost about $125,000. The company manufactures cranes.

DETROIT, MICH.—Plans are under consideration by the Central Forge Company, Euclid Avenue, for early resumption of construction on the extension of its forge shop and heat-treatment building, foundations for which have been completed. The cost is estimated at $200,000.

CINCINNATI, OHIO.—The National Biscuit Company, it is reported, contemplates the erection of a large baking plant, to cost about $1,500,000.

CLEVELAND, OHIO—The United States Copper Products Corporation of Cleveland recently incorporated with a capital stock of $1,500,000, it is reported, will soon begin the construction of a plant for the manufacture of brass and copper seamless tubes. The company has acquired a 25-acre site at West Seventy-third Street and the Wheeling & Lake Erie Railroad, on which it will erect the proposed plant. The equipment will consist of three electric melting furnaces, a copper-refining furnace for refining scrap, brass and copper for its own use, about forty crucibles, a tube mill and three electric traveling cranes. The initial installation will have a capacity of about 20 tons per day and will cost about $600,000. Orders for equipment, it is understood, will soon be placed. E. I. Heinsohn is president and general manager.

MASSILLON, OHIO.—The Massillon Gas & Electric Company has awarded general contract for construction of an addition to its power plant to the Republic Construction Company.

PIQUA, OHIO—The French Oil Machinery Company has engaged J. J. Wernette, engineer, to prepare plans for a new power plant at its works.

MANCHESTER, KY.—The Columbian-Panama Coal Company, it is reported, is considering plans for the construction of a power plant at its local properties.

TERRE HAUTE, IND.—The George A. Fuller Construction Company, 175 Fifth Avenue, New York, N. Y., has been awarded contract for the construction of a new repair plant for the Pennsylvania Railroad Company, which will include a car repair shop, machine shop, planing mill, paint shop, material warehouses, extension to roundhouse and other buildings, and also an extension to power house. The cost of the work is estimated at about $250,000.

CHICAGO, ILL.—The Edison Electric Appliance Company, 5660 West Taylor Street, Chicago, has been granted a permit for the erection of a one-story factory, 101 ft. by 147 ft., to cost about $40,000.

CHICAGO, ILL.—The Edward Katzinger Company has purchased a site at the corner of Washington and Sangamon Streets on which it proposes to erect a seven-story factory building, to cost about $250,000.

CHICAGO, ILL.—The Consumers' Packing Company, 11 South LaSalle Street, has awarded the entire contract for the erection of a packing plant, to be erected at 1400-1426 West Forty-sixth Street, including refrigerator, cold-storage and power buildings with all appurtenances, to cost about $500,000, to the Salamon-Waterton Company, 1343 South Dearborn Street.

CHICAGO, ILL.—The electrification of all its lines in Chicago and the early construction of a large passenger terminal has been agreed upon by representatives of the Illinois Central Railroad Company and attorneys for the city of Chicago. The equipping of the lines for electrical operation, it is stated, will take place in three periods of approximately five years each. First the suburban service will be electrified, then the through service and finally freight lines.

DURAND, ILL.—Application has been made to the Public Utilities Commission by the Citizens' Utilities Company of Durand for a certificate of convenience to supply electricity for lamps and motors in Durand, Davis, Rock City and Dakota. The company is capitalized at $40,000 and proposes to purchase the utility plant, in Durand, Dakota and Davis. J. F. Harris is reported interested in the company.

GALESVILLE, WIS.—The Davis Mill Company is contemplating building an addition to its power house and installing a 100-hp. engine. B. W. Davis is manager.

JANESVILLE, WIS.—The City Council has engaged J. C. Jacobsen, consulting engineer, First National-Soo Building, Minneapolis, Minn., to prepare tentative plans and estimates for extensions to the municipal hydroelectric generating plant and the auxiliary steam generating plant. C. V. Kerch is city engineer.

MENASHA, WIS.—Contract has been awarded by the Gilbert Paper Company of Menasha for the construction of an addition to mill and power plant, 97 ft. by 100 ft., with brick smokestack, 150 ft. high, to C. R. Meyer & Sons Company of Oshkosh.

OSHKOSH, WIS.—The capital stock of the Universal Motor Company has been increased from $50,000 to $100,000. The company manufactures direct-connected generating systems.

RACINE, WIS.—Plans are now being perfected for rebuilding the plant of the Maibohm Motors Company, recently damaged by fire. The loss of machinery, stock, etc., is estimated at $250,000, and that on buildings at $50,000. The company manufactures passenger automobiles. H. C. Maibohm is president.

SUPERIOR, WIS.—The Benson Electric Company of Superior has been awarded contract by the United States government to manufacture electric steering and signal systems and devices for the Emergency Fleet Corporation. The company, it is understood, will add another story to its main shop at once. M. B. Benson is president.

SUPERIOR, WIS.—Wallin & Johnson, promoters of the Lakeside colony near Maple, have submitted a proposal to Mayor Baxter offering to deliver electricity at a central transformer station in Superior for distribution by the city. The company states that it owns a power site east of the city which it proposes to develop, provided that a contract can be obtained for sale of energy for a number of years.

SLAYTON, MINN.—The Slayton Power Company will install a 75-kw. additional steam unit and will put in a steam-heating system in the village, to be completed in time for the 1919 heating season. F. D. Eddy is manager.

DES MOINES, IOWA.—Plans are being considered by the Advance Rumley Thresher Company for the construction of a factory and warehouse, to cost about $125,000.

NEOLA, IOWA.—The Town Council has authorized an issue of $10,000 in electric light bonds.

KANSAS CITY, MO.—Work has started on remodeling the ice-storage plant of the City Ice & Storage Company at 4832-42 Oak Street. The cost is estimated at $50,000.

KANSAS CITY, MO.—The lighting system for the Missouri side of the Inter-City Viaduct has been awarded by the Board of Public Works to the Kansas City Light & Power Company. The plans call for fifty-four lamps of 100 cp. each erected on 20-ft. poles.

MARSHALL, MO.—Plans are being prepared for the installation of an electric light plant in connection with the present waterworks system to cost about $75,000. The equipment will probably include one 150-kw. and one 250-kw. generator (steam-driven), one boiler, switchboards, pole-line materials, etc. Bids, it is understood, will be asked early in January. Henrici-Lowry, Commerce Building, Kansas City, Mo., are engineers.

ST. LOUIS, MO.—The City Council contemplates an issue of $200,000 in bonds for the construction of a new fire house, to cost about $200,000, for which preliminary plans have been prepared. L. R. Bowen, City Hall, is engineer.

SEDALIA, MO.—The City Light & Traction Company is planning to install a 1000-kw. General Electric turbine at its power house in the near future.

GLYNDON, N. D.—Arrangements are under way for the purchase of the electric light plant of the Glyndon Light Company, to be owned and operated by the municipality.

BURWELL, NEB.—The city of Burwell has sold $13,500 in electric light bonds.

ABILENE, KAN.—The Riverside Light, Power & Gas Company has taken over the property of the Kaw Valley Tranmission Company of St. George, in Pottawatomie County, which supplies electrical service in the town and for about forty rural homes. This service will now be supplied from the Abilene and Rocky Ford power plants. The company is also completing other extensions to Louisville, Westmoreland and Waunaunsee County.

DOWNS, KAN.—At an election to be held Dec. 17 the proposal to issue $40,000 in bonds for the construction of a municipal electric light plant in Downs will be submitted to the voters.

HIAWATHA, KAN.—Plans are under consideration for the installation of pumps at spring on the county farm and to extend the transmission line and connect with the city system. An election will probably be called soon to submit the proposal to issue from $20,000 to $25,000 in bonds for the project.

KANSAS CITY, KAN.—The Fogel Construction Company, Reliance Building, has been awarded general contract for the construction of a power house for Wilson & Company, Osage and Adams Streets, 50 ft. by 60 ft.

Southern States

ROCK HILL, S. C.—Plans have been prepared by Edwards & Sayward, Chamber of Commerce, Atlanta, Ga., for the construction of dormitory buildings and students' building at Winthrop College. An appropriation of $100,000 has been made for each building W. P. Goodman of Rock Hill is manager of construction.

COLUMBUS, GA.—A 7500-kw. steam turbine and two 600-hp. boilers are being installed in the plant of the Columbus Power Company. Further extension of the boiler room and the installation of two additional 600-hp. boilers are also under way.

FAIRFIELD, ALA.—Plans are under way for the construction of an electric plant by the Fairfield Utilities Company, reecntly organized with a capital stock of $50,000. The company, it is understood, also proposes to establish water, gas and street-car service in Fairfield. George Gordon Crawford, president of the Tennessee Coal, Iron & Railroad Company, is president of the Fairfield company.

BAY ST. LOUIS, MISS.—Arrangements have been made by the cities of New Orleans, La., and Mobile, Ala., for the holding of a conference at Bay St. Louis early in January to consider preliminary plans for the construction of a new electric interurban railway between the two municipalities. In connection with the proposed project hydroelectric plants will be established to supply power to operate the system.

INVERNESS, MISS.—Bids will be received by the Mayor and Board of Aldermen, Inverness, until Jan. 2, for improvements to the water and light plant, including oil engines, pumps, alternators and miscellaneous line material, cast-iron and galvanized pipe, valves and hydrants and reservoir. Specifications, form of proposal, contract and plans may be seen at the office of the Mayor and Board of Aldermen, Inverness, and specifications will be mailed upon application to Xavier A. Kramer, engineer, Magnolia.

MERIDIAN, MISS. — The Mississippi Fiber Company is considering the purchase of power plant and fiber-handling machinery. The company contemplates changing its plant into an absorbent cotton factory.

TUTWILER, MISS.—Bids will be received by the city of Tutwiler until Dec. 30 for the construction of a municipal electric light plant. Bonds to the amount of $8,000 have been issued for the proposed plant.

DALLAS, TEX.—Work has begun on erecting the transmission line preparatory to the installation of the 900 new street lamps to be erected in various parts of the city.

ORANGE, TEX.—The National Shipbuilding Company is contemplating the installation of an electric power plant at its local yards.

PHARR, TEX. — The Louisiana-Rio Grande Canal Company is contemplating extensions to its irrigation system, involving an expenditure of about $175,000. Additional pumps and other equipment will be installed.

Pacific and Mountain States

IMPERIAL, CAL.—The local power station of the Holton Power Company was recently damaged by fire, causing a loss of about $10,000.

RAYMOND, WASH.—The residents of Willapa have petitioned the Willapa Electric Company to establish an automobile line between Willapa and Raymond temporarily and later to extend its electric railway to that city.

BOISE, IDAHO.—A syndicate composed of Herbert Lemp, the Idaho Packing Company, the Davis Meat Company, the Boise Valley Packing Company and Ernest A. Evans is contemplating the construction of a packing plant, to cost about $1,500,000, in Boise.

SELIGMAN, ARIZ.—Steps have been taken to organize the Mojave Northern Power Company for the purpose of building and operating the proposed hydroelectric development on the Colorado River north of Seligman and Williams. The company will be capitalized at $24,000,000. Surveys have been made for the proposed plant. E. L. Beyard is interested in the project.

BUTTE, MONT.—The Mountain States Telephone & Telegraph Company is contemplating extensions in South Butte, involving an expenditure of about $30,000.

CARLSBAD, N. M.—The power plant of the Carlsbad Light & Power Company was recently damaged by fire, causing a loss of about $20,000. The plant, it is understood, will be rebuilt.

Canada

INGERSOLL, ONT.—Plans are being prepared by the Ingersoll Rolling Mills Company for an addition to its plant, to cost about $200,000.

SARNIA, ONT.—The Council is considering improvements and additions to the waterworks plant, including the installation of a motor-driven sludge pump, to cost about $10,000. H. F. Hall is engineer.

TORONTO, ONT.—Plans have been prepared by the Toronto & York Radial Railway Company for the construction of a carhouse on Kingston Road, Toronto for the Scarboro division.

TORONTO, ONT.—Tenders will be received by R. C. Desrochers, secretary of the Department of Public Works, Ottawa, until Dec. 24, for construction of boiler house, power plant, garage and mortuary for the military hospitals at St. Andrews, Toronto, Ont. Plans and specifications can be seen and form of tender obtained at the office of the chief architect, Department of Public Works, Ottawa; the clerk of works, Postal Station "F," Toronto, and the superintendent of military hospitals, Toronto.

CHARLEMAGNE, QUE.—La Minotérie Moderne, Ltd., recently organized with a capital stock of $20,000, proposes to take over the stock of Laurin & Frère of Charlemagne and to develop water power in the counties of L'Assumption, Montcalm and Joliette.

SHAWINIGAN FALLS, QUE. — The Shawinigan Water & Power Company is considering a hydroelectric development at Gres Falls on the St. Maurice River, to cost about $1,000,000. The company is planning to rebuild, immediately, its shops, recently destroyed by fire. The loss is estimated at $25,000.

Miscellaneous

PANAMA—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Dec. 28 for subterranean cable, copper, copper pipe and tubing cable thimbles, steam gages, etc. Blanks and information relating to this circular (1248) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York City; 668 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

Record of Electrical Patents

Notes on United States Patents

(Issued Nov. 12, 1918)

1,284,502. Flashlamp; Clinton E. Walton, Livingston, Mont. App. filed Aug. 31, 1917. May be supported from a suitable portion of a garment or may be attached to vehicles of different kinds.

1,284,533. Telephone Exchange System; Joseph L. Wright, Cleveland, Ohio. App. filed Sept. 24, 1914. To provide improved means for effecting connection between calling lines and trunks in automatic systems.

1,284,552. Armature Insulation; Vincent G. Apple, Dayton, Ohio. App. filed March 21, 1918. A durable, tough, single-piece insulating structure or jacket for conducting wires or parallel conducting bars that are to be contained in the same slot or orifice.

1,284,554. Elevator Equipment; Wesley Armstrong, North Battleford, Saskatchewan, Canada. App. filed Feb. 28, 1918. The doors opening into the elevator shaft may be secured against opening except when the floor of the car is level with one of the floors.

1,284,564. Electrical Receptacle; Reuben B. Benjamin, Chicago, Ill. App. filed Oct. 16, 1917. Means for holding a lamp base in position and to prevent it from becoming accidentally unscrewed.

1,284,573. Regulator for Dynamo-Electric Machines; Clarence A. Boddie, Pittsburgh, Pa. App. filed April 12, 1918. Regulation is effected by rapidly opening and closing a circuit in shunt to a resistor that is connected in series with the field-magnet winding.

1,284,574. Electrical Regulating System; Clarence A. Boddie, Pittsburgh, Pa. App. filed April 12, 1916. A quickly and accurately responsive regulator having a range that is not limited by the residual magnetism of the dynamo-electric machine.

1,284,604. Speed-Controlled Gas Cut-Off for Motor Vehicles; James H. Core, Nashville, Tenn. App. filed Oct. 4, 1917. Means for checking the movements of motor vehicles, and particularly speed-controlled means for cutting off the gas supply of such vehicles.

1,284,609. Protective Device; Elmer E. F. Creighton, Schenectady, N. Y. App. filed Jan. 13, 1914. Indication and detection of high-frequency disturbances or other overvoltage phenomena upon electrical transmission lines.

1,284,616. System of Electrical Regulation; Guy E. Ditzler and John F. Stender, Chicago, Ill. App. filed Aug. 12, 1915. For regulating the current output of a variable-speed electric generator when used in connection with a secondary battery.

1,284,618. Process of and Apparatus for Electrolytic Production of Caustic Alkali; Herbert H. Dow, Midland, Mich. App. filed Aug. 12, 1915. The liquid effluent may be obtained in a more pure state and with fewer by-products and impurities than heretofore.

1,284,623. Telephonic Recording and Reproducing Apparatus; Henry C. Egerton, Passaic, N. J. App. filed Feb. 1, 1918. Apparatus to produce a record of matter telephonically transmitted and to reproduce telephonically matter previously recorded.

1,284,629. Combined Choke Coil and Fuse; John L. Fay, St. Louis, Mo. App. filed April 19, 1918. To provide a combined choke coil and fuse which can be easily and cheaply manufactured.

1,284,648. Manufacture of Incandescent Lamps; Frederic W. Gill, Arlington, N. J. App. filed June 29, 1915. To introduce necessary gases in such small quantities that globe is not discolored.

1,284,645. Process of Making Ferrosilicon; George C. Furness, New York, N. Y. App. filed March 26, 1918. Relates to the preparation or compounding of the charge to be smelted.

1,284,649. Automatic Temperature Control for Electric Irons; Shirley L. Goldsbrough, Salt Lake City, Utah. App. filed Dec. 29, 1917. To provide a temperature regulator for flatirons.

1,284,660. Adapter for Ignition Systems; John A. Hall, East Orange, N. J. App. filed Oct. 9, 1915. The conversion of ignition systems in which no master vibrator is used into systems in which a master vibrator may be used.

1,284,664. Motor Vehicle; Alfred N. Hamrick, Silt, Col. App. filed Jan. 10, 1916. Employing a dynamo and means for operating the same to generate electric energy for use in a motor which is normally adapted to rotate the traction axle.

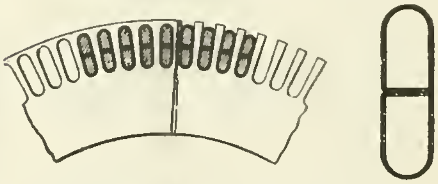
1,284,672. Automatic Switch; Charles J. Hendrickson, New York, N. Y. App. filed Dec. 29, 1916. Switches in which the power for imparting motion to the brushes is supplied by the action of a plunger and a solenoid.

1,284,707. Electrical Storage System; Charles F. Kettering, Dayton, Ohio. App. filed April 17, 1911. Controlling apparatus for regulating the storage of electrical current in storage batteries.

1,284,715. Damper Regulator; William A. Lacke, Chicago, Ill. App. filed Feb. 23, 1917. Thermostatically controlled electric motor devices for opening and closing the damper of a furnace.

1,284,726. Storage-Battery Construction; William Morrison, Chicago, Ill. App. filed Feb. 16, 1918. To make batteries less subject to injury when used with vehicles.

1,284,730. Party-Line Ringing System; Alben E. Lundell, New York, N. Y. App. filed June 17, 1916. Automatic switches are employed wholly or in part for the purpose of establishing a connection between the calling and the called line.


1,284,552—Armature Insulation

1,284,732. Electrical Controlling System; Arthur C. Magrath, Brooklyn, N. Y. App. filed June 22, 1916. An electromagnetic braking means which serves to retard the motion of the movable parts of an automatic switch.

1,284,735. Variable Switch Mechanism; Lewis A. Mapel, St. Louis, Mo. App. filed July 11, 1917. Under control of a float element.

1,284,736. Signal-Transmitting Device; Frank M. Marshall, Los Angeles, Cal. App. filed Oct. 25, 1916. To simplify controlling means for automatic signal transmitters.

1,284,742. Automatic Switch; James L. McQuarrie, Montclair, N. J. App. filed Aug. 29, 1916. Simplicity of structure and operation is attained.

1,284,743. Means for Segregating Currents of Different Frequencies in Electricity-Conducting System; Louis T. Merwin and Roy K. Freeman, Portland, Ore. App. filed Aug. 31, 1915. For conducting along individual paths certain selected frequencies present in the circuit of an alternating or pulsating electrical current.

1,284,782. Electric Dumb-Waiter-Control System; Harold Rowntree, Kenilworth, Ill. App. filed Feb. 9, 1915. For use in connection with any type of electrically operated dumb-waiter hoisting mechanism.

1,284,798. Control System; Karl A. Simmon, Edgewood Park, Pa. App. filed Oct. 6, 1915. For the control of railway or vehicle motors; embodying independent unit swithces and master controllers.

1,284,799. Knob and the Like; Lambert J. Sindelar, Howell, Neb. App. filed March 22, 1917. A knob and similar appliances for securing electric wires to suitable supports such as houses; device is simple in construction and operation.

1,284,823. Telephone System; Horace W. Ulrich, East Orange, N. J. App. filed March 30, 1918. Relates to systems in which are employed line or trunk circuits terminating at a central office and provided with line signals.

1,284,831. Apparatus for Controlling Commutating-Field Strength of Double-Commutator Machines; Miles Walker, Manchester, Eng. App. filed Sept. 30, 1916. Each commutator cylinder is provided with a suitable brush gear, the two brush gears being rigidly connected so that both may be rocked together.

1,284,846. Means for Measuring Electrical Energy; John C. Wilson, Milwaukee, Wis. App. filed May 24, 1917. Provides a method of compensating or correcting a wattmeter used for measuring the energy consumed in varying loads.

1,284,849. Time-Limit Relay; Albert Aichele, Baden, Switzerland. App. filed Dec. 30, 1916. To protect relays from effects of short circuits.

1,284,866. Regulating System for Dynamo-Electric Machines; Clarence A. Boddie, Pittsburgh, Pa. App. filed April 12, 1916. Regulation is effected by rapidly opening and closing a circuit in shunt to a resistor that is connected in series with the field-magnet winding.

1,284,872. Magnetic Separator for Sorting Heterogeneous Material; Daniel R. Bryan, Chatham, N. J. App. filed May 29, 1914. Will recover all the magnetic particles held in suspension in the dust which in present practice are carried away.

1,284,885. Means for Controlling the Speed of a Machine; Charles S. Franklin, London, Eng. App. filed April 7, 1916. For keeping constant the speed of any machine which it is desired to run at a particular speed by the use of a synchroscope.

1,284,891. Electromagnet; William H. Greenlead, Hartford, Conn. App. filed Oct. 16, 1916. Of particular utility when incorporated in or forming part of a timepiece.

1,284,924. Automatic Party-Line Telephone System; Arthur L. Piper, San Francisco, Cal. App. filed Sept. 20, 1913. To signal the stations on the party line selectively.

1,284,930. Electrical Hammer and Stone cutter; John J. Roberts, Louisville, Ky. App. filed Aug. 17, 1915. Means for operating and controlling solenoid magnets through automatic and manually controlled electrical switches.

1,284,937. Circuit Controller; Arthur Simon, Milwaukee, Wis. App. filed Aug. 30, 1915. A simple, efficient and sensitive controlling mechanism which may be readily adjusted to meet different requirements.

1,284,950. Automatic Electric Fire Alarm; Jacob W. Wahl, New York, N. Y. App. filed March 13, 1915. A thermostatic arrangement which is simple and readily assembled.

1,284,956. Flexible Conduit; George W. Emrick, Brooklyn, N. Y. App. filed Feb. 28, 1917. A conduit of simple and inexpensive construction which is strong and durable.

(Issued Nov. 19, 1918)

1,284,957. Signal Bell; Beryl W. Adams, Troy, Mont. App. filed Oct. 20, 1916. To give high-speed single strokes on alternating current.

1,284,966. Electrical Instrument; Charles T. Anderson, Edgewood Borough, Pa. App. filed Aug. 14, 1917. For keeping two or more contact fingers mounted on a common support in alignment for relays, etc.

1,284,974. Strain Insulator; Arthur O. Austin, Barberton, Ohio. App. filed May 24, 1916. For connecting insulating units together and to strain wires or supports.

1,284,975. Standard Insulator and Method of Making the Same; Arthur O. Austin, Barberton, Ohio. App. filed May 29, 1916. Multiplicity of projections on cementing surface aid in attachment.

1,284,976. Insulator; Arthur O. Austin, Barberton, Ohio. App. filed May 29, 1916. Any stress or strain due to unequal expansion or contraction of the insulator parts may be relieved without breaking the insulating member or causing an actual separation of the insulator parts.

1,284,977. Car Signal System; Rex G. Averill, Mansfield, Ohio. App. filed April 19, 1916. For protecting cars from collisions at night in case the current from the normal supply is cut off and they are thus left in darkness.

Electrical World

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America's Opportunity and the Engineer

IN NO spirit of vainglory or of greed, but with full realization of the solemn responsibility that the fact implies, and with recognition that international coöperation rather than international antagonism should be the future's watchword, every thoughtful American must perceive that as peace once more becomes established the United States will loom potentially if not actually the leading commercial nation of the world. The great engine of German foreign trade, reared with so much skill and care, lies crushed beneath the ruins of the medieval structure that housed it and the armed barbarism by which its expansion was sought. Austria is no longer even a geographical expression but only a political reminiscence. Russia, the home of chaos and the sport of anarchy, is hopelessly out of the running. Italy has not the capital or the widespread commercial spirit. France, more than ever the home of the fine arts and the nurse of valor, the "second country of every man," has been too sorely stricken by the long years of war to assume at once the commanding position in the world of trade that, were she able to take it, no generous soul would grudge her. Japan, secure in her Asiatic primacy, is unlikely for years to come to bid actively for more distant business. There remains of all the Great Powers only Great Britain to contend with the United States in fair and friendly rivalry for first place. Still to rank below that great trading nation would be no disgrace, and enemy mischief makers will fail if they try to sow the seeds of national ill will in business channels; but, with our continental solidarity as against Great Britain's scattered empire, with our triumphant melting pot as against her millions of unassimilated population in India and with our new merchant marine compelling enterprise by the fact of its existence, the elements in the case favor America.

The engineers of the nation have an interest in trade expansion that is both direct and indirect—direct because they stand back of the machinery and the sources of light, power, traction and communication that form so important a part of export business; indirect because trade means production and production means prosperity, and with the growth of prosperity opportunities for engineering ability multiply both at home and in the countries with which commercial relations grow closer. All the great national issues that bear on trade have therefore a special professional interest for engineers as well as the patriotic interest which engineers share with other good citizens. Shall the United States become a partner in a league of nations or perpetuate its hemispheric isolation? Shall the trend of tariff legislation be toward free-trade ideals or toward scientific protection? What means shall be tried to promote a lasting peace between capital and labor? Shall old-fashioned American individualism prevail or socialistic tendencies be met half way? Are private monopolies to go? Shall national, state or municipal government be extended to include the ownership or control of public utilities? These are perhaps the most insistent political questions with a direct commercial bearing. On them engineers individually, and where possible collectively, should be heard.

Vision, not hesitation, will land us the quicker upon the shore of peaceful development. A little more of the spirit of Columbus and a little less of the practice of Lot's wife is needed. Who can doubt the reward behind the curtain of 1919 for the progressive worker in electricity?

Water Power as a National Asset

CANADA can teach us much regarding the conservation of natural resources. Her water-power sites are not only surveyed; their economic features, capacities and in many instances costs of development are known as well. Moreover, in seeking to have these resources used, the Dominion government, while it affords reasonable protection to the public, at the same time offers suitable financial reward to private enterprises. There is, however, little advantage for Canada to develop power which is transmitted to the United States, especially when there is a shortage of power in the Dominion. Many Canadians are, therefore, solicitous about her natural resources and insist that her water powers should be developed for her people. Hence the growth of immense systems like that of the Hydro-Electric Power Commission of Ontario. Inasmuch as the greater part of the population of the Dominion of Canada dwells along the St. Lawrence River valley and it is in the provinces of Quebec and Ontario that the greatest amounts of power are developed and used, the utilization of the waters of the St. Lawrence for power purposes is of immense interest to Canadians. There are no indications that the Canadians object to the joint development of the river by the Dominion and the United States or by the two provinces mentioned and the State of New York. But Canadians have a very firm conviction that none of the water should be used for private enterprises. The water may be used by local, state and national governments or by creatures of those governments in the shape of public utility corporations amenable to rules and regulations of the respective states as to rates, service, etc., through commissions. A similar public opinion regarding water powers is beginning to crystallize in this country.

The Foreign Trade Door Open

As A NATION we have much to learn on the subject of foreign trade, and it is high time that we made a substantial beginning. The countries of the world will want to exchange products with us. There will be a redistribution of some of the channels of trade. Our unsurpassed record for big-scale production, our stores of raw materials, aptitude in learning, the financial strength of industries and the nation as a whole, fit us to interchange products so as to promote friendly trade relations on a degree never before possible to our people. Our position as a creditor nation makes it highly desirable that new thought and study shall be given to the requirements of foreign consumers and especially to methods of financing with which they are accustomed. The seller and buyer will have to talk in terms that both understand. Some people have yet to be taught that the United States manufacturer will have to make the goods and terms of payment that the foreign buyer wants. It will take patience to do this by system, and patience is not the pet virtue of the idolized type of our trigger business man looking for quick results. But whatever the terms, whatever the length of time needed, it is imperative that the industry set about it to prepare to take a large part in the future international commerce and financing of the world. Our foreign trade knowledge now rests largely with the companies which have done an international business for many years, notwithstanding unsympathetic laws and lawmakers, and they have paid a price for their information. Certainly the big companies have done much in the past to build a reputation for this country in foreign lands. They have put distributive organizations in the leading countries where sales are possible; they have established connections, men and agents trained in their products and the needs of consumers; their names and output are known favorably. They have faced European competition for years; they are able to market apparatus and supplies where that competition exists. Probably they can continue in much the same way as they have done. But with expanding circles of consumers in other countries it is to be hoped that they will develop the size of their business in proportion. They are entitled to benefit from their pioneer work.

With the small companies in the electrical industry the desirability of building export business under the new domestic and world conditions is also clear. They have a large productive capacity; they can meet competion as the large companies meet it; they have their individual problems of keeping labor employed at good wages. Under the old conditions they lacked sufficient points of contact with buyers in foreign countries to make a profitable business easy, if indeed it was practicable at all. They could not afford to finance exploitation of foreign possibilities as readily as companies of greater resources. But now that Congress has opened the way for coöperative organizations in foreign trade through the enactment of the Webb law they can initiate a movement to represent a number of units in the electrical industry. Readers of the Electrical World who study foreign trade possibilities are undoubtedly familiar with the combinations formed under this law by the copper and steel producers. The Copper Export Association, Inc., now includes the largest copper producers, but is designed to include any smaller producers. The North American Steel Products Corporation now embraces ten producers, but is expected to represent eventually all important steel-producing companies of the country except the United States Steel Corporation, which, of course, has its own extensive foreign marketing organization. In just what form, if any, electrical manufacturers will decide to coöperate probably the future will reveal, but the opportunity is open.

Life cannot go stale as "the tumult and the shouting die" if the open mind remains. The progress of applied science has been enormously accelerated by the war, and now is the time to go forward from a new base. The best brains are wanted to grapple with the problems and opportunities of the new era, but the issues are so far-reaching that the most humble constructive thought may be helpful.

The New Multiplex Telephone System

THE Postmaster-General has recently issued a public statement through the daily press, on information supplied by the president of the American Telephone & Telegraph Company, concerning the practical introduction of a new multiplex telephone and telegraph system on loop-line conductors.

The statement is gratifying not only to electrical workers but also to the members of the general public. The achievement constitutes a new step in the transmission of thought, in the communication of ideas, in the permeation of the material world by the intellectual world. The mere fact that such a step has been already taken in the actual practice between Baltimore and Pittsburgh for a number of months is a real benefit to the dwellers in those cities; but it is also a potential benefit to the dwellers in the most remote and uncultivated regions of the globe. The fact is notable, the accomplishment memorable, and all the contributors are, in the various degrees of their contribution, worthy of corresponding renown.

There is, however, another aspect of the matter which deserves to be considered. The new result which has been achieved is more than a mere utilitarian public benefit. It is also an engineering achievement developed not solely by the expenditure of money but, in addition, by the exercise of inventive skill and scientific ability. It is incumbent upon the company, which has announced the result in general terms to the general public, to make a corresponding announcement in technical terms to the engineering world. This does not necessarily entail the abandonment to the public of any of the rights of the company as possessor of a new telephonic process. It merely involves the rendering unto Cæsar of the things which are Cæsar's. Because the scientific world has trained and equipped, with the knowledge of past eras, those men who have been able, under the company's skilled leadership, to bring about an important new result, it is reciprocally due to the scientific world that the means for and the process of attaining the result should be made known.

We may, then, properly expect that a clear and adequate technical description of the new multiplex system will be communicated by the company to the engineering public at an early date, through the medium either of the electrotechnical press or of the electrical engineering societies' proceedings, or through both these channels.

This acknowledgment of indebtedness to the great fountainhead of scientific knowledge, fundamental or applied, is the more important at this time because as a nation we seem to be tending to intrust our large enterprises of all kinds to the tender mercies of an all too socialistically ambitious government. The theory implied in the suggestion that the government should either do everything or as near to everything as it can is that the average citizen, elected by popular vote, can do any duty well to which he may be honestly assigned. This seems to be a fundamental democratic doctrine. In opposition to this belief, engineers well know that only a relatively few men, specially selected for their native ability and for their technical training, are properly competent to undertake engineering responsibilities for the public service. The appointment of honest and well-meaning but inexperienced and untrained public servants to positions of specialized duties is wasteful in the extreme. This fact is not nearly so generally known as its importance deserves, and it behooves the scientific, the technical and engineering sections of the community to bring it clearly before the world at large.

Any policy on the part of the large engineering and public service corporations to conceal the scientific, technical and engineering work which they achieve with great effort and pain tends to play into the hands of those who think that all things can be done more or less equally well by the average man, and who therefore honestly believe that since the government is carried on by an average group of men, elected by the average man, the said government is the proper body to administer all public and engineering needs. On the contrary, the large public service corporations, being fully aware of the great importance of the service of specially trained specialists, should do all that can be reasonably expected of them to acknowledge the aid of specialists and to foster the supply of every needed type of specialists in the community.

War and repression go hand in hand. Civil needs are curtailed in great international emergencies, and major energies are concentrated for attack and defense. Victory unlocks old doors of opportunity as well as new ones. Let the electrical industry enter into its greater heritage with confidence and high resolve that splendid service may follow the patriotic achievements of the epoch just ended.

The Fuel Administration

DR. GARFIELD'S work as Fuel Administrator was a conspicuous part of the mobilization of industry for war efficiency. It was evolved in conditions which will probably never again be in existence in this country. It came into operation at a moment when prices for coal were in an extraordinary state of jumble. With the country in a war fever, there were inconsistencies in prices, there were inequalities in distribution, there were mistakes of direction. In this somewhat confusing mixture of events a clear and definite policy of conservation was developing. And conservation, as it finally developed in the Fuel Administration policy, was economy of fuel and economy of the power and heat resources of the nation. This meant, if extended to its logical conclusion, the survival of the fittest. It could mean nothing else than the enlargement of the field of usefulness of the central station, the upbuilding of the central-station industry. What the Fuel Administration wanted, what it had to have, was precisely the kind of service that the central station gave. The Fuel Administration was not tardy in recognizing the value of the central station to the community at a juncture when the life of the nation was at stake; but its early recognition was strengthened by new conviction as time brought out the real facts. "Lightless" nights and "workless" days, we can now see, are insignificant things compared with the indorsement of the central-station principle.

Customer ownership multiplies points of contact between public utilities and the people whom they serve. From the entente cordiale thus derived spring better understanding and direction of company policies and a closer personal touch between server and served. Let us capitalize the thrift taught by our Liberty loans for the mutual benefit of the electric service companies and their communities, thus securing the benefits of a large measure of popular ownership without the drawbacks of political administration.

Reorganizing a Small Central Station

THE description by Leo Lustig of the rehabilitation of a little Cuban plant is another example of the importance of getting at the root of matters instead of continuing the policy of patching up. The case which he describes is absolutely typical of hundreds not yet taken effectively in hand. Here was a little city of about 16,000 inhabitants with a three-phase, 2300-volt distribution and single-phase secondaries. The plant had grown up gradually until the phases were badly out of balance, transformers and feeders overloaded, and things steadily going from bad to worse as load increased. Finally the worm turned, and the course of improvement described by Mr. Lustig began. A plan of the distribution system was made, the network was redesigned, transformers were placed as near their centers of load as possible, and the phases balanced. In numerous instances 10 to 20 volts increase of voltage was obtained simply by reconnecting the load to the transformers. In redesigning the distribution plans were made for no more than 2 to 3 per cent drop in the secondaries even on a 5 per cent increase of load. All transformers below 3 kw. were thrown out, the secondary distribution was passed over to a three-wire system, and the motor service was rearranged. The poles were relocated, transformers more conveniently placed on the poles, all connections soldered and the house connections standardized. The result was that losses were minimized, better capacity was obtained for the equipment and the service so improved that added consumption promptly resulted.

Mr. Lustig notes that similar and even worse conditions than those originally here existing can be found on many other systems in Cuba. For "Cuba" read "the United States," and one will not be far from the truth.

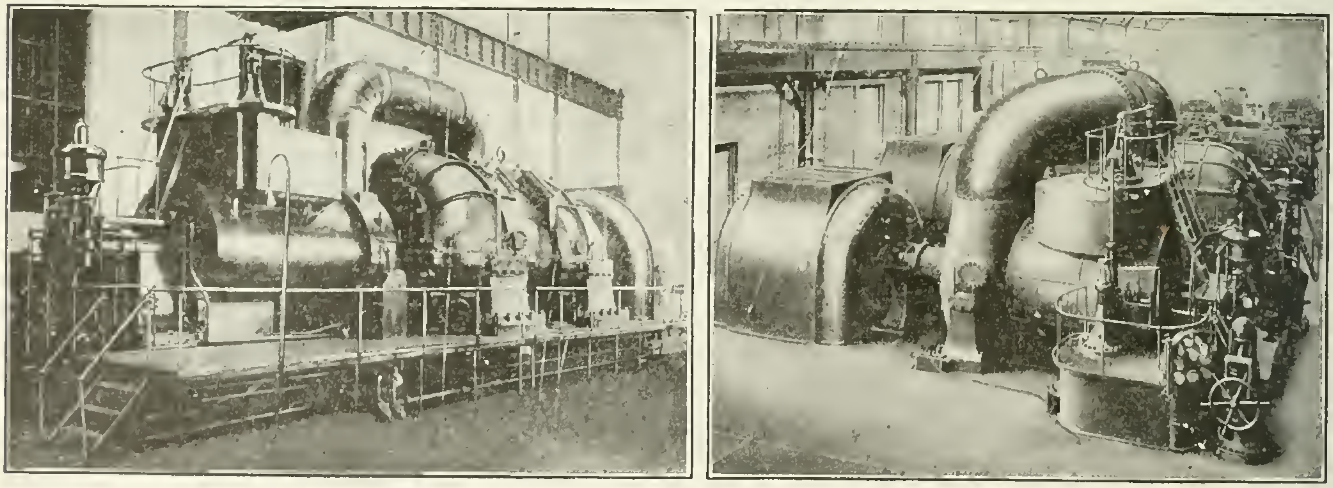
Reliability of Large Turbines[*]

Answers to Questions Frequently Raised Regarding Advisability of Using Larger Units, Reliability and Problems of Design—Limits of Commercial Practicability of Large Units Are Not Yet Reached

BY J. F. JOHNSON
Engineer Turbine Department, Westinghouse Electric & Manufacturing Company

THE remarkable growth of the electric power industry during recent years has been paralleled by an equally remarkable growth of steam-turbine-driven generating units. So rapid has this development been that frequently before the first machine of a new design was completed another of materially greater capacity and higher efficiency was being designed. For example, machines of 15,000 kw. rating were put into operation as early as 1908, but their use did not become general until 1913; whereas to-day nearly every one of what may be called our large generating stations has at least one unit of 30,000 kw. capacity or larger in service or on order.

The question arises, has this growth been natural, logical and healthy, or has it suffered temporarily from over-stimulation which is destined to result in a relapse or reversion to smaller sizes? If such reversion occurs, will it be the result of faulty engineering, born of over-confidence on the part of the builders of the apparatus or on the part of the users; that is, will it be because units of necessary reliability and economy are not commercially obtainable or because units of 30,000 kw. and larger are too large for the present and immediate future requirements of our large power-generating stations? While these questions will probably remain unanswered to the satisfaction of all for some time, it is with the hope of throwing some light on the subject that this article is presented.



FIGS. 1 AND 2—TANDEM-COMPOUND REACTION TURBINE OF CHICAGO COMPANY CONNECTED TO SINGLE 30,000-KW. GENERATOR; CROSS-COMPOUND TURBINE SET RATED AT 40,000 KW. BELONGING TO PITTSBURGH COMPANY

It is believed that a careful analysis of the present multitude of applications of electric power will not disclose in a single important one any serious element of fad or any likelihood of its use in that application decreasing. On the other hand, there are many applications in which marked future growth seems certain. There can be no doubt that the electric power industry is to-day only in the midst of a rapid, healthy growth, as shown by the following table:

District	Sum of Maximum Sustained Peak Load All Companies in 10-Mile Radius 1917	Total Capacities[†] to Be Installed by 1920
New York	800,000	1,190,000
Chicago	400,000	596,000
Philadelphia	250,000	373,000
Buffalo and Niagara Falls	300,000	447,000
Detroit	155,000	231,000
Boston	155,000	231,000

[†] Based upon an estimated increase of peak load of 8 per cent each year and a surplus of generating capacity installed above peak load of 20 per cent.

The choice of sizes of generating units is important because the number and sizes of units will materially affect the total cost of power generated. If the units be too small and the number too large, the cost per kilowatt of the station completed will be greater, the maintenance and operating expenses higher, the efficiency poorer and reliability at least no greater than if the proper sizes are used. On the other hand, if the units be too large, the cost per kilowatt installed may be too large because of the greater reserve or stand-by capacity required, and the efficiency may even be poorer by reason of the units operating at loads too far below their points of best efficiency.

Take, for example, a district with a maximum peak requirement of 600,000 kw., which to insure proper reliability it is decided to generate in three stations of approximately equal sizes. We will assume that these stations will normally always operate in parallel with each other and that there will be one spare unit for each five in service during the peak. If 20,000-kw. units are used, there will be thirty operating and six spares, making a total of thirty-six units, twelve in each station. If 30,000-kw. units are used, there will be a total of twenty operating and four spares, making a total of twenty-four units, eight in each station, etc.

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[*] Features of address before A. S. M. E. meeting at Pittsburgh.

If, for the sake of simplification, it is assumed that, irrespective of the size, the reliability, efficiency and purchase price per kilowatt will be the same, it should be obvious without resorting to calculations that the 20,000-kw. size is too small and that best results are to be expected with either the 40,000-kw. or the 60,000-kw. size, because the installation costs, including buildings, foundations, piping and switching equipment, and operating costs, including maintenance supplies and attendance, should be less per kilowatt. The efficiency would be higher because of the higher efficiency of the larger units, larger auxiliaries and smaller friction and radiation losses in the larger steam and water piping, and the reliability would be greater because of the smaller number of operations of starting and stopping and cutting in and out of service of units necessary.

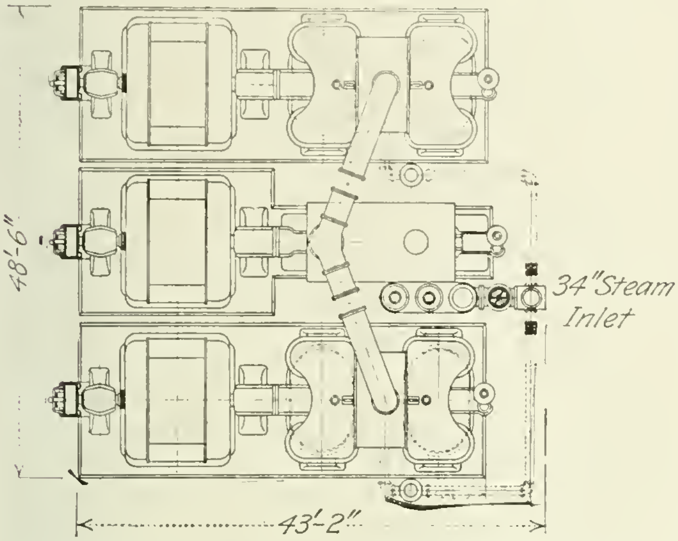

FIG. 3—THREE-CYLINDER CROSS-COMPOUND TURBINE WITH ONE HIGH-PRESSURE AND TWO LOW-PRESSURE CYLINDERS RATED AT 70,000 KW. USED BY NEW YORK COMPANY

In so far as conditions affected by the design of units are concerned, it is quite generally appreciated that in sizes up to at least 30,000 kw. rating, higher efficiency at the same cost per killowatt is obtainable purely by reason of the larger size and still higher efficiency for a slight increase in cost per kilowatt, and it has been quite conclusively demonstrated that as high a degree of reliability is obtainable in the larger units as in the smaller ones.

While districts in which the peak requirements of any one operating company are as great as from 400,000 kw. to 600,000 kw. are at the present time not numerous, there are many which will probably reach that stage before installations being made at this time will be expected to become obsolete. In these units of the larger sizes should be introduced to replace smaller ones as they become obsolete and to take care of increasing requirements at such a rate as will affect the most economical production of power over the estimated period of usefulness of the machines installed. Numerous generating stations of around 200,000 kw. installed capacity, projected and designed by the ablest engineering talent in the country, are under construction and in operation, and units of 30,000 kw. and larger are being employed in them. Stations of approximately 300,000 kw. installed capacity are being projected and probably will be built in the near future.

To show that large units are commercially practicable within limits not yet reached, that increase in size need not impair reliability and may improve efficiency, and to point out that any difficulties experienced with them can be corrected after proper analysis of the trouble, the writer will refer to installations of large-size units furnished by the company with which he is connected. Up to the present time this company has furnished fourteen large-size units, ranging in capacity from 30,000 kw. to 70,000 kw. Of these eleven have been shipped, ten are in service, and seven have been in service for one to five years. Their performance should speak for itself.

EXPERIENCE WITH NINE LARGE UNITS

The first three of these units‡, which are exact duplicates of each other, were sold to the Interborough Rapid Transit Company of New York. They are of the two-cylinder, cross-compound, pure-reaction type, rated at 30,000 kw. (maximum) with the highest efficiency at 25,000 kw., the high-pressure units operating at 1500 r.p.m. and the low-pressure at 750 r.p.m.

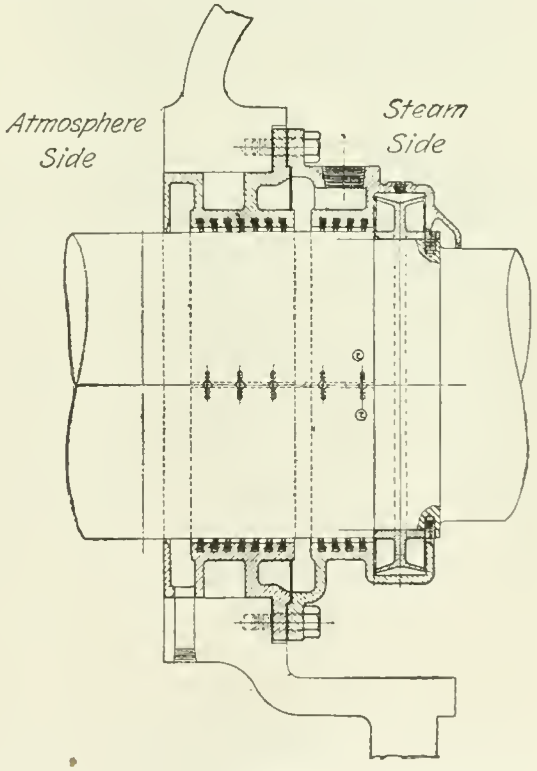

FIG. 4—LABYRINTH AND WATER-SEAL GLAND COMMONLY USED

These units since their installation (December, 1914, February and August, 1915, respectively) have been operating on an average from sixteen to twenty hours per day, on fluctuating railway loads varying from 10,000 kw. to 30,000 kw. With the first and third no troubles of any sort have been experienced, and they have been ready at all times for any service within their designed capacity except when out of service for regular periodic inspection or ordinary maintenance. On the second the labyrinth packing on the balance pistons of the high-pressure element has failed three times, requiring renewal of some parts. The cause of these failures was at first supposed to have been improper adjustment, but investigations following the third failure indicated excessive lost motion in the thrust bearing and heavy distortional stresses caused by rigid bracing of the steam pipe near the turbine as the probable causes.

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‡See paper by H. G. Stott and W. S. Finlay, presented at May, 1916, meeting of New York Section of the A. S. M. E., for results of tests.

The fourth unit, placed in operation in the Northwest station of the Commonwealth Edison Company, Chicago, in September, 1917, consists of a tandem-compound, pure-reaction turbine direct-connected to a single generator. It has a rating of 30,000 kw. with an additional overload capacity of 5000 kw. operating at 1200 r.p.m. A few hours after being put into service, subsequent to completion of erection, the labyrinth packing on the low-pressure element failed, owing to buckling of the turbine cylinder, caused by rigid piping connections between the two surface condensers, which are bolted rigidly to the two exhaust openings on the turbine, preventing the condensers from translating with the turbine as its temperature increased. Temporary repairs were made locally and the unit put in service in about four weeks. It has been operating almost continuously ever since without trouble of any sort (except cracking of a copper expansion joint), carrying loads as high as 40,000 kw. In one instance it was kept on the line for seventy-one days and then taken off only in order to clean the condenser. Material for making permanent repairs to the labyrinth packing was shipped to the station within a few months after the accident, but the purchaser has not yet given permission to take the unit out of service long enough to install it.

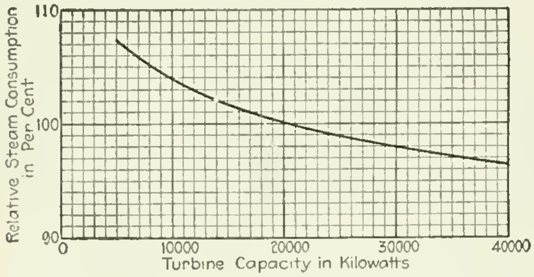


FIG. 5—APPROXIMATE WATER RATES OF DIFFERENT-SIZE TURBINES AT MOST EFFICIENT LOADS

The fifth unit, a 30,000-kw. pure-reaction, single-cylinder machine, was placed in operation in the Gold Street station of the Edison Electric Iluminating Company of Brooklyn in October, 1917. With the exception of a few leaks in the oiling system and the breaking of a defective gear on the oil-pump drive, no trouble of any sort has been experienced. It has been available for service at all times, and has been operating almost continuously, except over Sundays and when necessary to clean the condensers, at average loads of approximately 23,000 kw. and peak loads running as high as 32,000 kw.

The sixth unit, placed in service in December, 1917, in the Kent Avenue station of the Brooklyn Rapid Transit Company, is a duplicate of the fifth machine. Just after installation some rebalancing of both turbine and generator rotors was necessary. After having been in service approximately ten months the thrust bearing overheated and wiped to some extent, but did not damage any other part of the machine. When opened for inspection it was found that the labyrinth packing strips, which were made of an aluminum alloy, were considerably corroded by the action of strong alkalis used at this plant for treating feed water; and two rows of blading in the high-pressure portion of the machine were found to have been damaged at some previous time, this having been caused probably by foreign matter or a defective blade. This machine was in regular service up to that time, carrying maximum loads as high as 31,000 kw. and an average of 25,000 kw.

The seventh unit is a 40,000-kw. cross-compound machine, installed in the Brunots Island station of the Duquesne Light Company, and was placed in service in December, 1917. The high-pressure element of this machine operates at 1800 r.p.m. and the low-pressure element at 1200 r.p.m. This unit has been in regular service carrying loads normally of from 30,000 kw. to 40,000 kw. with peaks as high as 50,000 kw. While operating the machine to correct the balance of one of the generators, the main bearing at the coupling end of the high-pressure turbine burned out, apparently owing to interruption of oil service to that bearing. This let the spindle down sufficiently to cause rather heavy blade rubs throughout the machine. The bearing was rebabbitted and the machine put back in service without any other work being done except rechecking the clearances and placing a balance weight on the spindle to correct for the weight which had been rubbed off the blades.

Later the generator was damaged by electrical trouble, and while this repair was being made both elements of the turbine were dismantled. The high-pressure rotor was returned to the shops, the damaged blading replaced and rebalanced. New blading was also installed in the stator to restore original clearances and original efficiencies. Inspection of the low-pressure element revealed several broken blades which were defective and had slightly damaged the rest of the blading in those rows, requiring replacement of approximately one and one-half rows of blading on each end of the machine.

The eighth unit, practically a duplicate of the seventh, rated at 45,000 kw. (maximum), was delivered to the Narragansett Electric Light Company in Providence in January, 1918. In placing this machine in service the labyrinth packing on the high pressure was damaged, owing to improper adjustment, which necessitated temporary repairs. Since making them no trouble has been experienced except some distortion of the couplings caused by a series of violent short circuits and some defective workmanship on the fitting of the coupling keys. Permanent repairs to the labyrinth packing have been made and new coupling parts are to be installed in the near future. In the meantime the old parts are operating satisfactorily without any evidence of distress. This machine operates on loads as low as 5000 kw. and has carried a peak load of 50,000 kw. for periods of from four to five minutes.

The ninth unit is a 70,000-kw., three-cylinder, cross-compound machine installed for the Interborough Rapid Transit Company in New York. One low-pressure element was placed in service April, 1918, operating on high-pressure steam. The one high-pressure element was placed in service in August, operating in connection with the low-pressure element already installed, and the second low-pressure element was placed in service in October. Some intermittent vibration trouble appeared on the first low-pressure machine, the cause for which was found to be lack of sufficient clearance on one of the spindle rings, causing distortion during expansion. After this was corrected no further trouble was experienced except the breaking of a few defective blades on the intermediate stage of the second low-pressure element.

This unit is equipped with an automatic-control mechanism for cutting out of service, either automatically or manually, either element without disturbing the other two. These features have been given a thorough tryout, which in so far as a demonstration goes has verified all expectations as to flexibility of operation of a multiple-unit set. In regular service it has carried loads as high as 55,000 kw. with swings up to 61,000 kw.

While these records do not all show 100 per cent perfection, they do show that in not one instance has there been any evidence of inherent or basic defects in design or difficulties in construction or operation. Some troubles have been experienced, but these have all been of minor character, due to avoidable defects in detail design, construction, installation or operation, such as are experienced with new designs of any size or sort. It is significant that with one exception no important part of any one of these units has ever been returned to the works for replacement, alteration or repair. The high-pressure rotor of the Duquesne Light Company unit was returned to the shops for checking for truth and reblading. While most of them have not been subjected to any accurate steam consumption tests, definite reductions in station coal consumption rates were effected by their installation.

A 110,000-VOLT LINE OVER THE ST. LAWRENCE RIVER

Even Though Expense Is Greater, Span of 4800 Ft. Was Preferred to Submarine Cable Transmission—Details of Construction

Engineering problems involved in the construction of one of the longest transmission-line spans in the world were outlined in a paper read before the recent Toronto convention of the American Institute of Electrical Engineers by S. Sevenningson.

For a number of years the Shawinigan Water & Power Company has been transmitting energy from the generating plants at Shawinigan Falls north of the St. Lawrence River to towns south of the St. Lawrence River. The voltage has been stepped down from 50,000 volts on the transmission line to 25,000 volts, for transmission under the river by submarine cables, and up again to 50,000 volts for the lines on the south side. On account of the demand for energy on the south shore, however, it became necessary in 1916 to increase very greatly the capacity of the system for this growth in load. Submarine cables have always been a weak point in this part of the system, the current in the river sometimes carrying them down stream and even pulling them apart. It has even been necessary in the winter time to erect temporary wooden-pole lines across the ice to maintain service on the south shore. The company then decided to make an overhead crossing instead of putting in additional submarine cables, even at a cost of $200,000 compared to a cost of $150,000 for submarine cables.

Design of 4800-Ft. Span

A single span of 4800 ft. (1460 m.) was finally decided upon in preference to a round-about route by which it would have been possible to cross the river in three spans. There are two towers 350 ft. (106 m.) high and 60 ft. (18 m.) square at the base, the upstream and downstream faces tapering to a width of 14 ft. (4.3 m.) at the top. Piers for the foundation were constructed in the form of hollow cylinders of reinforced concrete with an outside diameter of 11 ft. (3.3 m.) and an inside diameter of 7 ft. (2.1 m.) on account of the great depth of sandy soil. Galvanized plow-steel cables 1⅜ in. (3.5 cm.) in diameter span the river on 50-ft. (15-m.) centers. These cables on test showed a yield point of 193,000 lb. per sq.in. (13,600 kg. per sq.cm.) and an ultimate strength of 227,000 lb. per sq.in. (16,000 kg. per sq.cm.). Although the cables will be the ultimate transmission conductors, they are at present messengers for supporting No. 1/0 copper conductors. This temporary construction was necessary on account of the inability of the company to obtain satisfactory insulators for the steel cables at that time.

The insulators which it is proposed to use when the steel cable becomes the transmission conductor are of unusual design, putting the insulators in compression instead of tension. These were described on page 1041 of the Nov. 30 issue of the ELECTRICAL WORLD. Excepting that the copper conductors were torn loose from the messenger cable by unusual mechanical resonance on one occasion, little difficulty has been experienced with the overhead span thus far, although a severe winter has not yet been weathered. On account of an increase in sag of from 24 ft. to 27 ft. (7.3 m. to 8.2 m.) in the first few months of operation, it was found necessary to draw up the cables after this time. The stretching of the cables was attributed to the movement of the strands on the central core.

Serious Ice Conditions

On account of ice conditions which occur in the river, some kind of guard piers outside of the towers were deemed necessary for their protection. Some 3000 tons of field stone were deposited on the river bed on each side, about 75 ft. (22 m.) from the upstream and river faces of the towers, carrying the rock to an elevation about 3 ft. (90 cm.) above the water level. Ice conditions last year were exceptionally severe, however, and the ice passed over the tops of these breakers and piled up around the tower foundations to a height of 25 ft. or 30 ft. (7.6 m. or 9.1 m.). No damage was done, but the company is at present completing new guard piers by means of reinforced-concrete cribs filled with rock and carried to a level of the maximum recorded high water.

Canada's Heritage in the St. Lawrence River*

The Estimated Low-Water Power Aggregates 2,000,000 Hp., of Which the Greater Part Is Wholly Within the Territorial Area of the Dominion and Capable of Development

BY ARTHUR V. WHITE
Consulting Engineer Commission of Conservation, Ottawa, Ont.

THE St. Lawrence as the wonderful water highway from the Great Lakes to the sea has been improved chiefly by the canal systems of the government of Canada. The new Welland Canal is being constructed with locks of 30-ft. (9-m.) draft. If it is to be used so that deep-draft, ocean-going vessels may go up to the head of navigation of the Great Lakes, then the St. Lawrence River in portions of its main channel will have to be canalized by means of a series of dams with suitable locks. If the river as a whole be canalized, obviously the water power of the river would be most economically developed by having the dams necessary for the navigation improvement made adaptable also for the development of water power.

One fact is certain, and that is that, in order to conserve the integrity of the St. Lawrence River so that it may suitably be canalized—when the time comes for such work—its integrity must not be compromised by permitting the erection of structures in the main stream for piecemeal development of power, although this has already been done to some extent. Naturally, there is a great temptation for water-power companies to do on the St. Lawrence as has been done elsewhere, namely, to make the cheapest possible preliminary developments—skim the cream off the powers, so to speak—for by so doing interests may readily acquire markets and vested rights, and often control of the general situation.

Canada's heritage in the navigability of the St. Lawrence, in a word, may be summed up that deep-draft navigation from the Great Lakes to the sea involves, absolutely, the treatment and canalization of the St. Lawrence River as a unit.

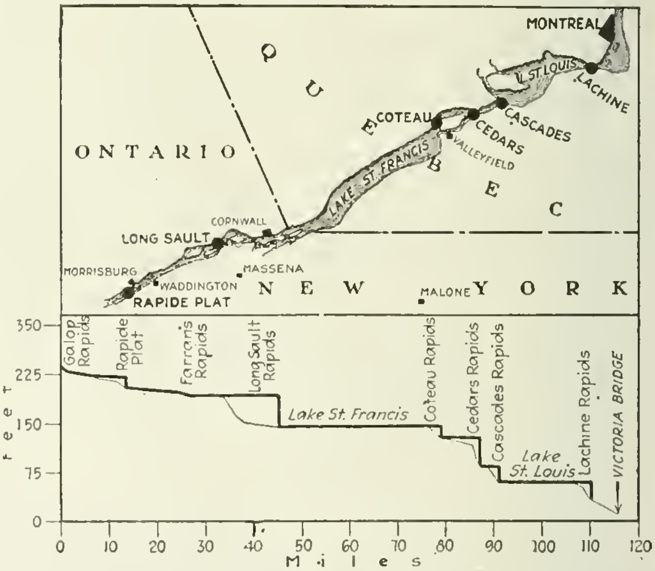
Water Powers of St. Lawrence River

The water powers of the St. Lawrence River are as yet largely within the control of the people. The recent shortage of hydroelectric power which has been so keenly felt both in Canada and the United States has drawn increased attention to the enormously advantageous powers in and adjacent to international boundary waters. Most of the water powers which are more readily capable of economic development in Canada as well as in the United States either have already been developed or are privately controlled. Concentration of ownership is a noticeable feature of this control. Canada cannot afford to have her St. Lawrence River powers pass into the hands of powerful private interests.

With respect to development of these water powers, there are some very important points such as ice conditions, the exportation of Canada's share of electrical energy and the character of the agencies utilizing the power.

Power development on the St. Lawrence River cannot properly be considered apart from the subject of the ice menace. Too great caution cannot be exercised before attempting to harness natural forces of such magnitude as exist in the flow of the St. Lawrence River. Too radical a disturbance of the balance which Nature seeks to maintain may cause disaster, hence it is well to emphasize this phase of the problem, for it involves basic physical factors of paramount importance.

Where very large developments of power take place it is usually necessary to have some industries, such as the electrochemical, take large blocks of power. These industries require cheap power. As the demand for power increases for municipal and small manufacturing purposes the experience has been that the demands for the power for such uses become so urgent, and the inducements by way of price so attractive to the vendors of such power, that large industries which were attracted by the cheap power have been compelled to go farther afield. A block of power—over 65,000 hp.—such as is exported from the Cedars plant in Quebec to the aluminum works at Massena, N. Y., would be sufficient, speaking on a broad basis, to supply light and power to some thirty-five manufacturing cities of 10,000 inhabitants each. It will be apparent from a comparison of the benefits resulting from power thus widely distributed and the localized benefits from the same power utilized in bulk, as in electrochemical industries, that the former contributes in a much greater degree to the upbuilding of communities and to the growth of the country at large.



POWER SITES ON ST. LAWRENCE RIVER

There is strong opposition, especially throughout Ontario, to any policy which permits the exportation of electric energy really required for use in Canada. The federal government has been memorialized upon this subject. It has been urged that no large power projects, such, for example, as those on the international portion of the St. Lawrence River, should be developed without reserving Canada's share of the power for use there; and, further, that powers situated wholly in Canada should be reserved against the day of Canada's need. This statement is made having in mind the fact that it is not the policy of Canada to embargo her exports, but that commodities of national importance should not be exported without an adequate *quid pro quo.*

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*From address delivered before the Electric Club of Toronto, Nov. 22, 1918.

POWER SITES

On the St. Lawrence River below Lake Ontario the first site where development involving the whole flow of the river could be made is in the vicinity of Morrisburg. With a dam near the foot of Ogden Island, a head of about 11 ft. could be obtained, or, by taking in a portion of the Galop Rapid, it has been thought possible to obtain a total effective head of about 15 ft. It is at this Morrisburg site—the Rapide Plat—that the New York & Ontario Power Company develops power in a small plant at Waddington, N. Y., under rights extending back for one hundred years. This company desires to reconstruct this plant and increase the development, thereby providing power for disposal in the United States as well as in eastern Ontario. The company offers to have this project made conformable to any scheme for the development of the river as a whole.

The next possible development is that at the Long Sault Rapids, where the possible head is variously estimated to be about 35 ft. to 40 ft. This is the site near Cornwall where the Long Sault Development Company, a subsidiary of the Aluminum Company of America, intended to erect its dams had not its charter rights been canceled by the State of New York—a cancellation which was confirmed by the Supreme Court of the United States.

Descending the river, in a stretch of about 14 miles between lakes St. Francis and St. Louis there are three series of rapids: the Coteau, the Cedars, the Split Rock and Cascades. The Coteau site is the one for which the Power Development Company, Ltd., has been seeking rights. Reliable assurances, however, have been given that rights for this development cannot be obtained without full public notice and discussion when all interested parties will have opportunity to be heard.

The Cedars Rapids Manufacturing & Power Company utilize at Cedars Rapids a head of about 32 ft. developed by means of a diversion canal some two miles long. The power house has been designed for an ultimate development of 180,000 hp. This company exports some 65,000 hp. to Massena, N. Y.

The Soulanges plant of the Civic Investment & Industrial Company is situated a short distance below the Cedars plant. Power is obtained by tapping the Soulanges Canal. The head is 50 ft. (15 m.).

The St. Timothée plant of the Canadian Light & Power Company is on the south side of the St. Lawrence directly opposite the two last-mentioned developments. The water is led through a portion of the old Beauharnois Canal. The head is 50 ft. and the development has an ultimate capacity of 75,000 hp. There are also small plants like those at Mille Roche and near Morrisburg.

To summarize, the estimated low-water power of the international portion of the St. Lawrence River may be placed at about 800,000 hp., of which Canada is entitled to one-half, or 400,000 hp. The potential low-water power on the portion of the river which lies wholly within Canada would be 1,400,000 hp. This, with its share of power along the international boundary, makes an estimated total for Canada of 1,800,000 low-water continuous horsepower. It is detailed in the following table:

WATER-POWER ON THE ST. LAWRENCE RIVER*
(Tentative Schedule)

Site	Head Available	Estimated Low-Water 24-Hr. Hp.	Average Estimated 24-Hr. Low-Water Hp.
Morrisburg-Rapide Plat	11–15	170,000– 230,000	200,000
Long Sault Rapids	30–40	500,000– 650,000	575,000
Coteau Rapids	15–17	230,000– 260,000	250,000
Cedars Rapids†	30–32	490,000– 525,000	500,000
Split Rock and Cascades Rapids	14–18	220,000– 280,000	250,000
Lachine Rapids	20–30	300,000– 450,000	375,000
Total		1,910,000–2,395,000	2,150,000

* In this table, to have the estimates fairly representative of the possible quantities which might be expected under representative low-water flow conditions, some allowances have been made for efficiency and other factors.

† Under development for about one-third of the low-water flow of the river. Consideration would be given to the possibility of combining the Coteau, Cedars, Split Rock and Cascades; also of increasing the Lachine power.

The above estimate, excluding ice conditions, is conservative. Under a "diversity load factor," such as is experienced by the Hydro-Electric Power Commission of Ontario, Canada's 1,800,000 hp. would take care of a power demand of some 2,400,000 hp.

Canada's share of this power belongs respectively to the provinces of Ontario and Quebec. The federal government has the rights in and jurisdiction over navigation. When the time comes for international questions in connection with the development of this river to be adjusted to admit of proper development, there is no doubt that the various interests involved, whether federal, provincial, corporate or private, will, respectively, be fully taken care of. Perhaps, for example, some arrangement may be made by which the federal governments shall provide the dams for navigation purposes, making available for each province its share of water power under an arrangement by which the provinces would assume such financial and other responsibilities as were purely incident to the power assets.

THE Priorities Division of the War Industries Board recognizes the whole-hearted support accorded by the industries of this nation to the regulations governing priorities promulgated during the period of active hostilities and expresses its deep sense of appreciation of that united coöperation. The public interest, as well as the interest of the individual industries, demands that the flow of materials, equipment, supplies, fuel, transportation and labor which has heretofore been diverted to war industries should now as promptly as possible, without unnecessarily disturbing the equilibrium of industry, be rediverted to its accustomed and normal channels.—*Edwin B. Parker, Priorities Commissioner.*

Viewing the Problems of Reconstruction

Representatives of Manufacturers and Central Stations Contribute to the Presentation and Hopefulness of Views on the Outlook—A Wide Range of Issues Is Seen as the New Era Unfolds

THAT it is a time of change, but that the changes mean on the whole a large demand for electrical energy, large demand for industrial and household apparatus and supplies, is the indicated viewpoint of statements to the ELECTRICAL WORLD.

MOVE SLOWLY IN WORKING OUT NEW PROBLEMS

Sydney W. Ashe, educational and welfare department of the General Electric Works, Pittsfield, Mass., said to the ELECTRICAL WORLD:

"In considering reconstruction we should remember that intensive coöperation, supplemented with thrift, discipline, unusual effort and sacrifice, won the war for America. The problem of reconstruction must be worked out along similar lines. Much thought must be given immediately to reducing the high cost of living. If the cost of living remains high and a surplus of labor is created, the country will face a serious situation. People must be encouraged to continue to produce food, to buy in bulk and to conserve. Reducing the cost of living is paramount.

"In addition to easing the food situation, we must give more attention in our organizations to equalizing wages for similar tasks. It is not so much the rate of pay which an employee receives that causes discussion, but how this rate compares with that of other departments doing similar work. If in one department doing semi-skilled work the wages are high owing to a shortage of help and nothing is done to create an additional supply of help by training additional employees. this one department may throw the whole organization out of gear. We need a largely increased use of factory training schools, schools which are flexible and which may be used to equalize the distribution of help, besides giving a sufficient training before placing new employees on production. In other words, equalize the distribution of labor and reduce shop inefficiency.

"Then, again, time itself is a cure-all for many ills, and we must move slowly in working out new problems, having confidence meantime in the natural vitality of our country."

"FROM DAY TO DAY"

A letter to the ELECTRICAL WORLD from an official of extensive operating and executive experience says:

"In the absence of a precedent, it seems to me the situation as to future demands on our industries has hardly developed far enough for us to comprehend what we have to meet. When we begin to get some vision of the conditions in Europe, from which during the past years the news has been so strictly censored as to give us little actual information, and we further know more as to the stability of the governments in Russia, Germany and Austria and something of the financial arrangements involved in peace terms, we may be able to form some conception of the industrial problem we have to meet and some idea of the time element involved.

"Until we do get a comprehensive view it seems to me that all that can be done is to follow such steps as from day to day appear sound. There may be individual industries where the course will be more clear.

"I think everybody is practically agreed that industry will require time for readjustment, but I do not believe as much time will be required by the electrical industry as by others, for the reason that other industries must have power while they are in operation. The use of power will probably drop off rapidly with the cessation of war activities, but as the other industries begin to manufacture on new lines they will require power, and the use of this power will be reflected in the earnings of the power companies some time in advance of the marketing of the manufactured products. There was a considerable lag in the advance of rates for power after the cost of operation began to overtake the gross revenue. I assume there will be a corresponding lag in the reduction of rates which will in a measure offset the curtailment of power.

"The power companies may have some spare plant capacity beyond their needs for a time, but they will have no large and useless inventories to scrap, so that on the whole they have little to fear. The efforts made by the government in the direction of conservation of power have shown the necessity of the central station to an extent that years of advertising by these central stations could never have accomplished. When the industrial readjustment is completed it seems to me the activity is likely to be as great as during the period of the war, although on somewhat different lines."

PROBLEMS FOR THE MANUFACTURER

The great problems of the hour for the electrical manufacturer as seen by the president of an important Middle Western manufacturing concern are:

"1. Adjusting industry to the rapid cancellation of government orders actually taking place.

"2. Effecting the transition which is bound to come from war labor costs down to the inevitable necessities of peace operations.

"3. Adjusting material costs gradually down, so as to avoid a critical shrinkage of values, back to the normal costs of material for peace times.

"I see no reason why there should be any delay in the revival of full activity in the electrical industry, unless it be the impoverished condition of the central stations. The country as a whole appreciates their difficulties of financing, however, and I get the impression that the public service commissions are disposed to meet their necessities for advances in rates. This period of difficulty may possibly lead to one important change in central-station practice, namely, requiring the consumer to purchase all the equipment, including the supply transformer, essential to his needs.

"The capital requirements of the central stations, in view of the possibilities of rapid extension of use of electrical energy, are going to make it good business on their part to throw as large a portion of the equipment costs on the customer as possible."

Success Rests on Labor and Capital

Another Middle Western manufacturer whose rapid achievement of success has been notable said:

"I believe the electrical industry should think accurately and fairly on the problems which are now before us as a result of the ending of the war. From our standpoint we see a wonderful future ahead if labor and capital will simply be fair to each other and try to stick together for the benefit of the whole country.

"In my opinion there is no question as to the markets available for manufacturers of electrical apparatus, both at home and abroad. We, although a small company, have found it possible to develop an export business in the past three years which is now much larger than our entire business was four years ago. As evidence of our faith in the export trade, I might say that we now have our own office at Rio Janeiro, a branch assembling plant at Osaka, Japan, a complete branch factory at Toronto, operated by our Canadian company, and we are planning to establish branch assembling or even manufacturing plants in South America, South Africa, France, and possibly Australia, within the coming year.

"The whole success of the big program, however, in my mind rests upon an adequate consideration and treatment of relations of labor and capital, with absolute fairness toward one another."

Utilities Should Get Themselves Understood

William E. Keily of Chicago, who is an observer and student of public utility relations, has made the following comment concerning one of the problems of utilities during the period of reconstruction:

"It seems to me that at this time the utilities should make an effort to get themselves understood. It is no use delving into the past for the cause, but while there are utilities and utilities, it does seem to be the fact that the public is mistrustful of some of the utilities—of the greed and lack of good faith that are alleged to characterize them.

"For their part, the utilities as a class may be said to be afraid of the public, or, more properly, of the governmental agencies of the public. The utilities seem to have an uneasy sense of insecurity in performing their very important work. They generally welcome fair and just regulation by the public, recognizing that such regulation should be made, but in very many cases they fear for their investment; the managers, laden with the responsibility of the interests of stockholders and employees, feel that their position and their desire to do right are not understood; they have some apprehension that the investment and jobs of those whom the represent will be taken away from them or curtailed in some way.

"Getting down to bedrock, therefore, it would seem that the public should endeavor to cast aside its suspicions and the utilities their fear. Let simple justice prevail. The utilities might say to the public: If it is really in the public interest that the utilities should not merely be controlled, but actually owned and operated, by municipal, state or federal government, so be it. But we declare our solemn belief that private ownership, subject to fair public regulation, is better for the people because it insures the benefits of private initiative, including careful management and continuity of management. In other words, Americans of energy and capacity work best when working for a stake depending on their own efforts. In this case the stake should be a reasonable return on private capital, sufficient to attract the brains that are necessary to the continued improvement and economical operation of the public utilities.

"The foregoing are simply some abstract observations relating to a very great and complicated subject. I simply express my personal belief that this is peculiarly a time when the public and the utilities should strive to understand each other with justice and good faith, the public putting away its old-time suspicions, and the utilities on their part meeting the public honestly and without fear."

IN PLANNING FOR THE DEVELOPMENT OF THE FUTURE, THE CENTRAL-STATION COMPANIES WILL GIVE CAREFUL ATTENTION TO NEW INDUSTRIES WHICH WILL PROMOTE THE INDUSTRIAL EXPANSION OF THE COMMUNITIES

Removing Obstacles to Power-Factor Charge

Necessity of Standard Method of Measuring Power Factor and Instrument That Would Be Universally Applicable—Examination Into the Methods That Are Now Employed in Widely Separated Plants

BY WILL BROWN
Electric Machinery Company

IF THERE were a standard method of metering power factor and a standard instrument which could be placed in universal use, it would be a fairly simple matter to base rates on power factor. As the situation stands, however, it is by no means a simple matter. Nevertheless, it must be done, and the numerous examples quoted below are proof of the fact that it can and will be done.

Periodic tests made with portable power-factor meters constitute a method very commonly employed, as indicated by the following statements from central stations:

Milwaukee Electric Railway & Light Company.—The company has no one instrument to determine the average power factor. It is determined by voltmeter, ammeter and wattmeter tests, when it is apparent that the power factor is low.

Wilkes-Barre (Pa.) Company.—We use ammeter and voltmeter readings to determine power factor of customer's load.

GRAPHIC POWER-FACTOR METERS

Quite a number of companies use some form of curve-drawing power-factor meter. The following examples are typical:

Wisconsin Power, Light & Heat Company.—The power factor of any customer's load, where we have any doubt as to its being maintained at the proper figure, is tested by temporarily installing the necessary graphic power-factor meter.

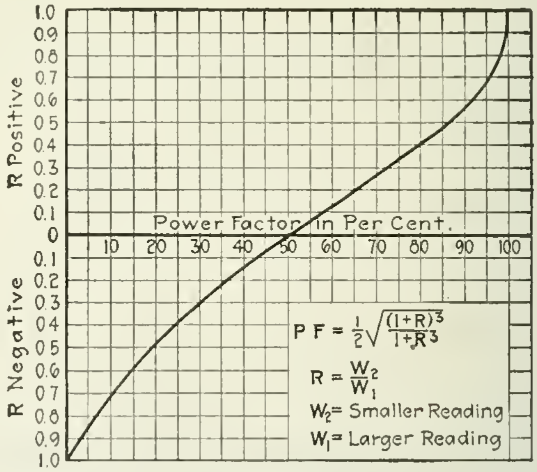
Rome (N. Y.) Gas, Electric Light & Power Company.—The graphic power-factor recording instrument which we have in use has a chart 60 ft. (18 m.) long and an eight-day movement. The instrument is of a switchboard type with all the resistances mounted on pipe framework in order to make it portable. It is our plan to connect this with each power customer for a week at a time as often as necessary and secure the average power factor during the heavy load for the week from the chart. We believe that this method would be sufficiently accurate for all practical purposes. Of course, it would be more convenient to have an instrument at each installation if the company felt warranted in going to the necessary expenditure.

The power companies in the Niagara district have made extensive use of graphic power-factor meters. There are probably more graphic power-factor meters installed in this district than in any other part of the country. The Niagara, Lockport & Ontario Power Company states that it uses a graphic recording power-factor meter installed on switchboards of all large power consumers. The power factor obtained at the time that the demand meter registers the maximum energy demand is used for computing 90 per cent of the kva. demand at that time.

The following power companies are getting reasonably satisfactory results from the use of graphic power-factor meters: Harrisburg (Pa.) Light & Power Company; Edison Electric Company, Lancaster, Pa.; Mahoning & Shenango Railway & Light Company, Youngstown, Ohio; Shenango Valley Electric Light Company, Sharon, Pa.; New Castle (Pa.) Electric Company; Pennsylvania Power Company, Ellwood City, Pa.; Republic Railway & Light Company, Youngstown, Ohio; Rochester (N. Y.) Railway & Light Company; Empire Gas & Electric Company, Auburn, N. Y.; Richmond Light & Railway Company, New Brighton, N. Y.; Northern Indiana Gas & Electric Company, Hammond, Ind.; Claremont (N. H.) Power Company; Northern Ohio Traction & Light Company, Akron, Ohio, and others.

It can be said for the graphic meter that it does give a fairly accurate history of the customer's power factor over a stated length of time. The person who examines the chart must have a good idea of the size and characteristics of the customer's load before he can make intelligent use of the information which the chart supplies, however.

TWO SINGLE-PHASE WATTHOUR-METER METHODS



POWER FACTOR OBTAINABLE FROM RATIO OF WATT-METER READINGS

In a three-phase, three-wire circuit, the power factor can be calculated from the readings of two wattmeters connected in the standard method for measuring power, as follows: $[(W_1 - W_2) (W_1 + W_2)] \sqrt{3} = \tan \theta$, where W_1 is the larger reading which is always positive, and W_2 is the smaller reading, which may be either positive or negative. The method is good for balanced loads.

Some of the best examples of rate making based on average power factor are found in Canada. In the heavy power districts of which Toronto and Montreal are the centers the power companies use two single-phase watt-hour meters. One meter is connected to record true energy while the other is connected with its potential coils reversed. The power factor is derived from the formula $\sqrt{3}B \div 2A = \tan \theta$, wherein A is the indication or record of the standard connected meter, B that of the reversed instrument, and θ the angle whose cosine is the power factor. This method of metering can only be used where the three phases are balanced.*

The following extract from a contract of the Montreal Light, Heat & Power Company refers to another method of using two single-phase watt-hour-meter readings:

> The minimum monthly average power factor of the electrical energy taken under this contract shall not be less than 85 per cent, and it is to be determined monthly from the ratio of the readings of two single-phase watt-hour meters. If the power factor of the electrical energy taken under this contract is found to be less than that specified, then the consumer shall pay for the electrical energy taken on the basis of the minimum power factor as specified herein.

In applying this ruling the power factor is readily obtained by the use of a chart like that shown herewith. So far as practical results are concerned, the method of billing and metering described seems to be the most accurate and practicable yet employed for this purpose. A clerk with no technical experience using this chart can figure out the average power factor of the customer's loads, and the whole thing becomes a simple matter of routine bookkeeping. Nothing is left to chance, and it can be seen that all the possibilities of error, such as the human element naturally involves in power-factor tests, etc., are avoided. It is interesting to note that the average power costs in the districts where this method of determining the power factor is used are very low.

Companies in the United States making use of two single-phase watt-hour meters on three-phase systems have the following to say:

> *Penn Central Light & Power Company, Altoona, Pa.*—Average power factor as defined by kw.-hr./kva.-hr. is calculated by our company from the readings obtained from two single-phase watt-hour meters over the period of time in which the power factor is to be determined, tests having been made to prove that the load and voltage are balanced across the three phases of the three-phase installation. We also use graphic power-factor meters for this work to some extent, where power factor for very short periods is in question.
>
> *Central Power Company, Canton, Ohio.*—We use the readings of two single-phase watt-hour meters and also power-factor indicators.
>
> *Trinidad (Col.) Electric Transmission, Railway & Gas Company.*—On all our large installations where we desire to keep tab on the power factor we use two single-phase watt-hour meters. Two single-phase meters will give the average power factor for any one day, week, month or period, as desired.
>
> *Toledo (Ohio) Railways & Light Company.*—Our method of metering is to use two single-phase watt-hour meters or ammeter and voltmeter with wattmeter.

The Cleveland Electric Illuminating Company usually makes its power-factor tests by single-phase integrating watt-hour meters set for a week or ten days.

A prominent authority on meters says:

The question of just how the charge for the service shall vary with power factor is a broad one and must necessarily depend upon the devices for measuring power factor. A device for determining kilovolt-ampere-hours as well as kilowatt-hours would be ideal in determining this matter, but unfortunately we have as yet no device which will determine kilovolt-ampere-hours. The nearest thing is the use of two wattmeters, as is apparently being done in Toronto and Montreal. This gives the average power factor over the entire period, but does not give the power factor of the maximum demand, which is really of more importance than the average power factor, since it is that quantity which fixes the amount of the equipment necessary to serve the customer.

"I have in mind a method of obtaining kilovolt-ampere-hours, but the device for measuring this quantity is not yet developed. I hope to be able to devote some study to this device in the near future, and if anything comes from this study, the device will undoubtedly be marketed at some future date."

EFFECT OF POWER FACTOR ON COST OF ENERGY

Professor Arno has expressed the opinion† that consumers ought to be charged for the energy actually consumed and metered and in addition ought to pay for a certain fraction of the difference between the amount consumed and the apparent amount consumed, which is the product of volts and amperes. This fraction would vary according to the circumstances and may be anything between a quarter and a half. Let us take it as one-third. Then a little calculation will show that the consumer will pay for two-thirds of the power actually supplied, together with one-third of the power apparently supplied.

Professor Arno's method of using meters to carry out this idea is described in the Swiss patents Nos. 55,774 and 55,973 and is somewhat as follows: A Ferraris system of meter is used. He proposes to displace the driving active field due to the volts with respect to the driving active field due to the current by a certain angle in a backward direction. This angle would be greater than 90 deg., and its precise value would depend on the variations of the phase displacement with which the meter was expected to deal. It would thus be likely to have values between 100 deg. and 114 deg. This meter would then give the reading of the amount of power for which the consumer has to pay directly. If the load is free from induction, the results are exactly the same as those given by a power meter; if it is inductive, a higher reading is given.

But there are objections to this method. The readings are not given in the lawful unit, the watt, but in a complex unit, which is difficult to explain. In some countries such proceedings are illegal. These meters give no idea of the power actually taken from the mains, which is a disadvantage from the management point of view; in fact, it is difficult to tell how the network is working unless the power put into and taken out of the network is known. And, apart from the question of explaining the system to the consumer, there may be many cases in which it would be still more difficult to justify the results. Thus, a man might obviously reduce his intake and yet find that, owing to a change in the power factor, his bills remained the same as before. Further, if a meter had been adjusted so as to read according to a certain fraction, say, one-third, of the apparent power, it could not easily be changed so as to allow for one-quarter, even if the conditions demanded such an alteration. Once the fraction or angle of displacement has been fixed it cannot be altered. If the character of the load were to change in the process of time, and motors were gradually added to a lighting load, or a predominantly lighting load, a meter which read properly for power factors between 1 and 0.8 would be wrong for conditions where the power factor varied from 0.9 to 0.5, as might well be the case with a motor load. Neither is the "complex" meter so good as the ordinary type in respect of the magnitude of the torque, the no-load current and simple means of calibration.

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*See ELECTRICAL WORLD, Jan. 19, 1918, p. 140, for accurate measurement of power factor on unbalanced loads.

†Abstract of an article in the *Elektrotechnische Zeitschrift*, Heft 39, 1915.

The disease of low power factor is insidious, and its victims are frequently unaware of the fact that they are sufferers. Very few of them will deny the evil effects of low power factor. They will all readily agree that the other fellow is suffering from it, but they simply don't wake up to the fact that the thing is right in their own plant. That is the reason so many evils have been allowed to grow to large proportions. In the future every user of electric power must recognize that proper consideration of power factor is an obligation which he owes the community.

REHABILITATING A SMALL CENTRAL-STATION SYSTEM

Conditions That May Be Found on Small Systems and How They Were Improved in One Case Without Great Expense

BY LEO LUSTIG
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OWING to the great increase of connected load and previous unsystematical extension of lines and addition of transformers, the Compañia Central de Electricidad y Traccion in Ciego de Avila, a Cuban city of about 16,000 inhabitants, had to redesign and reconstruct its entire distribution system to serve its loads. As in many smaller plants, and especially in countries like Cuba, where intelligent help is relatively scarce, the extension of lines was done by simply using wire which was at hand and by increasing the size of transformers or adding a new one, generally a very small one. Distribution was accomplished by three-phase feeders operating at 2300 volts and by single-phase transformers with 110-volt secondaries. No care was taken to balance loads on the generators, which had twice as much current in one phase as in the other two in some cases. Even worse conditions existed on feeders. Some transformers were greatly overloaded (120 per cent), while others carried hardly 25 per cent load. The secondary distribution system consisted mainly of Nos. 8, 10, 12 and 14 wire, of which more than 1500 lb. was later taken down. Owing to the fact that soldering of wire connections was the exception rather than the rule, the voltage drop was considerable, the voltage being as low as 60 volts in many places. The differences in voltage were very large.

In remodeling the system it was the object to:

1. Obtain the best possible distribution conditions using the existing equipment.

2. Adapt the system to motor service. Up to that time the plant operated only at night for lighting service.

3. To establish a system of recording individual consumers' loads that could be used in preventing breakdown of transformers due to overload.

First, a plan of the whole distribution system was made and the consumers' connected loads indicated thereon by marks of different color. This map was used for redesigning the network and installing transformers as near as possible to the centers of load. Between 7 p.m. and 9 p.m., which happened to be the most important period in this case, the transformer and line loads and voltages were measured. After the transformers were reconnected to meet the conditions observed the loads on the generators and feeders were balanced within 5 or 10 per cent. This in itself was of considerable benefit. In many cases 10 to 20 volts increase was gained by simply reconnecting a part of the secondary circuit of one transformer to another transformer more centrally located.

These rules were observed in redesigning the line:

1. Allowing for a 50 per cent increase in the lighting load over the expected load at the end of the reconstruction, no larger than 2 or 3 per cent drop was allowed in the secondary lines up to house connections.

2. All 1½-kva. and 2-kva. transformers were discarded, keeping the smallest size (3 kva.) for single-motor loads, with a view to discarding even these in future and standardizing 5, 10, 15 and 20-kva. sizes. By doing this the investment in transformers and protective apparatus can be minimized, the maintenance expense made smaller and the transformer rating can be reduced owing to a larger diversity factor. There are now thirty-two transformers, having a total rating of 187 kva., with a connected lighting load of 270 kva.

3. For secondary distribution 2 × 110 volts was employed for all principal street mains, three wires with a neutral of about half size being used. The load was distributed so that it would be balanced under normal conditions and provision made for keeping it balanced. By making this change it was possible to use fewer and larger transformers, to use some parts of old line by adding a neutral, to reduce thereby the losses to one-quarter, and in general to keep the drop in voltage within acceptable limits without using prohibitive amounts of copper.

4. Arrangements were made for serving motors by connecting a transformer to the nearest light transformers and joining them in open delta. When the motor load increases or becomes more distributed the delta connection will be closed and the secondaries of adjacent transformers banked.

For keeping track of the loads on the distribution transformers and to insure balancing, loose-leaf records were made, a sheet or two for every 120 blocks (approximately). On these were noted the number of the house (or indentification number), name of consumer, connected load in lamps, watts or some other manner, and street. Space was left for remarks regarding interruptions of service, etc. Transformer cards were also prepared and a map of the particular transformer circuit was attached to each. On this card are the transformer rating, its phase position on the circuit, name of the circuit, location number, maximum permissible connected load, and load factor. Columns were also provided for marking connected load on each side of three-wire line, for total load, for the number of consumers, and average connected load. Space was left for test and interruption records.

Each change in connected load is recorded daily in the consumer's book and on the transformer card and plan. Most of the records are written with pencil, but the yearly records and test record are entered in ink so that the card and plan can be used for considerable time. When recording the change in load it can be observed at a glance if danger of overload or unbalancing is imminent. As there are not more than four changes a day on the average, the recording does not require more than five minutes a day.

The mechanical part of reconstruction was a big item. In the old system the transformers were mounted on the tops of the poles between primaries and secondaries. In remodeling they were mounted below the secondaries at a height of about 18 ft. (5.5 m.) above the ground so that they were easily accessible. The 15-kva. and 20-kva. transformers were provided with a platform. Fuse receptacles and lightning arresters were placed on the upper transformer cross-arms. Only soldered connections were made.

Poles were relocated, as before rehabilitation they were haphazardly placed, some being 60 ft., others 200 ft. (18 m. to 60 m.) and more apart. House connections were made in the standard way, either by tapping at pole insulators or from distribution wires inside the portals. The houses have portals almost without exception. These circuits were fed in the normal way by connecting branches at the pole insulators. Formerly the house connections were made at almost any place on the secondary line between the poles. Almost all line material taken down could be used again, and the entire work was done without interrupting service.

Ciego de Avila is the first city in Cuba where such remodeling has been undertaken. This result is due to the progressive policy of the company's vice-president, Manuel A. Cadenas. Similar and even worse conditions can be found on many other systems in Cuba.

Not only were the losses minimized and better use of equipment obtained, but the service was so improved that many consumers who were on the verge of discontinuing the use of service were induced to continue it, and in addition many of them increased their consumption.

Safeguarding Electrical Employees

How Companies Which Take an Active Interest in the Wellbeing of Their Employees Have Made Use of Protective Devices to Guard Against Personal Injuries—Care and Testing of Rubber Goods

THE electric light and power industry has always been forward in safeguarding the lives of its employees. In perhaps no other business is the "safety first" movement promoted with greater zeal. Now that the war has taken such an awful toll of human lives, it is important that still greater precautions be taken in protecting life under peace conditions. To assist in this work as it is related to the electrical field the ELECTRICAL WORLD has investigated practices in the use and care of rubber goods for the protection of electrical workmen on both overhead and underground lines and in station work, and it here presents its findings. The data and opinions given represent the results of inquiries addressed to forty-eight companies in the United States and Canada. Among these companies are organizations which have been studying and practicing the most improved safety methods for many years.

Among rubber goods which companies use regularly for protecting men are rubber gloves, linemen's shields, rubber blankets, hose, rubber armlets, rubber boots and shoes, rubber coats and hats. Rubber gloves are used almost universally. Linemen's shields are also in general favor, a few companies using blankets and hose in combination instead of shields. The more common use for blankets, however, is on work at lower potentials. The armlet is a somewhat unusual device. It is made of the same material as rubber gloves. It is worn on the forearm and extends from the wrist to the elbow. The use of rubber wearing apparel seems to be governed partly by the climatic conditions under which different companies operate and partly by the liberality of companies toward their men.

Of the forty-eight companies only four reported that linemen's shields were not used at all. The companies which do use them find them successful on all the more primary potentials as 2200 volts, 4000 volts and 6600 volts. In several instances they are employed as protection on 11,000 volts and 13,200 volts, and one company reports that it uses them continually on 14,000-volt circuits. There seems to be some difference of opinion, however, as to the advisability of using shields on these higher potentials, and some companies report that when working lines at such voltages the shields are used only to prevent loose ends of wire from whipping into the workmen.

Despite the fact that the use of shields is almost universal, no standard method of testing or of treatment of the shields seems to be in vogue. As long as the shields appear to be all right from inspection, it is general practice to use them until some especially favorable offer for trading them in comes from the manufacturer, at which time new shields are purchased. Some companies change their shields as often as every two or three years, but there are instances where the shields have been in service for more than eight years and are still doing good work.

METHODS OF TESTING SHIELDS

In some instances where shields are tested the tests are conducted upon request only, there being no regular routine for the testing. The shield to be tested is mounted on a test bar which forms one of two electrodes. The other electrode is attached to the end of a stick and is carried over the surface of the shield. A potential of 50,000 volts is applied to the shield. Breakdown is discovered from the resulting arc. No tests are made previous to the acceptance of the shields from the manufacturer. One company states that during the last two years about twenty shields have been tested with no failure.

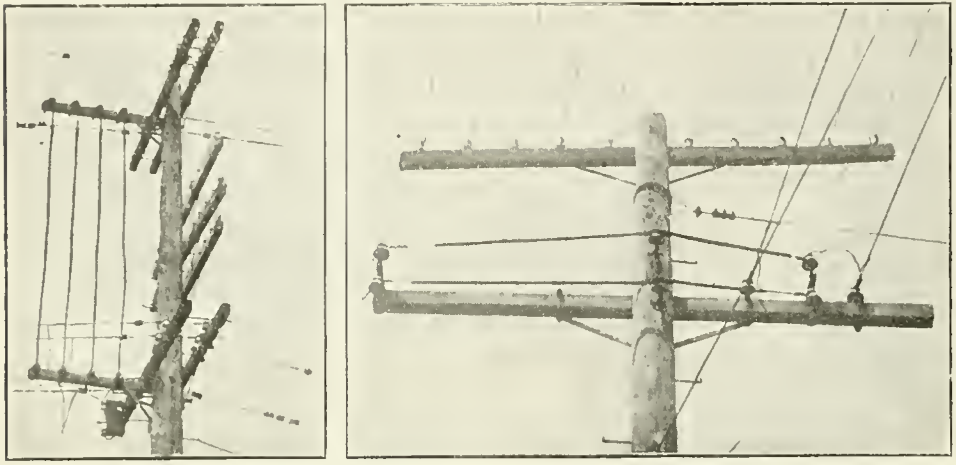


FIG. 1—RUBBER HOSE PREVENTS CONTACT WITH CIRCUITS WHICH LINEMAN HAS TO PASS

Another method of testing shields which one company employs about every eight months is to place the shield on a wooden form the exact shape of the inside of the rubber shield. This form is covered with sheet lead $\frac{1}{32}$ in. (0.79 mm.) thick. The rubber shield is then placed over this, and another sheet, $\frac{1}{32}$ in. thick, is placed over the rubber and the testing electrodes are applied to the two lead sheets. The shield is thus subjected to a potential of 10,000 volts for one minute.

Linemen's shields are sometimes subjected to what is called a submersion test once a year. The potentials used in this test vary all the way from 11,000 volts to 30,000 volts.

The shields are usually carried on the construction truck, the standard complement per truck consisting of from three to twelve shields on heavy construction wagons and from two to four shields on light construction wagons. Heavy trucks usually have not less than six shields and light trucks about four shields. There seem to be two approved methods of carrying the shields. On consists of stringing ropes along the top of covered wagons and suspending the shields on these ropes, as they would be suspended on a wire. The other means is to use especially constructed boxes to hold them. In some instances these boxes are carried on the flat top of the truck bed; in other instances arrangements have been made to stow the boxes under the chassis and thus utilize room which otherwise would be of no service. In practically all instances some precaution for ventilating these boxes is taken which will admit air without permitting water to enter. In case the shields become greasy through contact with truck axles or through other accident it has been found advisable to clean them with gasoline. But in so doing care must be taken that the shield is rubbed dry to remove all traces of gasoline before it is stored away.

In a few instances rubber blankets about 30 in. (75 cm.) square are used in place of shields. One of the companies employing blankets in this way has submitted the following report of its practice:

"Rubber blankets are used when working on or near the lines the potential of which exceeds 300 volts but does not exceed 4000 volts. Work on lines of over 4000 volts is always carried on with the lines dead and grounded. We cannot say at what potentials the blankets are successful, except that we have experienced no trouble in using them on the potentials mentioned. We have a rule forbidding the men sitting on the blankets. They are placed in position as a warning signal and as a safety device for protection in case the workmen accidentally back into or fall against the live parts. Several methods have been employed for fastening the blankets in place, the objection to most of them being that they permitted the blankets to slip around, thereby exposing the wire or other live parts. Our present practice is to use special wooden blanket fasteners similar to large spring clothespins. A heavier type of blanket is used for manhole mats, and where it is absolutely necessary to stand on top of transformers. The latter practice is discouraged as much as possible."

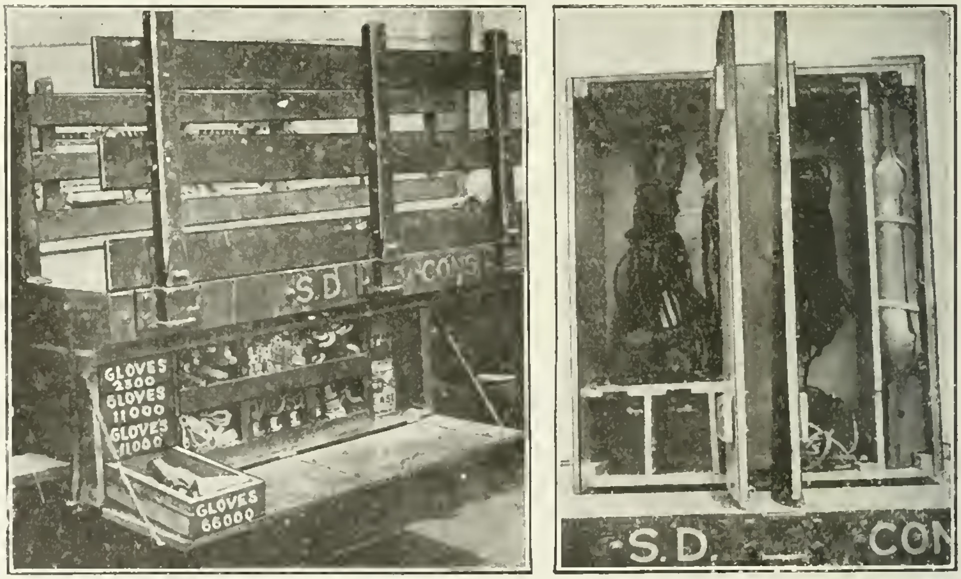


FIG. 2—RUBBER GLOVES KEPT IN DRAWERS UNDER TRUCK, AND LINEMEN'S SHIELDS IN BOX ON TOP

One company which uses rubber blankets on station buses and switchboards finds them successful up to 11,000 volts. They are fastened in place by cords and wooden strips. Another company punches eyelets in the edges of the blankets, so that they may be tied in place with marlin.

Blankets are not folded when they are stored in the trucks which carry them but are rolled around a piece of hose. Each blanket is rolled separately, so that each will get the same average amount of use. The standard complement of blankets where they replace shields is the same in number as the shields.

The usual method of testing blankets is to place them between two flat electrodes each having 1 sq.ft. (930 sq.cm.) of surface and to apply potential between these plates. The potential employed is usually 10,000 volts, and the time for which the blanket must withstand this potential is usually at least one minute. One company applies 15,000 volts for five minutes to blankets used on 13,200-volt circuits. Accurate records of the length of life of blankets are not available, but it is asserted by some companies that they should last at least one year. One company has found it can vulcanize patches on blankets successfully after they have been snagged.

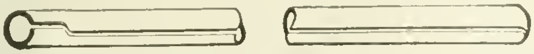


FIG. 3—METHOD OF SLITTING HOSE TO HOLD ON CONDUCTOR

How Rubber Hose Is Used for Protection

The methods of using rubber hose for protection may be divided into two general classes—first, the method which employs it for temporary protection of men working on lines, and, second, the method which places the hose permanently on all circuits that might need covering if men were climbing poles. The companies which use the former method have found it successful. The hose is cut into 3-ft. (90-cm.) lengths, either being split spirally or cut as shown in the accompanying sketch to keep it from falling off the wire. When the hose is new the lips at the end of the hose are sufficient to hold it in place. After the hose has been in use some time it becomes more flexible, and it is then necessary to wrap the ends and the middle with a few turns of friction tape as an extra precaution against its slipping off the wire. Some linemen even make a practice of using this tape with new hose. No instances were reported in which hose was used on potentials above 6600 volts.

Companies which issue hose to linemen usually consider that not less than eight pieces of hose should be carried on heavy construction trucks and not less than four pieces on service trouble and repair trucks.

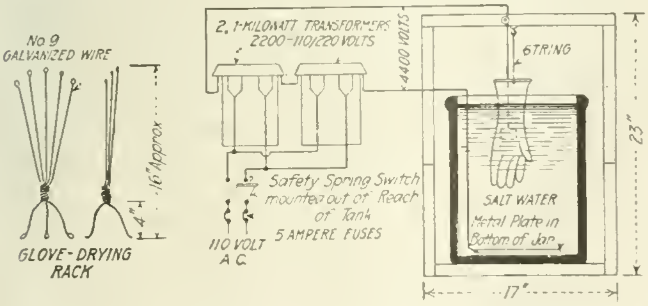


FIG. 4—METHOD OF TESTING GLOVES, WITH RACK FOR DRYING

Other companies install hose on primary wires at transformer poles leading from the primary mains down to the transformer. This practice is sometimes followed on 2300-volt, 4000-volt and 6600-volt lines and is found successful at these potentials. If the hose is installed when the transformer installation is made, it is of course not necessary to split the hose. If the hose is installed on an old installation, it is split and placed over the wires. It is then wrapped with No. 20 copper wire at intervals of about 2 ft., and the copper wire is then covered with friction tape.

Rubber Gloves Extensively Used

Of all the rubber goods in use by electric light and power companies, rubber gloves are perhaps the most numerous and most universally employed. Gloves are employed on all potentials up to and including 13,200 volts. Unlike the practice in the case of shields, blankets and hose, practically all companies have adopted methods of periodically testing gloves. Usually the number of tests which are applied to rubber gloves depends upon whether the gloves to be tested are samples submitted for future consideration or whether they are a shipment of an accepted grade of gloves. The tests of the samples is naturally more extensive than the routine tests made on rubber goods.

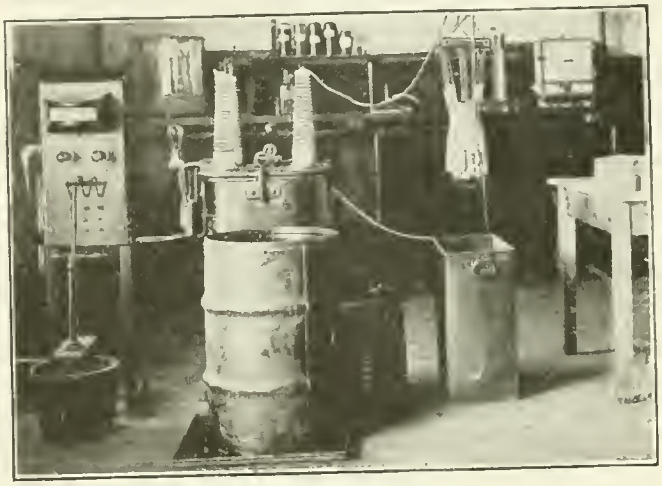


FIG. 5—HIGH-TENSION TRANSFORMER AND GLOVES READY FOR IMMERSING TO TEST

The following is a description of one of the so-called sample tests:

The gloves after being weighed are filled with water and suspended in a tank of water for a dielectric test. A flexible chain placed inside the gloves forms one terminal, and the tank itself the other. A potential of 4000 volts is then applied and the leakage measured. The gloves are kept at this voltage for one minute. The voltage is then raised until the gloves break down. This, of course, gives the maximum voltage the gloves will stand. The potential at the time of puncturing divided by the thickness of the glove in mils, at the point of failure, gives the volts per mil, which is used for comparison.

The object of the next test is to determine the mechanical properties of the rubber. This is accomplished by placing a sample of the rubber in the jaws of a machine which gradually stretches it until the load reaches a certain predetermined amount, when the load is gradually reduced and the rubber allowed to contract. This cycle of operations continues automatically until the rubber breaks. At the same time a curve is drawn on paper which shows the relation between load and elongation. The test is known as the hysteresis test, due to the fact that for any particular load the elongation on the stretching portion of the cycle—that is, when the load is applied—is less than the elongation for the same load on the contracting portion, or when the load is being removed. In other words, there is a lagging condition which is exactly analogous to the phenomenon of hysteresis.

A study of these curves indicates the relative pliability, strength, elasticity and other properties of the rubber, a knowledge of each of which is necessary in selecting the best glove. It has been found, for example, that if the rubber can be stretched too many times before breaking, it is too highly vulcanized and is just as bad for the gloves as rubber which has not been vulcanized enough.

Snagging tests are also made on samples of gloves to determine their strength and toughness. The test is made by clamping a sample of the rubber about 1 in. (2.5 cm.) in diameter in a machine so that the entire circumference is securely fastened. A small blunt plunger is then gradually forced against the center of the sample until the rubber is punctured. The pressure the rubber will stand, as indicated on the curve drawn, is a measure of its snagging-resisting qualities.

An ash test is made to determine the amount of solid matter, and this is the last test.

Routine Tests

The routine tests on shipments of gloves are as follows: (1) inspection, (2) weight, (3) leakage at rated voltage, and (4) test for one minute at rated voltage. All of these tests are made on each glove, with the exception that only four samples of each shipment received are weighed.

In addition to these tests the men in the field give them an inspection each time before using them. Holes in the gloves may often be found by taking hold of the top of the gauntlet with the fingers of both hands and whirling it around between the arms, thereby closing the end and pocketing the air. Very small pinholes cannot be found in this way and can only be located by immersing the glove in water.

Another common method of testing gloves is to fill the gloves with acidulated water and with shot to about 1 in. of the top. The gloves are then immersed in a jar of acidulated water to about the same distance from the top, and 10,000 volts is applied between an electrode placed in the glove in the shot and another electrode having a surface of about 1 sq.ft. (930 sq.cm.) in the bottom of the jar. The distance between the lower electrode in the glove is about 4 in. (10 cm.). The voltage is then applied for one minute, and if the current does not exceed 8 milliamperes or breakdown does not occur, the glove is approved for use; otherwise not.

Another company which is quite careful in testing its gloves states that in testing gloves the leakage current is taken into consideration, the maximum being 10 milliamperes at 10,000 volts. In testing the gloves this company has invariably found that the weakest part of the glove is in the crotch between the first finger and the thumb. At this point the gloves almost always run thinner than at any other point. This company has always found that where the thickness of the crotch is satisfactory the leakage current is never above the maximum.

Some companies during the last year or so have been experimenting with canvas, buckskin and horsehide gloves which are worn over the rubber gloves to prevent snagging. Almost every one who has tried this procedure concedes that it is an economical one. Still other companies which have tried it consider the use of the extra glove not economical, but very practicable, on account of the fact that it prevents snagging and hence is an extra safeguard for the man.

Rubber gloves should never be left in leather gloves over night. Taking the two sets of gloves apart prevents the rubber from deteriorating because of oil soaking through the leather gloves. In some cases the men wash their rubber gloves every other night with soap and water, which also helps to keep them in good condition. It is important that the leather glove be large enough to give plenty of finger movement. In the usual type of leather gloves employed the fingers and the thumb of the hand are entirely covered, but the back of the hand is left open. The leather gloves are usually of the ordinary length without gauntlets and are fitted with draw strings for tightening around the wrists.

According to the best information, it appears that the life of rubber gloves is a very uncertain thing. Some gloves have been known to last for two years, and others last less than two months. One company which regularly makes acceptance tests on gloves received from manufacturers states that between 1 and 2 per cent regularly fail to pass the test.

One company reports that gloves which are thrown out on account of defects brought out by electrical tests are turned over to the gas department for use by workmen as a protection for their hands against by-products which result from the manufacture of gas. With some companies periodic testing of all rubber gloves is done as often as once a week. Others think periodic tests every two months are sufficient.

Assuring Use of Safeguards

After rubber goods have been supplied to the men in sufficient quantities and "safety first" rules have been made comes the problem of seeing that the goods are used. No rules can be laid down relative to the number of pieces of rubber goods to be used on each class of work. All parts whose potential is over 300 volts with which the men can come in contact should be protected. In other words, sufficient rubber goods of the various kinds must be used to make the conditions safe for the men to work. In order to accomplish this in some instances each man is made responsible for every one else he may be working with, and the foreman is responsible for the safety of the whole gang. If a man, for example, is working on hot wires, it is of extreme importance to another working with him that he be protected just as much as practicable, so that in case of trouble the second man will not be unduly exposed in coming to the assistance of the first. Failure on the part of any one to observe the proper precaution is usually reported by the observer. It is punishable by an enforced lay-off without pay or discharge, the punishment, of course, varying with the gravity of the case. This lay-off in some instances is even extended to the foreman of the gang. All companies, however, do not believe in laying off men for failure to comply with rules.

While shields, hose and blankets and the heavier equipment are usually issued as the standard complement for each wagon, gloves, coats, boots, etc., are usually issued to the men for their personal use. Some companies issue goods free, others charge the men cost prices. The men are usually instructed that they can turn in such goods at any time they consider them unsafe. This practice is seldom abused, but some companies find it expedient to keep a record of the dates on which goods are issued. in order to keep a check on possible abuse

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

METHODS THAT SAVED COAL IN CUBAN PLANT

Savings Amounted to $20,000 a Year After Increases in Wages and Extra Expenses Had Been Met

BY HENRY G. FENTON

Owing to the cost of coal rising to three times its pre-war value in a southern Cuban plant of which the writer had charge, the coal bill became the dominating item in the cost of operating and every economy had to be practiced. All of the hands were either Cuban or Spanish, and at first they were very skeptical as to innovations. However, a study of the operating conditions showed that about 25 tons of coal per day should have been sufficient for the load, the actual consumption being from 30 tons to 35 tons. This was reduced to about 27 tons per day by the following changes:

The grate bars of all of the boilers were changed so that they had about $\frac{3}{8}$ in. (9.5 mm.) clearance between bars instead of $\frac{1}{2}$ in. (12.7 mm.) as before, thus eliminating many holes in the fire due to uneven air supply. The draft was reduced from about 0.70 in. (17.5 mm.) to 0.35 in. (9 mm.) by regulating the dampers. All of the settings were calked up with a mixture of fireclay and waste. Between boilers where there was not room for a man to enter iron plates were used to inclose the space and ashes were packed into the tops of the settings to prevent air from entering. The firemen were required to level the fuel beds with a tool made of a 1-in. (2.5-cm.) pipe with a "T" 20 in. (50 cm.) long on the end. It was found necessary to plug the handle of this and drill a few holes midway to allow the escape of the hot air inside. The soot was blown off the tubes by hand with a steam lance once in each eight-hour shift. The tubes were cleaned inside, when they were found to have $\frac{3}{32}$ in. (2.5 mm.) of scale in the lower tubes. The feed water was raised from 150 deg. Fahr. (66.5 deg. C.) to about 180 deg. Fahr. (82.2 deg. C.) by cleaning the heater and piping and changing the suction pipe from 3 in. to 5 in. (7.5 cm. to 12.5 cm.). This was later brought up to above 200 deg. by installing an economizer in the breeching, which had been made large to allow of future increase in capacity.

Draft gages were installed on each boiler and a portable gas-analysis set was purchased and a great many tests made to establish the best average draft to use. The thickness of the fuel bed was specified, and the men were taught to estimate it with some accuracy. The ashpits were kept wet and the fires were cleaned once on each shift, especially just before the peak came on. It was required that unnecesary boilers should be shut down promptly and disconnected from the steam lines at once.

The condenser of the turbine was cleaned each Monday, each tube being scraped out to insure a maximum of heat transfer, as the circulating water was of tropical temperature during the entire year. Along the bottom of the intake was found a cement-like deposit, several inches thick, which was removed at some expense with small bars and special shovels. It was floated out in small boats about 3 ft. (0.9 m.) long and a foot (300 cm.) or so wide, a little water being left in the pipe for this purpose. This improved the vacuum about $\frac{3}{4}$ in. (19 mm.). The bay was cleaned out near the intake by hand labor so as to allow cooler water to flow into the pipe.

Finally, the labor question was solved fairly well by requiring the shift engineers to remain habitually in the boiler-room, superintending the firemen and making periodical visits to the engine room, where the oilers took charge of the operating routine. One extra fireman was put on the peak-load shift and wages were raised from 10 to 15 per cent all around as soon as the saving in coal was definite enough to justify it, after which there was no tendency to object to the methods.

The total saving amounted to about $20,000 per year, owing to the extremely high price of coal, after the raise in wages and extra expenses had been met.

WHAT WAR HAS TAUGHT TO THE OPERATING MEN

Lessons that Rising Costs Made It Necessary to Learn Should Not Be Forgotten Now that Peace Has Been Declared

During the last two years boiler rooms have been operating under difficult conditions. Equipment designed and selected for handling certain grades of fuel has been operated on fuels of very inferior quality because the better grades were taken for war purposes. Naturally difficulties have arisen in trying to use coals that would be entirely unmarketable in normal times. But out of these difficulties have come valuable lessons. Methods of handling boiler-room equipment have advanced. Boilers have been tested and stokers have been reconstructed that maximum efficiency might be obtained. Baffles have been redesigned to get a minimum of draft loss consistent with good distribution of gases. Arches have been raised and lengthened to give better combustion. Settings have been rebuilt to exclude air, and car loads of setting insulation have been used with wonderful results. Pipes, feed-water heaters, boiler drumheads, pumps and engine cylinders that were never lagged before have been covered. Boilers and stokers have been tested to find the highest point of efficiency. Boiler-room instruments, including draft gages, Orsat apparatus, pyrometers and CO_2 recorders, have been purchased. Soot blowers, tube cleaners, Venturi tubes, water weighers and flow meters have been installed to get energy to the switchboard for the least expenditure of B.t.u.'s. More attention has been given to operating data. The old method of frequently blowing down boilers has been discarded in favor of a titration-test method which saves money by reducing the number of blow-downs to two or three a week. All of these things have brought out lessons that should not be wasted now that the war is over.

The foregoing is a summary of the general boiler-room situation to-day as it was given by Edward Marshall of Cincinnati to the station-operating committee of the Ohio Electric Light Association recently.

FROM THE VAULT TO THE OUTDOOR INSTALLATION

Simple Wooden Structure Eliminating Necessity of Housing Consumers' Transformers in Brick Walls Improves Rating of Apparatus

Although a company in the Central West formerly made it a general practice to construct brick vaults in which to place transformers for industrial consumers, the war led it to mount transformers on wooden structures where they would secure the utmost ventilation and hence carry the largest loads. Brick walls, while proving a good protection to the apparatus, usually do not allow the proper ventilation. Furthermore, consumers usually require that vaults for transformers used to serve them be built in some out-of-the-way place where the space taken could not be used for any other purpose. Thus the transformers were usually put in places where air was not likely to circulate.

The wooden structure consists of a four-pole or three-pole structure with the transformer placed about 12 ft. (3.6 m.) from the ground on a platform supported between the poles. The necessary disconnecting switches are placed on the poles carrying the terminals of the transmission lines. The expense in raising these transformers is not considered excessive by the engineers of this company; in fact, the amount is very little higher than that entailed in placing them in the vault.

METER INACCURACY IS FOUND DUE TO REGULATOR

Potential Side Connected Across Bus and Current Side in Load Circuit, Causing Phase Error and Voltage Difference

BY HALBERT R. THOMAS

Meter and Test Department, Southern California Edison Company

Meter trouble is not often traced to a regulator, but in one instance a rather baffling puzzle was solved when the regulator was found to be the cause of the irregularity. The meter in question was installed on a single-phase circuit supplying a constant-current transformer on street lights, and it was provided with current and potential transformers. It was tested soon after installation on its normal load and found to be several per cent in error, but was adjusted and left registering correctly. Subsequent tests, however, showed a wide range of error under different load conditions, the meter even running backward when the street-lighting transformer was short-circuited. The trouble was looked for both in the meter and its transformers, but all were found to be in good condition.

Finally the wiring was traced out, and it was found that the potential transformer had been connected across the circuit on the bus side of an induction-type regulator which served the distribution circuits, while the current transformer was connected in the street-lighting circuit on the load side of the regulator. The inaccuracy of the meter was therefore caused not only by the difference in voltage at these points, but also by the considerable phase angle between voltage and current caused by the operation of this type of regulator.

It is worthy of note that the error in the meter might not have been discovered (at least as long as it ran forward) if the standard used in testing had not been provided with its own transformers cut into the circuit independently. A "secondary" test, even to the extent of utilizing the meter potential in conjunction with a standard current transformer, would presumably have indicated that the meter was accurate, a condition far from being a fact.

RULES GOVERNING OPERATION OF LIGHTNING ARRESTERS

Michigan Company Repeats Instructions on Aluminum-Cell Lightning Arresters, Many of Its Former Operating Men Having Been in the Service

The inspection and charging of lightning arresters on high-tension transmission lines is one of the most important duties of the station operators. If these arresters are not in good condition, a total interruption to service may be the result. Because of the importance of the subject, and because new operators have been filling the places of those who went to the front, the Consumers' Power Company of Jackson, Mich., has been repeating detailed instructions regarding the care and operation of these arresters in its bulletin, the *Au Sable News*. The instructions follow in part:

> Consider the arrester alive at all times. By daily inspection be sure the pipe framework and guard railing are thoroughly grounded. Before any repair work is done on the arresters, open the horn gaps wide and ground the tanks and all insulated parts before touching any parts of the arrester, except the horn-gap operating handle and the transfer-device hand wheel. The arresters must be charged at least once each twenty-four hours. If the temperature around the arrester is 100 deg. Fahr. or higher, charge arresters two or even three times each twenty-four hours. To charge: (1) Close horn gap quickly until all arcing has stopped. Hold gap closed for five seconds. (2) Open gaps quickly to wide-open positions. (3) Reverse transfer switch. (4) Close gaps again for five seconds. (5) Open gaps quickly to wide-open position. (6) Set transfer switch in normal position. (7) Set gaps in normal position. Make note in log book, also on station record sheet, each time the arresters are charged, and also note any unusual occurrences or conditions such as: (1) The arc on the horn refusing to break when gaps are set to operating position. (2) Oil thrown from tanks or rumbling noise in the tanks. (A slight sizzling noise is often noticed when charging; this not not objectionable.) (3) Any arcing around arrester except at the horn. (4) Excessive charging current as shown by heavy yellow flaring arc at the horns.

The importance of careful inspection of arresters and insulators is also insisted on

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

PARTIAL-PAYMENT PLAN BRINGS BIGGER BUSINESS

Brooklyn Edison Company Sells Any Article Priced at More Than $6 on Deferred Payments if Purchaser So Wishes

Attention was directed to the psychological value of the deferred-payment plan by T. I. Jones, general sales agent of the Edison Illuminating Company of Brooklyn, N. Y., in a paper on merchandising of appliances, read before the supply jobbers' recent Cleveland meeting. Mr. Jones said in part:

"A far greater volume of business may be done with the installment-payment method than if payment in full is adhered to. The lure of partial payments is not limited to people who cannot afford to pay in full. Many a washing machine is sold to a consumer who could afford to pay, but would not pay, in full at any one time the sum of $125 or more, but who is willing to buy a machine on an initial payment of $25 and the balance in monthly installments.

"It has been the practice of the Brooklyn Edison company to sell on partial payments if desired any article the sale price of which is over $6, adding a carrying charge to cover interest, bookkeeping and collecting."

ALL CO-OPERATION MUST NOT COME FROM CENTRAL STATION

Brooklyn Sales Manager Points Out Present Merchandising Position of Utilities and How They Came to Be There

The dealer in electrical appliances other than the central station, it was suggested by T. I. Jones, general agent of the Brooklyn Edison company, at the recent Cleveland meeting of the Electrical Supply Jobbers' Association, should not develop an attitude of mind, as frequently happens, which leads him to see only one side, and that the temporary and immediate side, of the merchandising question.

"He should not expect all the 'coöperation' to come from the central sation," said Mr. Jones. "He must remember the expensive and laborious central-station pioneering that has helped so much to make possible the present volume of appliance business. He must remember that the central station is usually the largest merchandiser of electrical appliances in its community, frequently doing more business than all the other retailers combined, and is entitled to consideration from that standpoint. He must remember, what has already been set forth, the present importance of the appliance load to the central station in connection with residence revenues. He must remember the fact that the central station, by reason of its relation to the customer as a purveyor of electric energy, is frequently in the best strategic position to sell him electrical merchandise, but that every article sold broadens the field and opens new avenues to wiring jobs and future sales of electrical appliances.

"Recalling these facts, he must recognize, in friendly fairness, that many, if not most, of the central stations are handling their merchandising problems in a broad and coöperative spirit, as real leaders, and he must let his response, wherever deserved, be one of cordiality and coöperation, for mutual advantage."

EFFECT OF DAYLIGHT SAVING AT CANTON, ILL.

Opinion Is Expressed that While Some Coal Saving Was Made, It Was Not in Proportion to the Loss of Revenue

"It is very difficult for us to find wherein there was any considerable saving effected by the daylight-saving campaign and the lightless nights," said E. H. Negley, secretary and manager of the Canton (Ill.) Gas & Electric Company. "As nearly as we are able to ascertain, our lighting revenue was reduced about 10 per cent during the period covered by the lightless nights and the change of time, but so far as concerns being able to trace the coal saving, this is a very hard thing to do. It is possible that some saving was effected, but it was not in proportion to the loss of revenue. While the station is in operation the discontinuance of a few lamps here and there is scarcely noticeable, and we believe 5 per cent saving in the coal would be a conservative figure.

"To obtain some idea as to how much coal this amounts to, it could only be figured on the basis of just what coal was actually used for the lighting business, and as nearly as we are able to ascertain the lighting business in our city is only about 20 per cent of our total output. Fgured on a saving of 5 per cent of this coal, we are able to account only for a saving of about 150 tons during the entire eight months in which the daylight-saving plan was effective."

CHANGE IS ANTICIPATED IN FINANCING POLICY

Some Prospective Customers Consider that the War Is Over and Utilities Ought No Longer to Ask Customers to Finance Extensions

During the war, when capital was out of the reach of the average central station, prospective customers were asked by many companies to finance their own line extension and transformer installations. On account of the urgent demand for power and because in so many instances the government recognized the fairness of the utility's request for assistance, this policy was successful.

Now that the war is virtually over, central stations are already being forced to consider going back to their old policy of completely financing their customers or adopting some new policy which will be a compromise between the two extremes. The necessity for making this change is becoming more apparent every day to central stations' commercial organizations, which are negotiating with prospective power customers. Frequently these purchasers show no hesitancy in telling power salesmen that it is time the central station again relieved its prospective customers of such additional financial strain.

There are some utility men who think that central stations will never go back to their pre-war financing policy. Some even have suggested that perhaps it would be good policy to require customers to own such utilization apparatus as transformers, meters, etc. On this point, however, a representative of a prominent central station which had experience with this plan several years ago and entirely discarded it has stated that that particular company will not again require customers to own transformers.

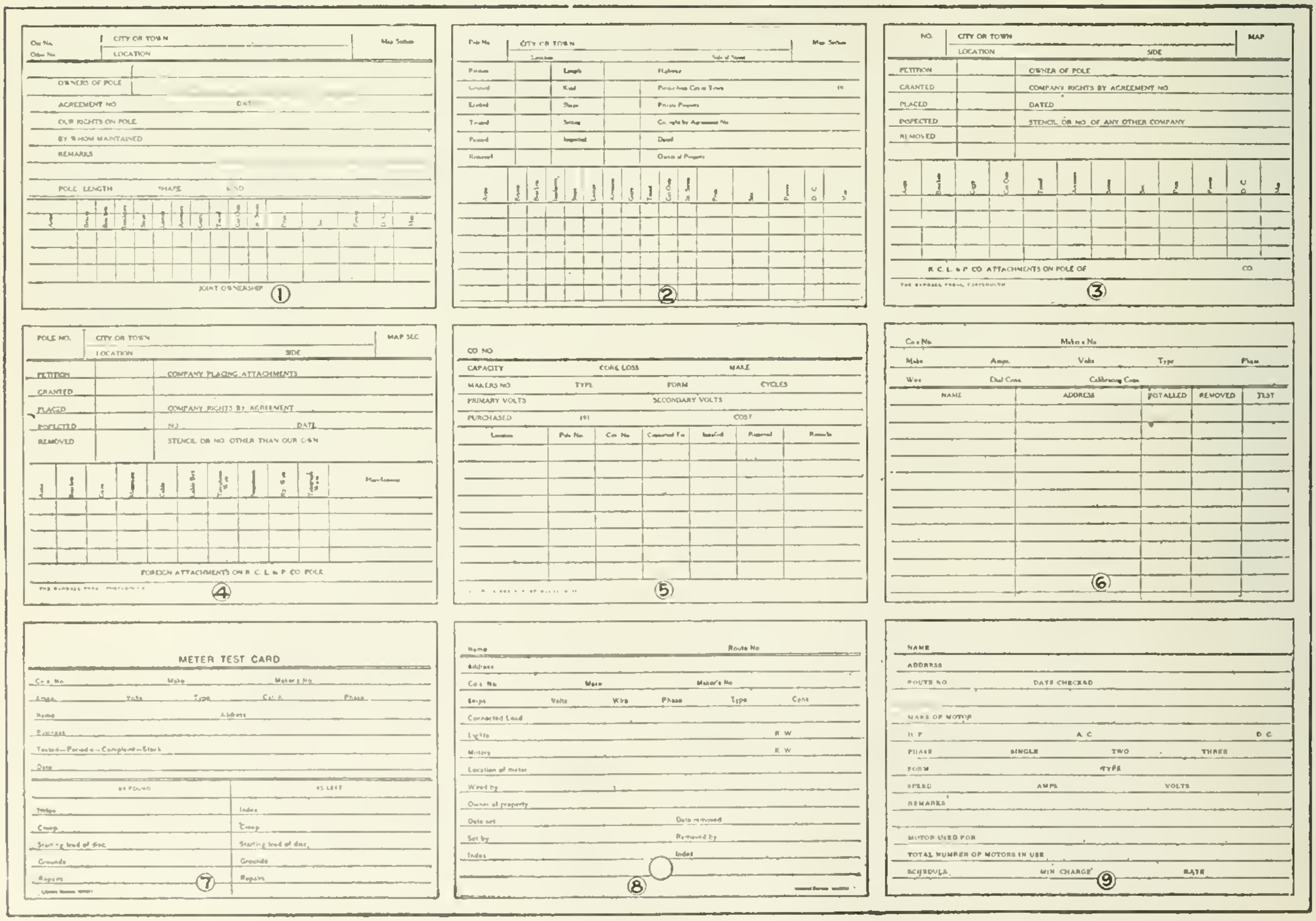
This same company will soon revise its financing policy, but will probably not go back to its pre-war policy of extending lines to every one who may ask for electric power.

Care will be used in analyzing the business of prospective customers to see if they have a good chance to succeed in their venture before money is spent in building for the purpose of serving them, with the possibility of finding the investment eventually useless.

RECORDING SYSTEM FOR DISTRIBUTION EQUIPMENT

Portsmouth (N. H.) Utility Makes Use of Cards to Show Not Only Equipment but Customer Data as Well

An unusually complete card record system for the distribution plant has recently been designed by the engineering department of the Rockingham County Light & Power Company, Portsmouth, N. H. The cards are about 4 in. by 6 in. in size and provide for recording full particulars in regard to pole data, transformer information, customers' connected loads, meter histories, meter tests, foreign attachments on company poles, company attachments on foreign poles, and motor listings. Some of these cards are reproduced on this page. The pole cards include one for joint ownership data, and this, with the separate cards for foreign attachment data and shared pole service, afford a means of conveniently filing material bearing upon intercompany relations and public aspects of line service which often is not readily available.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RECORDING SYSTEM FOR DISTRIBUTION EQUIPMENT

1. Joint-pole ownership card. 2. Company pole data. 3. Company attachments on foreign poles. 4. Foreign attachment card. 5. Transformer record card. 6. Motor record card. 7. Meter test card. 8. Customer's installation data card. 9. Motor record card

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Zigzag Leakage in Induction Motors.—K. Sachs.—The zigzag leakage in induction-motor windings is calculated on the lines of a former article (*Abs.* 150, 1916) by considering the difference in flux that is produced by the stator and rotor ampere turns. These ampere turns are evaluated for various characteristic moments by replacing the polyphase windings by equivalent single-phase windings lying in slots that are unequally spaced so as to imitate the effect of the unequal currents flowing in the different phases of the windings at the moments considered.—*Science Abstracts, Section B*, April 30, 1918. (Abstracted from *Electrot. u. Maschinenbau*, Jan. 20, 1918.)

Performance Diagram of Series Polyphase Collector-Ring Motors.—A. Tumerelle.—A short article explaining a diagram which, it is said, makes it easy to obtain characteristic curves for a series polyphase motor energized at constant current.—*Revue Générale de l' Electricité*, Nov. 2, 1918.

Note on the Theory of Blondel Concerning the Armature Reaction of Alternators.—A. Léauté.—If an alternator is supposed to be operated at constant excitation and with variable current output but gives a constant terminal voltage, the extremity of the vector representing the (Joubert) internal emf. lies on a Pascal limaçon. A simple construction of this curve is given. It is shown that the power output of the machine decreases as the phase lag increases, the law being given in terms of three parameters.—*Science Abstracts, Section B*, April 30, 1918. (Abstracted from *Comptes Rendus*, Dec. 31, 1917.)

Lamps and Lighting

Use of Glow Lamps for Projection Apparatus.—O. Kruh.—The author investigates, by the aid of formulas, the characteristics of glow-lamp filaments lending themselves to optical projection. A table of intrinsic brilliancies of the chief illuminants is given. Improvements have been made by mounting filaments as adjacent bars close together and increasing the diameter so as to use larger currents. The effect of altering the space between adjacent filaments is discussed. The chief difficulty in making lamps for very high currents has hitherto been the mounting of the leading-in wires. This, the author states, has been overcome, and lamps consuming up to 200 amp., giving 30,000 cp. to 40,000 cp. (Hefner) and working at 0.25 watt per candlepower (Helner), have been made. The candlepower attainable is limited only by the size of the bulb, but up to 100,000 cp. could be obtained if there were need. The effective intrinsic brilliancy of the source can also be increased by placing a mirror behind it, forming an image of the filaments in the spaces between the successive bars. In this way an intrinsic brilliancy of 70 cp. per millimeter, approaching that of the carbon arc, can be secured.—*Science Abstracts, Section B*, April 30, 1918. (Abstracted from *Elektrot. u. Maschinenbau*, Dec. 2, 1917.)

Generation, Transmission and Distribution

Electric Power Supply in British East Africa.—A bill dealing in a comprehensive manner with electric power supply is now awaiting its final reading in the Legislative Council of the Protectorate of British East Africa. The measure is designed to foster and promote bulk supply systems and to insure standardization. In accordance with it public and local authorities must adopt the standards and specifications of the British Engineering Standards Association. Practically every form of energy which industrialists in the protectorate will require must be obtained from or by the conversion of electrical energy generated by water power, internal-combustion engines or oil-fired boilers. Consequently a demand for apparatus is developing, and it is suggested that British manufacturers should not neglect this opportunity. Inquiries from those interested should be addressed to the Government Electrical Engineer, Nairobi, British East Africa.—London *Engineer*, Oct. 18, 1918.

Fusibility of Coal Ash and Determination of Softening Temperature.—Arno C. Fieldner, Albert E. Hall and Alexander L. Field.—This publication reviews the literature on the subject and gives in detail the effect of various oxidizing, reducing and neutral atmospheres, such as are found in various parts of the fuel bed, on the softening temperature of ash when molded in the form of Seger cones. As a result of this study a practical method of determining fusibility has been developed whereby the ash is caused to soften and form slags in which the iron exists in approximately the same state of oxidation as the iron in fuel-bed clinkers. Although it is believed that this method will indicate the probable clinkering characteristics of a coal better than any fusion tests heretofore described, the bureau does not recommend the general use of the method in coal specifications until it is justified by actual trial in furnace tests of different coals. As no fusibility test of a well-mixed sample of the average ash of a coal takes into account the physical distribution of the impurities in the coal as burned, much additional investigation is needed to establish the exact relation of these laboratory fusibility tests to clinker formation. Such investigations are being undertaken by the bureau at this time.—*Bulletin No. 129, Bureau of Mines.*

Partial Transformation of Direct-Current Reducer Sets.—C. L. Brown.—A scheme is described for reducing direct-current voltages to lower values in which the motor and generator are connected in series across the line and the load is taken direct from the generator terminals. This method is somewhat analogous to the well-known auto-transformation for alternating systems. The two advantages gained are higher combined efficiency and cheaper initial cost. Formulas are devised to show the size of machines required and thus the saving in initial cost. The importance of the greater overall efficiency is also demonstrated. It is pointed out that the advantages of this system are not so great when the voltage transformation ratio is high.—London *Electrical Review*, Nov. 8, 1918.

Care in Operation of Small Turbines.—J. A. MacMurchy.—The small turbine is subject to greater neglect, because of its size, than large main units. In this article the author points out the parts of small turbines that should receive particular attention.—*Power*, Nov. 19, 1918.

Principles of Waterwheel Design. — David R. Shearer.—Some of the underlying principles in the design of waterwheels are given, referring particularly to the relation between the velocity of the water and the peripheral speed of the wheel.—*Power*, Nov. 19, 1918.

Economic Design of High-Tension Transmission Lines.— G. Horstmann—It is shown that a number of causes tend to fix the voltages used in high-tension transmission lines, and that economic considerations are assuming a greater importance in their design than questions of voltage drop. The operating costs of lines are analyzed and a distinction is drawn between the most economical section for a given load and the most economical load for a given section. The latter condition is carefully examined with reference to the 100,000-volt lines of the Murg transmission system. Voltage regulators enable the lines to be calculated according to economic considerations alone, and this enables higher current densities to be used than if the voltage drop were the important factor. As the size of transmission systems increases, the attendant difficulties increase to a greater extent, thus tending to set limits to the size of stations and the voltage transmission. It appears that the upper limit for distribution is 20,000 volts and for transmission 110,000 volts. The cost of three transmission lines and particulars of installation, insulators, masts, copper, etc., are set out in a number of tables. These lines are situated between Mannheim and Karlsruhe, Karlsruhe and Muggensturm, and Rotenfels and Forbach, and the costs per kilometer are worked out for each in the form $a + bs$, where s is the section of the conductor. The cost of a transmission line is made up of the costs of corona and insulation losses and copper losses and interest on the capital invested. If those costs are plotted as functions of the current for various sections, a series of curves are obtained which show that there is a certain section for each value of the current that gives the smallest total cost. The calculations show that, although the most economical section is obtained with a constant current density for all loads, the most economical current density varies with the section of the wire, increasing with decreasing section.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Elektrot. Zeits.*, May 16, 1918.)

Prevention of Line Disturbances by Suppression of Arcing Earths.—W. Peterson.—The production of arcing earths is caused by the piling up of unidirectional charges that are left on the conductors when the arc ceases temporarily. The process of the building up of such charges is examined, and it is shown that in alternating-current networks twice the line voltage may be reached in a defective conductor through the superposition of the phase voltage and the above-mentioned static electric charge. This causes the arc to be restarted, and a succession of such restartings of the arc may cause the voltage to rise to four times the original value. As the capacity of the circuit available when the arc breaks is only half as great as that of the circuit presented to the restarted arc, the frequency during the quenching of the arc is generally twice as great as that during the ignition of the arc. Theoretical wave shapes are drawn and compared with actual oscillograms. Tables are given showing the voltages to be expected in single-phase and three-phase networks for different values of the capacities of the conductors between one another and to earth. The second portion of the article is concerned with methods of preventing the formation of excess voltages, and it is concluded that a very useful precaution is to earth the neutral point through a resistance of such a magnitude that the steady charge is reduced in half a period to such an extent that the sum of the phase voltage and the voltage due to the steady charge does not greatly exceed the normal phase voltage. It is remarkable to note how completely the arc collapses on the introduction of such a resistance and how the violent and noisy arc to earth degenerates into a silently burning arc that goes out very quickly. A similar result can be achieved with horn dischargers associated with suitable resistances, but this method is inferior to the former, as the protective device only comes into operation after the high voltage has been generated. Earthing through reactive coils is very effective. In contrast with the resistance method, several periods elapse before the voltage reaches its normal value, and after the arc is quenched the voltage rises so slowly that the best conditions are presented for the extinction of the arc, because the ionizing of the air vanishes before the voltage rises to such values as to maintain an arc. These theoretical conclusions are borne out by tests made of three interconnected 10-kw. networks fed by four separate generating stations. Earths were produced by damped string, but arcing earths were not produced when the system was suitably protected by reactive coils to earth. When using such coils it was found that exact adjustment of the constants of the coil is unimportant, and that good protection is afforded by coils varying somewhat in their dimensions.—*Science Abstracts, Section B*, September, 1918. (Abstracted from *Electrot. u. Maschinenbau*, June 30, 1918.)

Traction

Electrification of Main Lines in Austria.—Utilization of water power for electrification of state railways was first studied in 1891, but the Ministry of Railways did not take up the whole matter systematically until 1905. The present notes outline the state program in the problem of utilizing all available water power in the Alpine district and in Dalmatia and electrifying as much as possible of 4400 km. of state and 1800 km. of private railways south of the Danube. A comprehensive study has been completed of all the geological, hydraulic and climatic factors involved, as well as of the alternative schemes for utilizing and dividing the available water power. During this period the Railway Department has developed sixteen large water-power schemes of 70,000 minimum and 150,000 maximum hp. Opposition has been offered to speculative enterprises and to schemes involving the splitting up of valuable falls. In the original report of the commission appointed to consider the electrification of the state railways, particulars are given concerning electric railways in Germany, Switzerland, France, Italy, Russia, Sweden and Norway, particularly in respect of the state measures taken to secure technical and financial efficiency.—*Science Abstracts, Section B*, April 30, 1918. (Abstracted from *Elektrot. u. Maschinenbau*, Jan. 13, 1918.)

Regeneration of Energy by Electric Railways.—The author examines first the effect of regeneration upon the annual cost of energy. This varies according to whether the installation is steam or hydroelectric and according to the extent of traffic. It is more advantageous with steam. The author holds that electrical braking still presents difficulties with heavy trains and that more experience is necessary.—*Revue Générale de Electricité*, Sept. 14, 1918. (Abstracted from *Schweiz, Bauzeitung*, May 4, 1918.)

Installations, Systems and Appliances

Electrical Clock Installations.—C. SYLVESTER.—Of the several systems of electrical clocks in use at the present time the "Synchronome" system in particular is briefly described in this article. It consist of a special form of automatic switch so combined with a pendulum that it operates exactly at each half minute. The action of the switch is arranged to impart an impulse to the pendulum so that it is kept swinging for the next thirty seconds. The object of the switch is to send impulses each half minute to a series of clocks placed in any desired position. Details of the system are described by the use of appropriate diagrams.—London *Electricity*, Oct. 11, 1918.

Extracting Nitric Acid from the Air.—M. Andriessen has, it is said, invented a new arc furnace which produces nitric acid in greater volume than has hitherto been possible. The arc is derived from alternating current at high tension. It crosses a current of air forced between the electrodes. The flame passes between the poles of an electromagnet which gives it a helical form, this permitting its inclosure in a very restricted space and an energetic cooling of the nitrous gas. With an oven of 35 kw. the inventor claims to have obtained 70 g. of acid as compared with 45 g. with a Birkeland oven of the same size. It is contended however, that this output has been equaled and even exceeded at Notodden, and that inventors should now seek above all to extract the acid from very much diluted nitrous gas in the most economic way possible.—*Revue Générale de l'Electricité*, Sept. 21, 1918. (Abstracted from *Elektrot. Zeits.*, May 30, 1918.)

Metallic Tube for Joining Lengths of Bare Cable.—The two ends of the cable to be joined are inserted in a flat metallic tube in which a series of notches are then made with a special tool. The contact is perfect, and it would require almost as much force to pull out the ends of the cable as to break it. The system is recommended because of its simplicity and because it can be employed in the coldest weather.—*Revue Générale de l'Electricité*, Sept. 7, 1918. (Abstracted from *Elektrot. Zeits.*, May 9, 1918.)

Electrophysics and Magnetism

Cables of Iron and Zinc Substitute for Copper.—Extensive researches have been carried on by the Swedish government industrial commission to find a substitute which could be used instead of copper cables for transmission lines so as not to handicap the general electrification of the many industrial and rural districts of the country. The metals which are produced within the country in sufficient quantities for this purpose are iron and zinc. For cases where large amounts of power are to be transmitted and for long distances where iron conductors cannot be used it has been found that a combination of iron and zinc may be used. Zinc can naturally not be used alone on account of its mechanical properties without being armored with iron to increase its strength. The cables which were tested by the commission both mechanically and electrically were made in seven strands with the center wire of zinc and the outside wires alternately zinc and galvanized iron, so that the cable consisted of four parts of zinc and three of iron. This construction is intended for areas from 16 sq.mm. to 50 sq.mm., while for from 50 sq.mm. to 95 sq.mm. the cables are made with nineteen strands, ten of zinc and nine of iron. For still larger sizes thirty-seven strands are used, twenty-two of zinc and fifteen of iron. The specific resistance of these combination zinc-iron cables was found to be 0.0740 to 0.0780 at 50 cycles, 2000 deg. C. and 0.5 amp. per square millimeter, thus corresponding to a conductivity of 12.8 to 13.5. As the copper which can be obtained under present conditions for transmission-line purposes is very poor and in general has a conductivity not exceeding 55, it may be seen that a copper conductor can be replaced with a combination zinc-iron conductor having about four times the cross-section and about three and three-tenths times the weight.—Report of Swedish government industrial commission.

Miscellaneous

Last Words in Electrical Vehicle Development.—A. JACKSON MARSHALL.—The speeds of electrical vehicles, both passenger and commercial types, are adequate to meet fully all rational requirements in large cities, according to the author. As soon as financial conditions will permit an extensive electric taxicab service will be begun in New York and other cities. Electric taxicabs have been successful in Europe for some years. Tests are cited to show that electrically propelled vehicles will actually cover a route more quickly where a number of stops are required, in urban traffic, than horse-drawn or gas-propelled vehicles. It is pointed out that electric vehicles may be used for long-distance traveling, and attention is called to the popularity of electric vehicles in New Zealand. In discussing excessive speeds of ponderous vehicles, their destructiveness to road contruction is emphasized. A formula is suggested considering the case of a 20,000-lb. (9000-kg.) unit with a speed limited to ten miles per hour, showing that the "fee" or compensation for road wear would be $20, and where the speed obtainable is fifteen miles per hour the fee would be $45. Thus it would seem that high speed is particularly undesirable from the standpoint of road maintenance.—*Southwestern Electrician*, Oct. 31, 1918.

Readers' Views and Comments

Direct-Current Arc Welder

To the Editor of ELECTRICAL WORLD:

SIR: I have read with much interest the article on arc-welding characteristics written by J. F. Lincoln, and I agree with the conclusions which he arrived at in his analysis of the alternating-current welder. However, I wish to call attention to a statement made in the preliminary paragraph of the article regarding the direct-current machines.

In speaking of direct-current machines of the inherent regulating type, Mr. Lincoln states that it is impossible to get more than one arc off such a machine. However, I would call his attention to the fact that with the closed-circuit system which is covered by a series of patents issued to the writer as many as ten arcs may be connected to an inherently regulated machine, said arcs being connected in series.

ARC WELDING MACHINE COMPANY, INC.
O. A. Kenyon, chief engineer.
New York City.

The Demand-Meter Situation

To the Editor of ELECTRICAL WORLD:

SIR: Referring to the article on "The Demand-Meter Situation" in the Nov. 30 issue of the ELECTRICAL WORLD, we have the following comment to make:

There is no question that the choice of demand-recording instruments is governed largely by the magnitude and character of the customer's load. The annual income from the smaller customers will not warrant the installation of high-grade graphic recording instruments, whereas in the case of the larger customers the amounts involved are such that the highest grade equipment obtainable should be installed.

Where loads are heavy and variable a continuous graphic record of the load as a rule furnishes the most satisfactory basis for demand charging. The continuous record simplifies greatly the settling of disputes, makes available to the customer the necessary information to enable him to control his demand, and also furnishes the operating department with valuable data regarding load conditions on the customer's premises.

The maintenance of demand-metering equipment requires taking care of both the metering system and the chart-driving mechanism. The metering systems employed in most modern meters have been thoroughly tried out by the manufacturer and are easily maintained. Judging from the variety of types of timing systems employed, it is apparent that there is still considerable difference of opinion as to the best timing system for this work.

The writer's experience indicates that the greatest reliability and lowest maintenance cost result from the use of extremely heavy clock parts, together with the highest practical torque. A clock designed along these lines and inclosed in a separate dust-tight case will give satisfactory service for a period of from one to two years without any cleaning or attention other than winding.

At this time the metering and recording of demand is a very important subject from the standpoint both of the central stations and the instrument manufacturers. Articles such as the one written by C. F. Mathes, constructively criticising the instruments available at this time, are very interesting to the manufacturers.

D. J. ANGUS,
Treasurer and chief engineer the Esterline Company.
Indianapolis, Ind.

Effect of Transient Voltages on Dielectrics

To the Editor of ELECTRICAL WORLD:

SIR: Two gaps set for equal 60-cycle spark-over voltages may have entirely different lightning spark-over voltages. For instance, if a needle and a sphere gap are each set at 150 kv., 60 cycles (operating frequency), the transient spark-over voltage of the sphere will be 100 kv., while that of the needle may be 200 kv. or more. Obviously, the needle, or point, is not a good arrester gap. The sphere or sphere-horn arrester gap is now used. The effect of wave front can be nicely shown experimentally by connecting a sphere gap and a needle gap directly in parallel. If the sphere gap is set at 200 kv., 60 cycles, and the needle gap at 100 kv., 60 cycles, an impulse may be made to pass at will over one gap or the other by a change in the wave front. The reason why lightning spark-overs and break-downs often occur in such unexpected ways is thus readily explained.

Two insulators or bushings with equal 60-cycle spark-over voltages may have entirely different lightning spark-over voltages. It is important to know how to design them so that the transient spark-over voltage is high. It is also important to know how to arrange the insulation in apparatus to obtain the maximum lightning puncture voltage. Many other interesting effects can be obtained with the impulse generator, for instance: (a) Corona produced by voltages lasting only one micro-second can be distinctly seen. (b) With some of the very steep wave fronts a 25,000-volt "drop" has been obtained from a 3-in. (7.6-cm.) copper tube about a meter long.

The "impulse generator" for studying the effect of transient voltages on dielectrics was devised some time ago by the writer. By means of this generator impulse voltages of any given wave front, length of tail, etc., can be obtained. In tests recently made the rate of voltage application was, in some cases, 1000 kv. per micro-second. The impulse generator and the early work were described in a paper, "Effect of Transient Voltages on Dielectrics," presented before the American Institute of Electrical Engineers in September, 1915, and also in the *General Electric Review* under the head of "Lightning," June, 1916.

Pittsfield, Mass. F. W. PEEK, JR.

The Nature of Induced Emf. Again

To the Editor of ELECTRICAL WORLD:

SIR: Among the aviation problems brought out by the war there was one on speed measurement of airplanes with respect to the fixed ground. It is simple enough to measure the speed of an airplane with respect to the ambient air by means of some wind-wheel device, but such an indication is not very accurate in determining the position of the airplane as long as one does not know the velocity or the direction of the wind in which the airplane is traveling. In night flying, in sea patrol or during a fog the aviator is entirely lost as to his position. But to determine away up in the clouds his speed with respect to terra firma one would have to have something there that is invariable with respect to the ground, and about the only thing of this kind seems to be the earth's magnetic field. Imagine a long horizontal wire stretched across the airplane; an electromotive force will be induced in this fire by the vertical component of the earth's magnetic field, and emf. is directly proportional to the velocity of the moving airplane. Consequently, the induced voltage is a simple measure of this velocity, assuming the field to be constant.

In spite of the apparent simplicity of such an arrangement it seems to be impossible to measure this emf. by any known means. The two leads from the ends of the wire to the galvanometer will be cut by the same magnetic field in the opposite direction, and the total voltage registered by the instrument will be zero. Placing these leads in an iron pipe so as to shield them from the magnetic field would not remedy the matter in the least. Our experience with electrical machinery shows that the same emf. is induced in conductors placed on a smooth armature as in those embedded in slots.

Here is then an interesting practical problem and also an extremely important theoretical proposition about measuring the induced emf. in a moving conductor when the measuring device itself is moving with the conductor. I recommend both aspects of this problem to your readers.

V. KARAPETOFF.
Cornell University, Ithaca, N. Y.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

SYMPATHETIC STRIKE AT GENERAL ELECTRIC WORKS

Action Follows Reduction of Forces Because of Canceled Orders—Attitude of Company Stated by President E. W. Rice, Jr.

A sympathetic strike began at most of the plants of the General Electric Company on Dec. 19. Some of the men who went out had returned on Dec. 24, but it was estimated on Tuesday of this week that 20,000 men were out, including 15,600 at Schenectady. At Erie, Pa., where the cause of the strike originated, it was stated that 800 out of 5200 men were out, 400 of the 1200 employees who went out originally having returned. None went out at Lynn.

The strike followed the action of the company in laying off 200 men at the Erie works, of whom ten were union members, as a result of the cancellation of orders following the signing of the armistice. The union demands the reinstatement of the men, and other matters have also been raised, such as the recognition of the union.

President Rice Makes Statement

Replying to a communication from John I. Wickham, secretary-treasurer Electrical Manufacturing Industry Labor Federation, E. W. Rice, Jr., president General Electric Company, says that the committee plan of employee representation adopted in Erie "is the same kind of a plan as that adopted in Pittsfield and in Lynn, pursuant to the award of the National War Labor Board, and there is no reason for the elimination of the plan at Erie, unless similar plans are also eliminated at Lynn and Pittsfield, where they have been established under governmental direction. The elimination of such plans the company would decline."

On the question of lay-off the answer of Mr. Rice is: "That the managers of the several plants are taking up with their employees' committees the question of so handling the work as to reduce to a minimum either inconvenience or hardship from loss of work resulting from the cancellation of orders due to the cessation of the war and the diminished volume of orders received. This is a problem which involves different conditions in the different plants and in the several departments of each plant, and it must be worked out with the management of each individual plant because no general rules can be made applicable to all."

Regarding the reëmployment of men in the service Mr. Rice wrote: "On Dec. 11, 1918, a letter was issued to all departments of the company stating that it was a matter of great pride to the company that 8000 of its employees had entered the military or naval service and that we would welcome them home with pleasure and reinstate them in our employ. Your attempt to create the impression that we are refusing reëmployment to our men who have been in the service is unworthy of you, and the statement is untrue."

Condition at Pittsfield Works

Substantially half the employees at Pittsfield remained loyal, and at the Lynn (Mass.) works of the company all the employees remained at work and were at their posts on Monday of this week. It was claimed by the Pittsfield employees that local grievances existed in addition to the Erie matter which were factors in the strike action. In a statement to the press, General Manager C. C. Chesney of the Pittsfield works discussed the situation as follows:

"Orders have fallen off at least 50 per cent at the Pittsfield plant during the past month, and in that time we have laid off about 1200 hands. It has been the policy of the Pittsfield management to allow the latest to go unless we are obliged to discharge certain men because of inefficiency. For the past day or two I have been working on a short-time schedule which will go into effect next Monday, and thereby we hope to keep all our present force employed. Because of the comparatively few orders we now have on hand here in Pittsfield, the works could be closed entirely until Jan. 1 and the company would suffer little, if any, inconvenience and loss.

"There is absolutely no truth in the charge made by the men that the management has shown discrimination. Only yesterday I issued a notice assuring reëmployment for men who gave up their positions to serve the country. We claim, furthermore, that the strike is in clear violation of our mutual agreement with the War Labor Board."

Mr. Chesney said that the records of the company's employment office show that eighty-six men who have been in the service have asked for their old positions. Eighty have been placed; two have been promised work to start Jan. 1 at their own request, and the four others have been offered jobs but have not accepted them. It was further stated at the plant that the shop committee on appeals, organized by the War Labor Board, informed General Superintendent A. F. Blaisdell that it had no complaint to make regarding conditions at the Pittsfield works. The strike was still in force on Monday.

Present Status of Orders

Some figures as to the present volume of business and orders of the General Electric Company have been made public in connection with the strike situation. The 1917 orders aggregated $247,000,000. Orders received during the seven weeks prior to Dec. 14 were at the rate of $157,000,000 a year. In the last two weeks of this period they were at the rate of $125,000,000.

COPPER EXPORT PRICE IS FIXED AT 23 CENTS

Newly Formed Association of Producers Announces Figure for Export Metal of 3 Cents per Pound Below War Price

The newly formed Copper Export Association has fixed a price of 23 cents per pound for copper for export. This is 3 cents per pound lower than the prevailing government figure, which is to be discontinued. Since the War Industries Board relinquished its control of prices the copper producers have not made any announcements as to price, but bids have been on the market at from 19 to 23 cents. While the new figure applies only to export business, it is taken as an indication of reduction in the domestic price.

HYDRO RATES MUST CARRY COST OF AUXILIARY SUPPLY

Massachusetts Commission So Decides in the Case of Turners Falls Company and the Town of Westfield

The rates established by the Turners Falls Power & Electric Company and the town of Westfield, Mass., in a five-year contract signed April 13, 1918, are declared reasonable in a decision of the Massachusetts Gas and Electric Light Commission issued recently. The town owns a municipal lighting plant which it has operated since 1899. Hitherto it has generated in its station the electricity distributed.

The Turners Falls company recently entered Westfield to supply energy to the Springfield street railway. The question of buying electricity from the company was then under debate, and in the franchise it was stipulated that the municipality should be free to buy and the company be required to sell to the town such energy as it might need at any time for distribution to its inhabitants or for municipal use.

The subsequent contract calls for the delivery to the town for five years of all the electricity required by it, with a maximum of 2000 kw. continuously available at the point of delivery and such additional amounts available as may be necessary upon twenty-four hours' notice to the company. The following rates were established: For the first 1,000,000 kw.-hr. delivered in any operating year, $0.012 per kilowatt-hour; for the next 1,000,000 kw.-hr., $0.011; for the next 1,000,000 kw.-hr., and for all energy in excess of 3,000,000 kw.-hr., $0.009.

A coal clause provides for an increase in price to be paid by the town equivalent to 1 mill per kilowatt-hour for each dollar in excess of $5 per gross ton for coal delivered at the company's Hampden steam plant in Chicopee, and a corresponding decrease of 1 mill per kilowatt-hour for each dollar of coal cost below $4. At present the company's coal cost is about $8 per gross ton, making the rates 3 mills higher than the foregoing, with a range of from $0.015 to $0.012.

In accordance with the contract, the town requested the commission to pass upon the fairness of the coal clause. After investigation, the commission said in part:

> In common with all hydroelectric companies, the Turners Falls company is obliged to supplement its water-generated by steam-generated power in order to provide reliable and continuous service, and it has recently put in operation a modern and well-equipped steam plant at Chicopee for this purpose. To what degree it will be called upon to supplement the [Connecticut] river's supply is a matter of almost pure speculation, subject as the problem is to the immutable laws of nature, but that year in and year out the plant will be called on to supply a substatial amount is certain. It is true that the cost of coal does not directly affect the cost of electricity generated by water, but it must be borne in mind that every unit of hydroelectric energy has to carry the cost of the auxiliary which takes the burden when the water power fails.
>
> In view then of all the circumstances affecting the parties to this agreement, the so-called excess-coal-cost charge provision of the contract may in general terms be regarded as reasonably applicable and workable as a fair measure of the increased cost due to coal in a modern and efficiently managed station such as this is. Taking into account then the life of the agreement, the board is of the opinion that the rates and excess-coal-cost charge are fair and do not require modification. The return of normal conditions and a longer experience with the bulk supply of electricity will test the soundness of this conclusion before the present agreement expires and enable the town to see what modification, if any, should be required upon its renewal. Meantime the citizens of the town may feel assured that in the mind of the board sound and good judgment has been exercised in securing for the town an abundant and reliable supply of electricity upon favorable terms.

ABANDON CONSERVATION IN INCANDESCENT LAMPS

With Change in Fuel Conditions It Is No Longer Necessary to Continue Voluntary Restrictions and Limitations

The lamp conservation program involving restrictions upon inefficient incandescent lamps has been abandoned. John W. Lieb, chairman of the lamp committee, has sent the following letter to manufacturers:

> The urgent necessity of fuel conservation having largely passed, particularly in connection with the supply of bituminous coal to central stations, it was thought by your committee that it would be no longer necessary to continue the voluntary restrictions and limitations placed upon the production and distribution of inefficient incandescent electric lamps in accordance with the program approved by the United States Fuel Administration.
>
> This question was taken up at a recent conference in Washington, and we now have official approval of this course as disclosed in the attached letter just forwarded to us by the Fuel Administration through our Washington office.
>
> It is, therefore, suggested that all voluntary restrictions and limitations assumed by manufacturers, central stations, supply dealers, jobbers, etc., be withdrawn, effective Jan. 1, 1919. This conforms also to action under similar circumstances on the part of the War Industries Board as indicated by the inclosed statement.
>
> In terminating our relations as a committee of representatives I desire to express my warm appreciation of the hearty coöperation that I have enjoyed from all parties interested in this important voluntary conservation program.

The letter addressed to Mr. Lieb by G. N. Allen, acting director of conservation of the United States Fuel Administration, says:

> Confirming our recent interview, we approve of the suggestion you made that under present conditions the incandescent lamp manufacturing program recently approved by this administration be abandoned.
>
> In this connection we wish you would thank the various manufacturers who entered into this voluntary agreement,

in behalf of the Fuel Administration, for their patriotic coöperation in endeavoring to assist the Fuel Administration in its efforts to conserve the coal so urgently needed for the war.

ALL PRIORITIES ARE OFFICIALLY CANCELED

Formal Announcement Made by Judge Parker and Mr. Baruch of the Passing of Priorities Rules and Pledges

Circular No. 60 of the Priorities Division of the War Industries Board, addressed to all concerned, says: "Effective Jan. 1, 1919, all the rules, regulations and directions of every nature whatsoever issued by the Priorities Division of the War Industries Board are hereby canceled, and all pledges heretofore made on the suggestion or request of the said Priorities Division are hereby revoked."

This is signed by Edwin B. Parker, Priorities Commissioner, and approved by Bernard M. Baruch, chairman War Industries Board. It is dated Dec. 20

NEW INTERCONNECTION OF CALIFORNIA POWER

Advantages Found by War Industries Board and Company Representatives in Further Connection of Pacific and Sierra Systems

Acting on the suggestion of Major George F. Sever, Pacific Coast representative of the Power Section of the War Industries Board, a committee of engineering representatives of three power companies centering at San Francisco recently held a series of meetings to consider additional interconnections between their transmission systems. At the conferences the Pacific Gas & Electric Company was represented by F. G. Baum and P. M. Downing, the Sierra & San Francisco Power Company by J. E. Woodbridge, and the Great Western Power Company by W. G. B. Euler.

In the discussions the three properties were considered as one system and a study was made of the possible advantages to the entire network to be expected from further interconnections. Between the Pacific and Great Western systems and between the Sierra and Great Western systems no further interconnections were justified, it was agreed. Between the Pacific and Sierra systems, however, another interconnection between the high-voltage network near the south end of San Francisco Bay was found desirable and was recommended.

The Port Marion substation of the Sierra company would ultimately be the better transmission center, it was agreed, for the various lines radiating from the south end of the bay. For the present, however, the best plan would be for the Pacific company temporarily to terminate its 100,000-volt line at Mission San José and step down to 50,000 volts at that point. Then a 100,000-volt branch about a mile long should be built from Mission San José to connect with the main line of the Sierra system. The Sierra company at this part of its system operates at about 105,000 volts, varying between 102,000 volts and 108,000 volts. It was the opinion of Pacific company representatives that its voltage could be brought within the same range, making unnecessary any voltage-varying devices especially for interconnection purposes.

The committee agreed that this interconnection would have "the following inherent advantages that will prove of value to both companies":

(1) A greater utilization of the hydroelectric energy that may be available at any time of the year, making it possible to combine the steam plant standby service better, at least during a certain part of daily and yearly operation.

(2) Improvement in the daily and seasonal load factor and power factor of the two systems as a whole, thus utilizing to better advantage the plant and transmission capacities of the systems.

(3) Adding an insurance feature to the service and thus reducing the capital charge of the individual companies for this purpose.

It was also thought that at some future time a consolidated substation at the south end of the bay would result in a reduction of capital and operation cost and in more effective operation.

Power from This Station Produces 5000 Tons of Coal Daily

One of the big outstanding developments in recent power transmission has to do with electrification of coal mines. Particularly in the states of Indiana, Illinois, West Virginia, Pennsylvania and Kentucky has this movement been brisk. A sizable generating station and transmission systme was financed and built in one instance almost wholly on the strength of the mining load available. In all this work the fundamental feature was the outdoor substation. While nearly every company has been striving to arrive at its own standard outdoor design in this work, there has been no concerted effort to achieve a universally standard design. Perhaps this would be impossible in view of the widely varying conditions under which different groups of substations operate. A series of standard types might be the answer.

As typical of the work in this field the endeavors of the Kentucky Utilities Company may be mentioned. The photograph which is published here shows one of a group of substations that serve the Stonega Coke & Coal Company at Big Stone Gap, Va. It is rated at 600 kva., 33,000/2300 volts. A substantial steel tower supports the disconnecting switches, choke coils and lightning arresters. The transformers rest on a concrete foundation. All 2300-volt switches and measuring instruments are inclosed in a small metal house built at the base of the tower just behind the transformers. This substation is in a valley between two mine openings from which about 5000 tons of coal is produced daily.

FUEL PROBLEMS BEFORE ENGINEERS IN BOSTON

As Fuel Costs Are Still High and Promise to Continue So, the Incentive to Conservation Remains Strong

War-time fuel problems and how they were solved were discussed at a meeting of the Boston Section of the American Society of Mechanical Engineers on Dec. 19, the principal speakers being Prof. A. E. Norton of the Massachusetts Institute of Technology; David Moffat Myers, advisory engineer United States Fuel Administration, and Perry Barker, fuel engineer, Boston.

Professor Norton described the work of the engineers who advised New England Fuel Administrator James J. Storrow, and paid a high tribute to the particular work of Dr. Ira N. Hollis, president of the Worcester Polytechnic Institute; Charles T. Main, consulting engineer, Boston, and Thomas Hawley of the Hawley School of Engineering, Boston. The speaker said that the engineering advisory committee waked up the manufacturers and power-plant owners of New England to a realization of the critical problems of fuel supply and utilization, and spoke feelingly of the coöperative gains in plant efficiency thus secured. Twenty-nine hundred steam-plant data sheets were sent out from Mr. Storrow's office, and in 1300 cases the replies necessitated correspondence with the plant owners and operators. Through the shop committee system adopted at Worcester at least 100,000 tons of coal has been saved in the year, and this movement has spread to other important Massachusetts cities with good results.

The volunteer expert engineer-inspectors who visited the power plants and made immediate recommendations for economy accomplished much good, the speaker said. No time was lost in making recommendations through ordinary clerical channels, but the inspector visiting the plant in each case filed his report on the spot and carried away a carbon copy for reference. Plant owners coöperated willingly as soon as they found that the engineer-inspectors of the Fuel Administration understood their business.

In order that a permanent contact may be maintained between mill treasurers and their power plants, some sort of a committee organization should be formed before the Fuel Administration goes out of existence. In too many cases, Professor Norton said, the mill treasurer is uninterested in fuel economy simply because of the small percentage of total supply costs represented by the coal bills.

Conservation Idea Accepted by Public

That the general public should have come to agree to the principles of fuel conservation is a triumph for the engineer's war service behind the lines, declared Mr. Myers. "It is not exaggerating," said he, "to state that the period of the war was materially shortened and that thousands of lives of our soldiers were saved by this great movement of constructive fuel conservation proposed, indorsed and largely executed by the engineers of this country. I therefore feel that I am here to-night primarily to celebrate with you this great victory of conservation."

The speaker said that a conservative estimate of the annual savings secured is 7,000,000 tons of coal in power plants, 1,000,000 tons on the railroads and 4,000,000 tons in such items as the introduction of skip-stops on electric railways, rearrangement of power plants to avoid duplication, the substitution of central power for that produced by isolated plants where such action was feasible, and the larger utilization of water power and savings in domestic consumption. Based on what has been accomplished, it should not be difficult to carry the annual savings up to 50,000,000 tons. At $5 per ton this would pay the interest on the country's war debt.

It was thought by many when the government took up the plan for power-plant inspection that many plant owners might resent this activity, but the patriotic spirit of all concerned led to excellent results. The disinterested manner in which the engineers of the administration and the various committees carried on their work resulted in their securing the full coöperation of the manufacturers and plant owners. Savings of from 5 to 30 per cent were realized in the fuel consumption of many plants.

No Relaxation Must Be Allowed

As fuel costs more than double the pre-war price and as little evidence of lower coal costs can be seen in the near future, the incentive to continue conservation work under peace conditions will be very strong. For the next few months it will be unsafe for managers to relax their efforts toward steam and fuel economy. The production of both anthracite and bituminous coal has fallen off rapidly during the past few weeks, and unless the production can be very considerably increased, stringent economies must be practiced in order to insure sufficient fuel to meet manufacturing demands.

Power-plant fuel economies have been based up to this time upon the idea of obtaining the highest possible efficiency from existing equipment, owing to the practical impossibility of securing new or improved equipment during the war. The chief factor has been the efficiency of the man behind the machine or on the factory committee, and up to the present time little or no official attention has been given to the efficiency of the apparatus and plant layout. This involves the matter of initial design and proper supervision of the changes contemplated in order that they may be made strictly in line with what will yield the highest efficiency in fuel utilization. Just before the armistice Mr. Myers proposed this question for discussion by the committee of consulting engineers of the Engineering Council, and it is hoped soon to secure a report from this committee.

The general idea is to formulate a so-called decalogue of power-plant design, treating only of fundamentals and not of specific designs. It is desirable to avoid ill-advised installations which waste fuel over long periods, and it is proposed to establish certain fundamentals of plant design which will guide plant owners and engineers in the selection of methods and equipment. The program of conservation cannot be considered comprehensive unless it treats both of operation and equipment. It is hoped to formulate the above principles before the close of the administration's work.

In closing, Mr. Myers spoke appreciatively of the disinterested services of engineers in coöperating with the Fuel Administration's efforts and pointed out the duty laid upon engineers to see to it that conservation is continued. The public has great confidence in the engineering profession as a result in part of the war.

"We should look forward," said Mr. Myers, "to the future recovery and utilization of the valuable by-products of coal resulting from low-temperature distillation. No raw coal containing these by-products should be burned directly under boilers. The resulting carbonized coal should be the boiler fuel of the future. Water powers should be developed and utilized further, though, according to Dr. Steinmetz, even when these resources are utilized to the ultimate extent they can care for only a very small fraction of the power demands of the future and coal will always of necessity be our mainstay for heat and energy."

UTILIZATION OF WAR-TIME COAL

It is estimated that New England steam coal consumers had in storage on Dec. 1, 1918, between four and five million tons of coal in excess of their supply on hand a year ago, according to a paper by Perry Barker, consulting fuel engineer, Boston. Mr. Barker pointed out that the source of coal supply for New England has not been materially different from former years but that the quality has been lower owing to the urgent need for increased production. The factors which affect the net utilization of coal for steam generation as expressed in the cost of evaporating a unit quantity of water are: (1) Cost per ton, including fixed price at the mine, freight and handling charges to the boiler furnace; (2) increased percentage of non-combustible; (3) increased percentage of volatile matter in fuel delivered to plants not having properly designed equipment for burning coal of such character; (4) decreased efficiency in burning coals not containing excessively high percentages of moisture, volatile matter or ash, but which have very low heating values due to "weathering" or heating in storage; (5) increased cost of evaporation due to poor efficiency and excessive labor and repair charges caused by using coal containing ash of a low fusing temperature.

The effect of increased percentages of ash is shown in Tables I, II and III. These figures represent from fifteen to twenty shipments of coal in each case and are typical fuels used by New England manufacturing companies. The average difference in heating value between the normal fuel and deliveries for the past year to a mill using low-volatile West Virginia coal was 3.6 per cent. This difference represents very nearly the actual decrease in evaporation per pound of coal, as the addition of this amount of impurities should have no material effect on the efficiency with which the coal is burned. The comparatively small change in the quality of the fuel from this district is due to the fact that it is all subject to rigid inspection for naval and bunkering purposes.

The average of deliveries given in Tables II and III shows a much greater increase in non-combustible material. These impurities increase the cost of delivering a unit of combustible to the point of consumption, affect the distribution of air in burning the coal, cause excessive loss of combustible in cleaning the fires and entail extra labor charge for handling the ashes. It has been estimated that the average increase in impurities in fuel delivered is as high as 5 per cent, which would represent 1,250,000 tons of additional non-combustible transported with the 25,000,000 tons of coal supplied to New England this year. In one plant burning 10,000 tons of coal a year the cost due to handling ashes alone was increased to more than $2.50 per ton, representing an additional charge of $3,800 for the year.

Table IV shows the results of tests of three deliveries to plants normally using fuel of the quality given in column 1. The coal in column 2 was used in a hand-fired plant having return-tubular boilers with low settings. The firemen reported that the coal was "flashy" and made steam quickly, but with a firing interval of twenty to thirty minutes a large loss due to incomplete combustion resulted.

TABLE I—WEST VIRGINIA LOW-VOLATILE COAL

	Normal	Average, 1918	High Ash, 1918
Moisture, per cent	2.50	3.11	2.48
Volatile matter, per cent	17.50	17.91	18.42
Fixed carbon, per cent	74.00	70.83	68.98
Ash, per cent	6.00	8.15	10.12
Sulphur, per cent	0.65	0.63	0.73
B.t.u. per pound	14,410	13,886	13,656

TABLE II—PENNSYLVANIA LOW-VOLATILE COAL

	Normal	Average, 1918	High Ash, 1918
Moisture, per cent	2.50	4.74	6.82
Volatile matter, per cent	18.50	26.09	26.00
Fixed carbon, per cent	71.50	57.19	44.67
Ash, per cent	7.50	11.98	22.51
Sulphur, per cent	1.40	1.12	1.47
B.t.u. per pound	14,125	12,554	10,047

TABLE III—PENNSYLVANIA STEAM SIZES OF ANTHRACITE

	Normal	Average, 1918	High Ash 1918
Moisture, per cent	4.50	6.92	6.77
Volatile matter, per cent	5.00	5.74	4.40
Fixed carbon, per cent	74.50	67.12	57.50
Ash, per cent	16.00	20.22	31.33
Sulphur, per cent	0.80	0.52	0.42
B.t.u. per pound	11,775	10,440	8,635

TABLE IV—TYPICAL CHANGES IN CHARACTER OF COAL FOR NEW ENGLAND STEAM PLANTS

	Normal Coal	War-Time Fuel Supply		
	1	2	3	4
Moisture, per cent	2.50	4.28	16.87	0.62
Volatile matter, per cent	18.50	34.12	28.00	19.36
Fixed carbon, per cent	71.50	47.16	44.50	67.90
Ash, per cent	7.50	14.44	10.63	12.12
Sulphur, per cent	1.20	1.94	0.46	3.61
B.t.u. per pound	14,150	12,074	8,990	13,543
Fusing temperature	2,550 deg. Fahr.			2,120 deg. Fahr.

The figures in column 3 of Table IV illustrate a type of fuel which has been delivered to New England during the past year. This "outcrop" coal is loaded from seams which have been exposed and a part of the combustible volatile matter lost. Coal of this character will not coke in the boiler furnaces, thus causing uneven distribution of air and excessive losses of combustible to the ash pits. The shipment of "outcrop" coal has been stopped by the Fuel Administration, and to date about 200 mines responsible for such fuel have been closed. The coal shown in column 4 of Table IV is of the most troublesome character owing to the low fusing temperature of the ash. It will be noted that this figure is 430 deg. Fahr. below the coal used prior to 1918. The low-fusing temperature caused excessive clinkering, particularly at the high rates of combustion necessitated by the overloaded condition of the boilers.

OPPORTUNITY FOR INDUSTRY IN THE GOVERNMENT PROGRAM

General War Service Committee of the Electrical Manufacturing Industry Offers Service of Its Organization to the Government

Bulletin No. 12 of the General War Service Committee of the Electrical Manufacturing Industry, dealing with reconstruction matters, says in part:

> From a practical standpoint war is now over, but coöperation between manufacturers and government, with the full potentiality of the emergency through which we have just passed, is ushering in an era of tremendous possibilities.
>
> At the Atlantic City conference of war service committees it was emphasized by many speakers that the best policy of this country in the matter of raw materials would be to treat even the Central Powers generously so that they may be enabled to pay the debts imposed by the war. It was clearly indicated that the supply of raw materials is insufficient to fill reconstruction needs essential to the economic development of the countries engaged in the war.
>
> To provide the opportunity for industry to mobilize and coöperate in the solution of reconstruction problems in the same manner it did for "winning the war," the Secretary of Commerce has invited fourteen of the leading men in the War Industries Board to serve as his advisers for the period of reconstruction. Industry is thus given an opportunity to continue, through its war service committees, the coöperative effort which has proved so effective in war by establishing a direct contact through the Department of Commerce between the government and industry whereby the needs of each may speedily receive due consideration and appropriate action. Accordingly your General War Service Committee has in your behalf accepted the invitation and proffered to the government the services of our war service organization.
>
> In order that we can discuss the means which will best fulfill our obligation to render full assistance to the government in this difficult situation, a general meeting will be called at the earliest possible date. Meanwhile hold fast—suffer no change of policy without consulting with your group committee.

THE HARVARD SCHOOL OF ENGINEERING ORGANIZED

Plan of Reorganization to Accord with Ruling of Massachusetts Supreme Court Regarding Use of Gordon McKay Funds

The Harvard School of Engineering, reorganized in accordance with a ruling of the Massachusetts Supreme Court regarding the use of funds willed by the late Gordon McKay, will be opened for instruction on Jan. 2, 1919. Courses will be continued during the summer in order to enable students to complete a full year's work before the opening of the academic year in September.

The school was first established in 1914, when Harvard University and the Massachusetts Institute of Technology entered into an agreement to coöperate in courses on engineering and mining. By this plan some of the funds left under the McKay will were to be used. The court held that the agreement could not be carried out under its terms, by which Harvard was made the beneficiary. Under the new plans which have been approved by the trustees of the McKay estate and the governing board of Harvard, the school will be maintained as a separate institution with the instruction wholly in charge of a Harvard faculty and will lead after four years of study to the degree of bachelor of science.

The work will be carried on in the classrooms and laboratories of the university, with the exception that arrangements may be made from time to time to utilize the facilities of other institutions, especially in the advanced technical courses, when the needs, financial resources and best interests of the school so require. This latter provision is subject to the approval of the court. Courses will be given in mechanical, civil, sanitary and electrical engineering, mining, metallurgy and industrial chemistry. The requirements for admission are to be the same as those for Harvard College. The degree of master of science, or an equivalent degree, is to be awarded upon the successful completion of at least one additional year of study. For the doctor's degree the requirements are to be similar to those in the Harvard Graduate School of Arts and Sciences.

Among the faculty are the following professors well known in the electrical world: Arthur E. Kennelly, professor of electrical engineering; Harry E. Clifford, Gordon McKay professor of electrical engineering; Comfort A. Adams, Abbott and James Lawrence professor of electrical engineering; Lionel S. Marks, professor of mechanical engineering; George W. Pierce, professor of physics and director of the Cruft memorial laboratory.

THE CENSUS OF THE 1917 ELECTRICAL INDUSTRIES

The 1917 Information as to Central Stations Is Now Being Compiled by the Census Bureau, and Early Returns Are Promised

S. L. Rogers, Director of the Census, in his annual report to the Secretary of Commerce, made public in Washington last week, announces that his bureau will soon be able to present to the public the result of the census of electrical industries which was taken during 1917.

The census, which was begun in April in Omaha, Neb., and which, in accordance with the general practice of the Census Bureau, was collected so far as possible through correspondence, will present information as to the number of establishments engaged in electrical industry, character of ownership, traffic, equipment, expenses, employees, salaries and wages, finances, etc. The compilation of this information is now under way.

In his annual report Director Rogers says:

> This census, which, under the act creating the permanent Census Bureau, has been taken quinquennially since 1902, covers central electric light and power stations, street and electric railways, telephones and telegraphs, and municipal electric fire-alarm and police-patrol signaling systems. The current inquiry is being made as of Dec. 31, 1917.
>
> By reference to the various records available, supplemented by correspondence with some 14,000 postmasters throughout the country, with state telephone associations and with public service commissions, a card index of establishments engaged in electrical industries was prepared. In formulating the schedules used, criticisms and suggestions were requested and obtained from the Interstate Commerce Commission, the American Telephone & Telegraph Company, the independent telephone companies, the American Electric Railway Association, the American Railway Accountants' Association and the National Electric Light Association, and a number of conferences were held with representatives of these organizations. All the organizations named have given their hearty coöperation and have rendered valuable assistance to the bureau in the revision of the schedules and the preparation of the reports.

INVESTIGATION OF THE MILWAUKEE PROPERTIES

Report of Hagenah & Erickson Follows Request of Employees for Higher Wages, Which Was Rejected Because of Insufficient Revenue

A report by Hagenah & Erickson of Chicago on an examination of the books and records of the Milwaukee Electric Railway & Light Company and the Milwaukee Light, Heat & Traction Company has been made public. The investigation grew out of a request on the part of the employees of the companies for increased wages, which the companies felt that they were unable to grant owing to insufficient net revenue. Permission was given to the Employees' Mutual Benefit Association, representing the employees, to satisfy itself from the books of the companies as to their ability or inability to grant the increases requested.

An auditing committee of the association, composed of G. W. Kalweit, William E. Gundlach and A. J. Killa, in recommending to the board of directors that the association accept the Hagenah & Erickson report, gives a synopsis of that document. The committee says in part:

The report points out that the value fixed by the Railroad Commission is based on average cost of labor and material for a period of years prior to 1914, that since then copper wire has increased 80 per cent, cable 50 per cent, pig iron 100 per cent, lumber 20 to 40 per cent, granite paving blocks 30 per cent, cedar poles 40 per cent, rails 40 per cent and ties 75 per cent. It points out that present-day prices ought not to be used but that higher costs would have to be applied in valuing the property in 1918. It points out that a trained and skillful organization was acknowledged as a property value in the Wisconsin Telephone Company case but was given no value in the case of the company. Except for these, it does not believe the commission's value is subject to criticism.

We understand that Hagenah & Erickson have made a great many appraisals for commissions and cities, and it is probably true that the Railroad Commission's value is not over-liberal.

The report points out that the commission allowed 3 per cent as a proper provision for depreciation in its street-railway fare case decision of June 1, 1918, and after a number of proving calculations accepts this as fair for the entire property. It points out that the method used by the commission is not open to serious criticism.

What is a fair return in this kind of business? Have the companies earned more than a fair return in the past?

The report points out that a fair return is indicated to be ordinarily not less than 7.5 per cent of the fair value of the properties. Courts and commissions have generally held that a return of from 7.5 to 8 per cent was not only reasonable but necessary to attract capital. At present a return of 8 per cent is probably too low. In the past ten years the company's return has not been unreasonable. The estimated return for the entire company in 1918 is 4.8 per cent. The railway system alone is 3.84 per cent; the electric and heating system is just over 6 per cent. These returns are indicated as being too low for the best interests of the service, which condition has already been recognized in part by the Railroad Commission of Wisconsin. We have no suggestion to make on the rate of return that is fair except to point out that savings and loan stock secured and protected by rigid state laws earns in excess of 7 per cent.

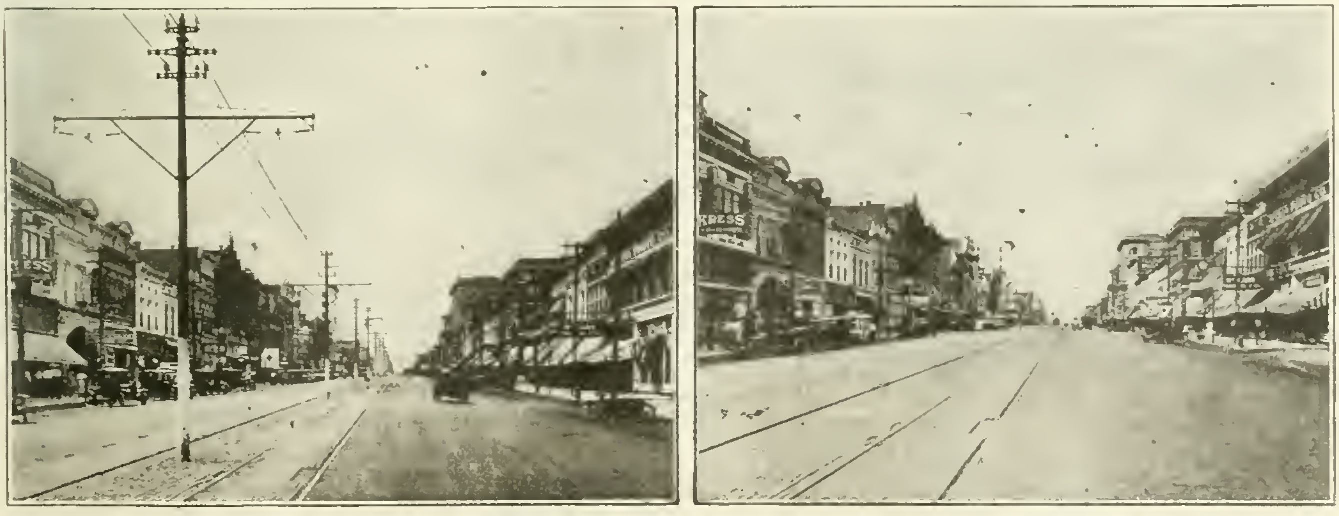
The report points out that with the adoption of the standard of wages recognized by the War Labor Board operating expenses would be increased over $900,000 per year, made up as follows: Railway employees and shop men, $640,000; electric and heat department employees, $265,000; total, $905,000. It points out that this increase in wages could not be made with present rates and could only be met when granted an increase in rates sufficient to make a wage adjustment possible and provide what is considered a fair return on the investment.

Since the report was written the Railroad Commission has increased electric rates. In addition to providing for increased cost of coal, materials and taxes, the commission has allowed 1.9 mills for wages in the electric and heating departments. This amounts to $350,000 per year. This increase in wages was made on the date the commission's order was delivered. The electric order made no provision for increased wages for street-railway employees. The $640,000 per year needed to bring railway employees' wage scales up to War Labor Board standards can be provided only through increased railway fares.

Our examination of the report and our familiarity with the accounting systems of the companies convinces us that the work of Hagenah & Erickson has been well done. The report appears to fully cover the scope of the work required by our association and to answer completely the several questions raised. We accordingly recommend the acceptance of the report.

A Business Street Before and After Rehabilitation

Garrison Avenue, in Fort Smith, Ark., was until recently a jungle of public utility poles and overhead construction. It is now a broad, clean thoroughfare from which the majority of the supporting structures have been removed. The photographs which are published here show Garrison Avenue before and after the Fort Smith Light & Traction Company had undertaken the work of rehabilitation.



A FORT SMITH (ARK.) BUSINESS STREET A FEW MONTHS AGO AND AT THE PRESENT TIME

CAPITAL ISSUES COMMITTEE WILL SUSPEND ACTIVITIES

Imperative that Capital Should Be Saved and Not Wasted—Law Sought to Prevent Sale of Fraudulent Securities

The Capital Issues Committee of the War Finance Corporation will suspend active operations on Dec. 31. Chairman Charles S. Hamlin of the committee announces that it will not be dissolved but will remain inactive unless it is found that the sale of new securities competes unduly with government financing or for other reasons it may become desirable for the committee to resume its work pending its dissolution by the President or by operation of law.

A statement by Mr. Hamlin says:

> Although the war emergency which gave rise to the creation of the committee has passed, it is nevertheless imperative that capital should be saved and not wasted, and the removal of the restraining influence exerted by the committee during its existence should not be construed as approval of the financing of unnecessary public projects or private enterprises of doubtful merit. On the contrary, the financial needs of the government and the large capital requirements of the railroads and for the readjustment of American industries to a peace basis compel strict economy in the use of new capital.
>
> While legitimate business may safely be left to work out its own problems, the Capital Issues Committee feels that it would be unfaithful to its responsibility if it failed to warn the public respecting the enormous losses sustained by the nation through the sale of worthless and fraudulent securities. In the opinion of the committee the sale of such securities should be restrained in times of peace as well as in war, and it strongly urges that Congress establish adequate machinery to put a stop to this traffic.
>
> The extent of the menace, due to the issue of such securities, to the holders of government bonds is revealed by the fact that schools are being established in some parts of the country to drill salesmen in the art of persuading investors to subscribe for unmeritorious or worthless securities. This can only be prevented by legislation vesting in some duly constituted public agency full power to restrain the offering of fraudulent or worthless securities.
>
> The Capital Issues Committee warns the public and earnestly directs the attention of Congress to the problem. It is the intention of the committee to make a supplementary report to Congress recommending a law to prevent these existing abuses and such impositions upon the investing public. The committee will maintain its offices in Washington until further notice.

Secretary of the Treasury Glass also issued a statement saying in part:

> The decision of the Capital Issues Committee to suspend its activities on Dec. 31 should not be interpreted by the business public as a warrant for any expenditure of capital for needless or unwise purposes, whether public or private in their nature. Should it become apparent that voluntary restraints are not being exercised so as to prevent the misuse of capital, I shall request the committee to resume its control.
>
> My chief misgiving in accepting the action of the committee arises out of the need the committee has frequently expressed, and the importance of which has become increasingly obvious, of protecting the public investor against the flood of worthless or doubtful securities which threaten the market when the restrictions are removed.
>
> I intend to ask Congress immediately for legislation that will check the traffic in worthless securities while imposing no undue restrictions upon the financing of legitimate business, and shall urge that it be made effective before the close of the present session. Meantime, it may become necessary before such legislation is passed to reassemble the committee for the purpose of resuming its functions.

ADVANCES TO PUBLIC UTILITIES BY WAR FINANCE CORPORATION

Relief to the Amount of Forty-two Million Dollars Authorized to Sixteen Companies, Part of Which Has Been Repaid

According to the annual report of the War Finance Corporation, when that body was organized and announced itself ready for business late in May it found a large number of applications pressing for action, most of which were from corporations operating public utilities. The managing director of the corporation comments on this situation as follows:

> The impression seemed to prevail in the minds of some that the act was designed particularly to finance the maturing obligations of these corporations, and the directors found it necessary to make a public statement calling attention to the fact that the resources of the corporation could not be loaned directly to essential industries unless in exceptional cases where relief could not be had through the usual banking channels, and that in every instance the directors were charged with the duty of requiring adequate security.
>
> The directors adopted a policy in those cases where it appeared necessary to make direct advances to public utility companies, under the provisions of Section 9, of enlisting the coöperation of holders of maturing obligations, and this policy has proved very successful. In many cases adequate relief was provided by making advances of less than one-third of the amounts originally asked for, and in other instances it developed that the moral effect of a commitment by the corporation was such that the whole amount desired was obtained through the investment market without the necessity of calling upon the corporation to take any part of the amount agreed upon.
>
> In making advances to public utilities the directors of the corporation undertook to satisfy themselves not only that the facilities afforded by these companies were necessary or contributory to the operation of enterprises directly engaged in the manufacture or transportation of war essentials, either by furnishing power or by affording means of transportation for labor employed at the war industries, but also that action by the corporation was necessary to avert a general financial condition which would have affected unfavorably government borrowings.
>
> While the banks as a rule have shown a liberal attitude toward public utilities by renewing in whole or in part obligations already held by them, their policy has been to decline to act as intermediaries between the utility companies and the War Finance Corporation, as contemplated in Section 7 of the act, their preference being for commercial paper of short maturity.

The corporation received ninety-nine applications for advances to public utility companies, aggregating $175,595,113. Of these applications ten, amounting to $2,522,642, were, under Section 7 of the act, being made through banks, bankers or trust companies, and eighty-nine applications, amounting to $173,072,471, were for direct loans under Section 9 of the act. Of these applications, six under Section 7 were approved, advances made to Nov. 30 having amounted to $1,942,642.49, and up to the same time ten direct advances were made, amounting to $38,916,300, of which $11,967,500 has been repaid.

Books Received

Elementary Mathematical Analysis. Textbook for First Year College Students. By Charles S. Slichter. New York: McGraw-Hill Book Company, Inc. 498 pages, 186 illustrations. Price, $2.50.

The Gasoline Automobile—Electrical Equipment; with Notes on Its Maintenance, Care and Repair. By P. M. Heldt. Nyack, N. Y.: P. M. Heldt. 406 pages, 317 illustrations.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

American Museum of Safety.—It has been decided to change the name of the American Museum of Safety, beginning Dec. 31, to be "Safety Institute of America."

A. I. E. E., Schenectady Section.—"Steam Road Electrification" was the subject of an address by A. H. Armstrong of the General Electric Company at the monthly meeting of the Schenectady Section, A. I. E. E., held Dec. 20.

Electrical League of Cleveland.—At the regular Thursday noon meeting, Dec. 19, of the Electrical League of Cleveland Walter C. White, vice-president of the White Company, addressed the meeting on the subject "Auto Trucks in Army Service."

Los Angeles Jovian Electric League.—The regular weekly meeting of this league was held Dec. 11. Leslie Henry, special representative of the Federal Reserve Bank, was speaker of the day. D. C. Pence of the Illinois Electric Company acted as chairman.

I. E. S., Philadelphia Section.—On Dec. 20 T. C. Mahady, fuel engineer for Philadelphia of the federal Fuel Administration, addressed the Philadelphia Section of the Illuminating Engineering Society on the subject "Fuel Conservation as Affected by Lighting Curtailment."

N. E. L. A., Philadelphia Section.—The engineering department branch of the Philadelphia Section, National Electric Light Association, held a meeting Dec. 17 at which J. M. Cope, field engineer of the Chester generating station, spoke on "Construction of the Chester Generating Station."

Ohio Electric Light Association.—At a recent meeting of the Ohio Electric Light Association a general meter conference was held. J. T. Kermode presented a paper entitled "Conservation in the Meter Department." A roundtable discussion of problems of interest to meter men was devoted principally to different types of demand meters. C. P. Garman of Dayton is chairman of the meter committee.

Massachusetts State Association of Electrical Contractors and Dealers.—The meeting on Dec. 19 of the Massachusetts State Association of Electrical Contractors and Dealers, held in Boston, was devoted to a discussion of the "open price" plan of coöperation. This new form of coöperative organization is of great interest at the present time, when the electrical contracting business faces the uncertainty involved in getting back to a normal basis.

A. I. I. and S. E. E., Cleveland Section.—On Dec. 14 the Cleveland Section of the American Institute of Iron and Steel Electrical Engineers devoted an entire evening to discussion of storage-battery industrial trucks, tractors, trailers and other equipment for operation with power units. Representatives of equipment manufacturers were the principal speakers. Among the manufacturers who presented information were the Mercury Manufacturing Company, the Lakewood Engineering Company, the Leeson Lift Truck Company, the Lansing Company, the Edison Storage Battery Company, the Electric Storage Battery Company and the Electric Products Company. The suggestion was made during the course of the discussion that a committee of the A. I. I. and S. E. E. should be designated to meet with the manufacturers to work out standard specifications for suitable industrial storage-battery haulage equipment for iron and steel mills.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Value of Abandoned Plant.—In allowing increased rates for the Aguilar Light & Power Company, the Colorado Public Utilities Commission discussed the value of "abandoned steam plant" as follows: "At the hearings in this case the respondent contended that full allowance should be made by the commission for its abandoned steam plant, which was appraised by the engineering staff at $5,000. The commission is of the opinion that some consideration is to be given to this claim, but that it cannot be allowed in full. This plant was installed in good faith and was abandoned much before the end of its useful life for the purpose of improving the service and reducing the operating expenses. The electric generators have been disposed of, so that as the plant now stands it is of no value to the property even for standby service. The boilers and engines should, in the opinion of the commission, also be disposed of, especially at this time when they are much in demand and will command a fair price. It cannot be assumed, as urged by the respondent, that the existence of this plant is of value for the purpose of securing a reasonable rate for energy at wholesale from the Trinidad Electric Transmission, Railway & Gas Company, since that company is entirely under the jurisdiction of this commission and the present rate cannot be increased without the consent of the respondent unless a proper showing that such increase, is necessary be made to the commission."

Boston Sliding Scale in War-Time Costs.—In raising the standard rate of the Boston Consolidated Gas Company from 90 cents to $1 per 1000 cu.ft. the Massachusetts Board of Gas and Electric Light Commissioners says in part: "The language of the act itself, as well as its history and the English precedent upon which it was modeled, makes it evident that the Legislature fixed the standard price at a figure sufficient in its opinion to permit the company to earn the standard dividend. A price so fixed necessarily reflected the then cost of producing and distributing gas, based on the experience not only of the Boston company but of the industry as a whole. Obviously if such cost were to be subsequently affected by improvements in the art, or other circumstances not attributable to the skill and efficiency of the management, or by decreased or increased burdens beyond its control, the standard price would no longer bear the same relation to the standard dividend as at the outset, and the stockholders might have an undue reward, notwithstanding management of a very moderate capacity, on the one hand, or on the other might be unable to earn the stipulated return, without fault on the part of the management and in spite of the utmost skill and efficiency. . . . The unprecedented prices which the essential factors in gas making—coal, oil and labor—are now commanding are too well known to require discussion. The causes are beyond the control of the companies. The resulting increase in the cost of making and distributing gas under conditions similar to those surrounding the Boston company has approximated 30 cents as compared with the cost at the time when the standard price was adopted and during the intervening pre-war period. . . . The sliding-scale system of regulation makes reduction in price to the consumer depend solely upon the desire of the stockholders for greater dividends. It rests upon the belief that this desire will prove an effective stimulus to such increased skill and efficiency in management as will make lower prices to consumers probable. For its proper operation the conditions upon which the relation of price to dividend are established should be stable and likely to continue for a sufficient period to demonstrate the effectiveness of the incentives to good management. Otherwise the system will achieve little by way of actual regulation of price. The board has been of the opinion that the present extraordinary conditions are not likely to outlast the war, even assuming that pre-war conditions may not immediately be restored. Therefore it has seemed expedient in other cases to temporize by making such adjustments as may for the moment seem necessary, but to postpone until the return of normal conditions any final conclusions upon debatable rate questions. Such a policy seems applicable with even greater force to establishing a standard price under the sliding-scale plan."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Food Conservation by Floodlighting.—A Los Angeles company recently ordered floodlighting projection for lighting rice fields at night to keep ducks and geese away.

Rehabilitation of Disabled Soldiers and Sailors.—The United States government, through its Board of Vocational Education, is calling for the coöperation of employers in the rehabilitation of 200,000 American men disabled in the war. It is the intention of the government to assist in replacing each man, regardless of his handicap, in suitable civil employment Free courses of instruction in all agricultural, industrial, commercial and professional occupations are being provided under the jurisdiction of the board, the intention being that the disabled man shall be qualified for a "real job," not a "temporary soft snap." Employers should address the board at Washington for details of the coöperative plans.

Training for Department of Labor Examiners.—A conference of far-reaching importance will be held in Washington, beginning Jan. 6, when the United States Employment Service of the Department of Labor opens a two weeks' normal training course for examiners. Upon the completion of the course those who have acceptably passed through it will be sent out as a trained and efficient staff to make standard the use of a common agency under the government for labor distribution and placement. Thirty employees of the Employment Service in fifteen states have been designated to take the first course, on completion of which they will be returned to their own states, so far as possible, and there will train their own examiners for service.

Decorative Arts and Industries Association Formed.—A number of the larger manufacturers of the country have just organized a National Association of Decorative Arts and Industries to raise national standards of taste in home furnishings. The organization meeting was held in New York City, and officers were elected as follows: President, James P. Haney, New York; vice-president, Henry W. Frohne, Grand Rapids, Mich.; secretary, William Laurel Harris, New York; treasurer, Chandler R. Clifford, New York. The constructive object of the society is to promote closer relations between manufacturers, jobbers and retailers of home furnishings all through the country by means of printed publicity, traveling exhibitions, lectures and trade and general information on furnishing the home. Through the association it is also planned to make exhibitions of good home furnishings in New York, Philadelphia, Boston, Chicago, St. Louis and other cities.

Red Cross Instead of Banquet.—The annual banquet of the Southern Public Utilities Company, Charlotte, N. C., which has long been a fixture with this company, will not be held this year. Instead, the company will present to each employee a membership in the American Red Cross, in keeping with the desire expressed a year ago by every employee, with a single exception. Last year the employee body voted, with one exception, to request the company to call off the banquet and to use the money to purchase memberships in the American Red Cross instead. This year it is felt that there is just as much necessity for concentrated effort toward the support of the nation in these trying times of reconstruction as there was for patriotic endeavor last year, and after having canvassed the large majority of the employees, and finding not a single one who prefers the banquet to the Red Cross membership, it has been decided to renew the memberships.

Development of Foreign Trade.—T. C. Powell, special representative of the United States Railroad Administration with the War Industries Board, in a letter on the development of foreign trade, says: "It appears to be the consensus of opinion that one outlet for the surplus capacity of the United States is in the direction of foreign trade, and with that thought in mind, for the purpose of ascertaining to what extent the manufacturers of the United States are interested in such foreign trade development, I am addressing this letter to a large number of the firms which in the course of the past year have had relations with the War Industries Board, as it seems advisable to establish a point of contact between the United States Railroad Administration and the exporters and importers of the country, to develop whether the administration can be of any substantial assistance." The Port and Harbor Facilities Commission, created by resolution of the United States Shipping Board in May, 1918, has been for months collecting all the information available with regard to facilities at the ports, and is coöperating with the Railroad Administration in preparing other data for consideration. Mr. Powell asks for suggestions and information regarding foreign trade, such as (a) character and volume of business, (b) country with which the foreign trade relations are to be established or extended, (c) relation between such development and the transportation facilities and rates of freight, and (d) any other data which will be of value to the administration or any individual railroad in preparing for such foreign commerce."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Effect of Covenant Not to Sue.—In action for death of telephone lineman against telephone company and a power company whose wire electrocuted him, if jury held power company negligent, it should, in assessing damages, credit to it $7,500 paid plaintiffs by the telephone company for a covenant not to sue, according to the Supreme Court of Mississippi in Bogdahn versus Pascagoula Street Railway & Power Company (78 S. 844).

Evidence of Experts.—Where a witness was asked his opinion as to the amount of voltage causing the death of plaintiff's intestate, and upon defendant's objection the court said it would be competent to ask the amount of voltage which would produce death, such suggestion was not objectionable as an expression of the judge's opinion upon the facts, according to the Supreme Court of North Carolina (97 S. 378). Where one of the chief issues for the jury was the amount of voltage passing through intestate's body from defendant's wires, it was not competent for a witness to state his opinion of the amount of such voltage. Where there was an issue for the jury as to the negligence of defendant city in installing a brass, instead of a porcelain, electric light socket in bottling works, it was not competent for an expert witness to answer questions calling for conclusions on the facts.

Evidence Regarding Defective Insulation.—In action for the death of an employee in a drug store who was killed by a service wire coming in contact with the primary wire carrying high voltage, testimony of a witness to the effect that wires were not properly insulated held by the Supreme Court of North Carolina within his immediate observation and experience, in Raulf versus Elizabeth City Electric Light & Power Company (97 S. E. 236). Asking an expert electrician "whether the conditions arising on the facts stated would naturally and inevitably lead to intestate's death" was not reversible error, there being no serious contention that if primary wire carrying 2300 volts came in contact with service wire running into store where intestate was employed it would produce death. Question asked expert electrician "whether the conditions arising on the facts stated would naturally and inevitably lead to intestate's death" was not objectionable as embodying the very fact that the jury was to pass upon, there being no dispute that if wire of high voltage came in contact with service wire it would cause death.

Men of the Industry

Changes in Personnel
and Position—
Biographical Notes

Prof. A. E. Kennelly of Harvard University and the Massachusetts Institute of Technology has been elected an honorary member of the Institution of Electrical Engineers in Great Britain.

W. D. Alley, formerly with the Northern Indiana Gas & Electric Company of Hammond, Ind., has been appointed electric meter expert for the Southern Public Utilities Company, Charlotte, N. C.

Nicholas Stahl, formerly of the power department of the Westinghouse Electric & Manufacturing Company, has succeeded the late Martin W. Kern as general engineer of the Narragansett Electric Lighting Company, Providence, R. I.

Major George F. Heustic, formerly superintendent of the Malden (Mass.) Electric Company, established a new record in the American army. In sixteen and one-half hours of actual work an athletic field, seating 9000 people, was constructed under his direction at Camp Pike, Ark.

Frank O. Emery recently resigned his position as superintendent of the water and light department of the city of Reedsburg, Wis., to become general superintendent and electrical engineer of the Janesville (Wis.) Electric Company. Previous to his employment with the city of Reedsburg, Mr. Emery was with the Mineral Point (Wis.) Public Service Company for five years as superintendent and electrical engineer.

John F. Killeen, formerly in charge of the heating device section of the General Electric Company and more recently vice-president and sales manager of the Rathbone-Sard Electric Company, has become identified with the Edison Electric Appliance Company, Inc., Chicago. Mr. Killeen was associated with the General Electric Company in the development of the heating device business for ten years prior to becoming vice-president and sales manager of the Rathbone-Sard Electric Company two years ago.

John Macfarlane has recently been appointed chief engineer of the Scranton (Pa.) Electric Company. For two years after leaving school Mr. Macfarlane was associated with E. B. Cox testing stoker boilers and coal-handling machinery. Later he became a pump engineer with the Jeansville Iron Works and shortly afterward he became operating and construction engineer for the Harwood Electric Company, during the construction of the Hauto plant. Upon the completion of this plant he was appointed superintendent of all of the Harwood Electric Company's plants.

Frederick Pearson, who for the last fifteen years has been associated with Marshall Field & Company as advisory engineer in the development of their various manufacturing and merchandising enterprises in Chicago and elsewhere, has entered the practice of consulting engineering, with offices at 25 East Washington Street, Chicago. He will continue as advisory engineer to the above firm. Mr. Pearson's extensive engineering experience covers a period of about twenty years, five of which were spent in the design and installation of central stations and isolated plants. Later he was assistant to the consulting engineer for D. H. Burnham & Company, architects, Chicago. While Mr. Pearson has never been an opponent of the privately owned and operated plant, he was one of the first engineers in Chicago to realize the advantages offered by central-station service, and some years ago recommended the abandonment of the private plants operated by Marshall Field & Company and the transfer of the entire load to the central-station company, which load now aggregates approximately a consumption of 12,000,000 kw.-hr. annually. Mr. Pearson's experience includes electrical, mechanical and chemical engineering. He has had wide engineering and technical society affiliations and was a member both of the Electrical Congress in St. Louis in 1904 and of the International Chemical Congress, Chicago and Washington, in 1912.

Obituary

Lucien W. Carr, superintendent of the Crawfordsville (Ind.) Electric Light & Power Company, died of acute indigestion Dec. 11.

Edgar Wallace Bates, superintendent of construction of the Plymouth (Mass.) Electric Light Company, died recently at Plymouth. Mr. Bates was well known in New England central-station circles, and his experience covered a wide range of activity in both engineering and commercial fields. He was born at Lynn, Mass., in 1864, and as a young man was sent to Australia for the old Thomson-Houston Electric Company, where he had charge of the company's display at the Melbourne Exhibition, and he operated the first electric car in that country in 1887-88. After his return to the United States he became superintendent of the Cohasset Electric Company, remaining at this post more than twenty years. About four years ago Mr. Bates went to Plymouth and took charge of the high-tension line construction between Plymouth, Marion and the Cape Cod Canal. He was a charter member of the New England Section of the National Electric Association and was a frequent attendant at its conventions. He was very highly regarded among electrical men in Massachusetts.

Lieut. A. E. Granberg, who prior to joining the army was employed in the New York office of the General Electric Company, died in France, Nov. 1, of pneumonia. Lieutenant Granberg was graduated in 1912 from Syracuse University as an electrical and mechanical engineer. He was at one time power engineer with the Rockford (Ill.) Electric Company.

Jacob Bard, chief engineer of the Sangamo Electric Company, and one of the best known electrical meter engineers of the country, died on Dec. 13 at his home in Springfield, Ill., from pneumonia. Mr. Bard was graduated from the University of Illinois in 1906 and, after a few years' work divided between the Western Electric Company and the Peoria Gas & Electric Company, he entered the employ of the Sangamo company in 1911, rapidly rising to have charge of all engineering matters, including development work, for that company. Mr. Bard was a member of the American Institute of Electrical Engineers.

A. L. Hart, in charge of the power sales department of the Metropolitan Edison Company of Reading, Pa., died of pneumonia on Dec. 13 at his home in Wyomissing, at the age of thirty years. Mr. Hart was one of the most capable men in the Metropolitan Edison Company's organization, with which he had been identified for seven years, and was a graduate of the Massachusetts Institute of Technology. His first employment was with the General Electric Company in the small-motor department at West Lynn, Mass. He first took up power sales work with the Pennsylvania Light, Heat & Power Company of Pottsville, Pa., in 1909, remaining for one year, when he went to Poughkeepsie, N. Y., to take up similar work, joining the Reading company in 1911 to manage its power sales department.

Charles E. Phelps, chief engineer of the Maryland Public Service Commission, died in Baltimore on Sunday. Mr. Phelps was born on Jan. 31, 1871, and in 1894 was graduated from the Johns Hopkins University in electrical and mechanical engineering. From 1894 until 1898 he was superintendent of electrical construction for the David E. Evans Company. He then engaged upon some private contract work, but upon the organization on Oct. 1, 1898, of the Electrical Commission of Baltimore he was appointed chief engineer. At the same time he represented a number of cities in technical matters principally relating to public utility corporations. In 1906 he was selected by the National Civic Federation, together with Theodore Stebbins, to conduct the investigation carried on by the federation into the question of municipal ownership and operation of public service corporations. He resigned from the Baltimore commission in 1910. In the fall of that year he was appointed chief engineer of the Maryland commission.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

ELECTRICAL SALES FOR 1918 IN NEIGHBORHOOD OF $750,000,000

Indications Are that the Record Made in 1917 Has Not Been Surpassed by Any Considerable Amount This Year

As the current year comes to a close it becomes apparent that sales of electrical equipment billed in 1918 are not much greater, if greater at all, than those billed during the record year of 1917. In fact, in not a few instances it will be found that gross sales for 1918 are below those for 1917.

If the above is true, then the sales of electrical goods billed in 1918 will probably be found to run around $750,000,000.

A good many reasons can be found for sales not running higher. First, there was not the quantity of new factory space in 1918 that there was for 1917 production. Second, there was less commercial and more government purchasing. Third, the shortage of raw materials and labor reduced production in many lines. Fourth, conservation measures required curtailment in the output of a number of electrical products. Fifth, the signing of the armistice early in November caused a very large reduction in output. Sixth, government prices on raw materials brought lower average prices on certain lines, particularly wire, which has the largest output in dollars and cents of all electrical manufactures.

At the close of 1917 the unfilled orders on hand were very large. Some of these orders have not yet been filled. Unfilled orders now on hand are probably much smaller than they were a year ago. The close of the war brought many cancellations. All government contracts, however, were not canceled. The big government contract for outpost wire, for instance, still remains in the process of fulfillment.

When the new year opens the electrical manufacturing industry will find itself in a better condition to attract business than it has been in for the past two years. Once more it will be able to give service to buyers.

DIFFERENCE OF OPINION OVER THE TREND OF PRICES

Some Hold to Stiff Prices for Some Time, Others Desire Quick, Sharp Break, but General Gradual Decline Is Expected

There is a considerable difference of opinion among members of the trade regarding the future trend of prices of electrical goods. That prices will eventually go to lower levels none deny.

Some are firmly of the conviction that it will be some time before lower prices can reasonably be expected. Labor is still high. There are stocks on hand of raw materials that were laid in at the high prices. Besides, more were ordered which are either on the way or will be shipped within the next few months. Until these conditions are changed this group believe that prices must stay up. In the vacuum-cleaner and washing-machine lines particularly is this view strong.

One of the pioneers in the manufacture of electric washing machines a week or so ago stated that his machines, and they represent a substantial portion of the entire output of the country, would not be lower in price before the latter part of 1919. To this, of course, was attached the proviso "unless forced to by price lowering of competitors."

Contrary to this view is the hope expressed by many prominent men in the industry that prices will at once drop as far as they are going. These people, as a prominent insulated-wire manufacturer expressed it a few days ago, "want to take their loss all at once, get it over with and make it attractive to do business." This, of course, would involve lower prices all along the line down to raw materials and labor.

Those who hold this position, while they do not believe that it will come, say that the buyer will not be enticed into the market by a small decrease. Rather will a decrease lead him to expect still lower prices. To do things this way, these people state, is simply to postpone buying and in the meantime go through a long-drawn-out period of business hesitancy.

The view, however, that is coming to be held most generally is that prices from now on can be expected to fall not fast but surely. In some lines this has already happened. Insulated-wire base, for instance, has dropped slightly in the last few days. When the price of copper drops after the first of the year, as copper authorities say it will, other commodities where copper or brass plays a large part may be expected in some degree to follow the lead of wire.

Except for certain lines, few orders are now being received for electrical goods, and while the factories may have large quantities of unfilled orders, still incoming orders must be stimulated. Competitive conditions, therefore, may arise shortly.

A case came to light a few days ago in which an order for $25,000 worth of motors and substation equipment was about to be placed. The concern that received the order cut its price first 8 and finally 10 per cent in order to get the business. Moreover, it was said at the time that this was the first occasion in two years when the salesmen had been allowed to meet competition in that way.

While it is probably true that much business is going to be delayed waiting for further decreases, still this must be expected. So long as prices are to come down slowly, new business will be placed slowly. Manufacturers naturally then must protect themselves in their stocks.

WHEN TO TURN OUT SPECIAL EQUIPMENT

Lamp Manufacturer Points Out the Necessity of Effort in Order to Build Up the Good Will of Customers

Standardization of electrical equipment because of the need for conservation has been in force sufficiently long for manufacturers to wish the continuance thereof in a large degree. There are occasions, however, when special equipment may be necessary and then the manufacturer may feel justified in taking the order.

A New England lamp maker in discussing this matter recently pointed out the necessity to make some odd-type lamps, even at the cost of considerable annoyance due to the bother and unusual care required: "We must all appreciate," said the manufacturer, "that our customers, the people who buy and use our lamps and pay the company the money with which we pay the wages and other expenses of the business, have some rights in this matter. In return for buying our lamps in the standard sizes they certainly have the right to call upon us to make up the odd-type lamps when there is a real need for them. You would not trade with your grocer long if he refused to supply you with kerosene, simply because it was bulky, hard to handle and carried a small profit, but asked you to buy from him only the articles which were profitable for him and which would not take up much of his time and energy in handling. Likewise our lamps would not build up much good will if we took the narrow attitude of refusing to accommodate customers by supplying some of the types of lamps that are a little difficult to manufacture."

A reasonable measure of protection is secured for the factory by the policy of refusing orders for special-type lamps from customers who do not buy standard lamps from the establishment in large quantities. In this factory it so happens that the number of special-type lamps is at present much larger than it appears likely the company will have to turn out in the future, as lamps now being made cover orders which it has not been feasible to fill for about two months.

METAL MARKET SITUATION

Market Continues Stagnant, with Prices Falling—Base Prices on Pig Tin to Stand

The metal market continues to drift without consumers showing any active interest, while the producers have so far appeared content to wait for overtures from the buyers. The impression is growing, however, that in the case of copper the time will be short before a basis is found for doing business on future orders. Bids of 23 cents per pound were mentioned frequently last week in trade discussion and again this week, and it is expected that producers will shortly seek to put their offerings somewhere in line with current bids.

The base prices on pig tin which were announced some days ago by the War Industries Board to continue until Jan. 31 will be continued until all of the tin now held by the United States Steel Products Company, the sole distributer in this country, has been disposed of. The market here continues stagnant with more outside lots being pressed for sale, with the result that lower prices for such lots are prevailing.

On Dec. 19 the War Industries Board announced that the government-fixed price on aluminum would remain in force until March 1, 1919, when it would expire by limitation. The market is very dull.

Spelter continues at an absolute standstill, and the trade cannot remember in years such a period of entire absence of inquiry on business. Prices are still softening.

Old metals have fallen considerably, and there are rumors of further cuts in prices, especially in the soft metals.

NEW YORK METAL MARKET PRICES

	Dec. 17	Dec. 23
Copper:	£ s d	£ s d
London, standard spot	122 0 0	122 0 0
	Cents per Pound	Cents per Pound
Prime Lake	Govt. price 26.00	Govt. price 26.00
Electrolytic	Govt. price 26.00	Govt. price 26.00
Casting	Govt. price 26.00	Govt. price 26.00
Wire base	28.75	28.75
Lead, trust price	7.05	6.50
Antimony	8.00	7.62½
Nickel, ingot	40.00	40.00
Sheet zinc, f.o.b. smelter	15.00	15.00
Spelter, spot	8.67½	8.47½
Tin	72.50 (official)	71.75
Aluminum, 98 to 99 per cent	Govt. price 33.10	Govt. price 33.10

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	18.50 to 19.00	17.00 to 18.00
Brass, heavy	10.50 to 11.00	10.00 to 10.50
Brass, light	8.50 to 9.00	8.00 to 8.50
Lead, heavy	5.25 to 5.50	5.25 to 5.50
Zinc, old scrap	5.25 to 5.50	5.25 to 5.50

THE WEEK
IN TRADE

DURING the final week of holiday sales electrical goods took a spurt, and excellent sales are being reported by dealers from every part of the country. Up to a week or ten days ago the holiday sales had been very disappointing.

No new business of any importance is being placed with manufacturers, and jobbers are still marking time.

Prices generally are holding pretty firm, although wire is softening somewhat except for double-braid, in which a tendency to higher prices is seen.

The building market shows no signs of improvement or of an early opening. The mortgage-money market shows no signs of soon becoming more inviting to builders.

Deliveries on back orders are beginning to be made and are expected rapidly to increase.

NEW YORK

Business the past week has been almost wholly confined to retail channels. While it is conceded that the stores have done a very large general Christmas trade this year, it is a matter of comment that the sale of electrical appliances, portable lamps, etc., has been distinctly disappointing. In jobbing and wholesale lines a noticeable slacking up is in evidence.

No great activity or new construction is looked for for some time. In certain sections there is considerable alteration work going on and this may grow to large proportions.

A favorite sign is seen in the awakening of automobile manufacture. This industry has in the past absorbed vast quantities of insulated wire, storage batteries, lamps, magnetos, electric self-starters and electric instruments.

Considerable activity in exports is developing all along the line. Many of the smaller manufacturers are becoming interested, and it is understood that already a very satisfactory volume of sales is being recorded.

METERS.—Domestic demand for meters at the present time is quiet, but this condition usually prevails just before and after the holidays. An increased demand is looked for after Jan. 1. Many country and suburban dwellings which had been finished during the latter part of the war period but not electrically connected are now coming into the market for watt-hour meters. Export inquiry for meters is excellent, and large shipments are being made to practically every country in Europe, South Africa, Australia and South America. Supplies are good and factory shipments are made in two weeks.

TRANSFORMERS.—Central-station demand is very slack, and there is practically no ordering. Better conditions are looked for in the spring. Supplies on hand are fair.

WIRE.—Stocks are growing in the larger sizes. Nos. 10 and 12 can be supplied but in no great quantity. No. 14 is still very scarce, and there are so many back orders on hand to be filled that it is doubtful if the market will be in shape much before February. Prices continue to soften and 33-cent and 32-cent bases are frequently mentioned. It is understood that one producer is quoting on a 30-cent base.

SCHEDULE MATERIAL.—Switches, cut-outs, etc., are in active demand for industrial plants which could not be supplied during the war. A particularly heavy demand from the rubber industry is noticed.

AUTOMOBILE SUPPLIES.—Manufacturers of electric instruments for automobiles have for the past two years been actively engaged on war contracts in other lines, noticeably in radio equipment. Now that hostilities have ceased, automobile makers are again entering the market for instruments, but they are showing caution in buying and are not placing orders for more than two or three months ahead. Prices have advanced in the past two years about 30 per cent, half the advance taking place in 1918. Supplies on hand are limited, and deliveries take from four to six weeks.

BATTERIES.—Dry batteries continue to be in steady demand and factory stocks show improvement. Shipments are still behind, however, and cannot be made under two weeks. Flashlight battery orders are still well ahead of supplies, and shipments, it is reported by one concern, cannot be made under six weeks.

LINE MATERIAL.—Buying is still holding off, although the mild weather has been favorable for this class of work. One manufacturer has reduced his stock considerably by a large export order. Supplies on hand are good and deliveries prompt.

WASHING MACHINES.—Demand is still far ahead of production. Future orders on producers' books are very large. Prices are strong, and it is doubtful, manufacturers state, if, even with the reduction of the price of metals, there will be any change in the price of machines for some time to come. Shipments of the best makes of copper machines are still four weeks behind.

HEATER CORD.—Cord is slowly finding its way back into the market. Orders placed two months ago are being now about one-third filled.

BOSTON

Business continues quiet, but little apprehension is felt as to the future. Electrical contractors report many prospects in sight for new or reconstruction work, and a good deal of estimating is being called for. Jobbers are well stocked and until the New Year arrives will not be in the market for material on any large scale. Collections continue fair and very little complaint is now heard as to deliveries. Prices are being shaded here and there in order to keep goods moving, but no general reductions are as yet to be seen. The opinion is widespread, however, that material decreases in price will feature the early 1919 market. Labor conditions are more unsettled this week. A serious strike is in progress at the Pittsfield works of the General Electric Company in sympathy with the strikes in progress at Schenectady and Erie. At the Lynn works of this company the employees have remained at their posts up to this writing.

MOTORS.—Stocks are increasing as the demand slackens, and prices remain about the same. The market is meeting the transition period well. Some motors are being thrown upon the market through auction sales, but not much disturbance appears to result.

BATTERY-CHARGING EQUIPMENT.—An active demand is reported, especially for industrial electric truck charging service. Deliveries are quoted at from thirty to fifty days, with steady prices.

STORAGE BATTERIES.—Stocks are increasing and the falling off of government demands is being turned to good account for the civilian trade. The automobile battery trade is in exceptionally good condition, the open winter being reflected in local sales. The factories are busy filling orders of long standing, and it is expected that prices will remain firm for some time.

PORTABLE LAMPS.—Trade is unusually brisk, and the holiday demand has been excellent. One central station reports the sale of about 600 portables since Sept. 1. The supply at the beginning of the holiday season was larger than usual.

WASHING MACHINES.—Deliveries are steadily improving, and a fine year's business is anticipated for 1919. The demand holds up well.

VACUUM CLEANERS.—Business is good and bids fair to remain so. Special campaign work by central stations is now under way and the response is gratifying.

FRICTION TAPE.—Stocks are improving. It is anticipated that prices will be a little easier within a few days.

CONDUITS.—Boston jobbers are still low as to conduit supply. Not much buying is being done at present, the opinion being held in some quarters that it would be well to wait for a reduction in prices. As a matter of fact, there is reason to believe that prices will hold firm around present levels for some time to come, and that while merchant pipe may show a moderate reduction in January, the "spread" between merchant pipe and conduit is such that very little change will be seen in the latter.

FLASHLAMPS AND DRY CELLS.—A rushing holiday trade is being handled in flashlamps. Dealers report that the shortage in lamps and dry cells has now been overcome.

LAMPS.—The demand is heavy for the new 25-watt and 50-watt mill type lamps for use in industrial plants where vibration is encountered. Stocks of the ordinary sizes of lamps are in good shape for immediate delivery. Some shortage in gas-filled lamps of the 75-watt and 100-watt sizes is reported as regards delivery from local stocks. The manufacturers are catching up with the demand for miniature lamps. Sign lamps are moving very slowly, contrary to expectations when the lighting restrictions were removed; in fact, there is a disposition to do away with carrying local stocks of sign lamps in the coming year.

CHICAGO

Holiday trade ran into record-breaking figures this week. Sales of electrical appliances are reported to be high, conditions pointing to a big electrical labor-saving Christmas. War wages and the proceeds of bountiful crops at high prices are pouring into retail stores in volume never before known, and electric shops are getting their share. This is true not only in Chicago but in the Middle West generally.

Wholesale business is dull, as usual at this time of year, but there does not seem to be any evidence of unrest, the general tone of the trade being confident.

Collections are uniformly good and there is a tendency toward easier financial conditions.

BELTING.—A manufacturer of a substitute for leather belting is doubling his output for 1919 in anticipation of a healthy demand.

BELL-RINGING TRANSFORMERS.—Demand continues good. One concern that builds 500 of these transformers a day reports that it is 15,000 behind in deliveries. The daily output will be increased after Jan. 1.

WASHING MACHINES.—Several manufacturers report that deliveries would be better were it not for the difficulty of obtaining wringers. However, the general condition is better than it has been for the past year.

PORTABLE LAMPS.—Demand and deliveries for the medium and low-priced lamps are reported good.

SMALL MOTORS.—Deliveries are much better, and manufacturers are looking for new applications and new outlets.

CHRISTMAS-TREE LAMPS.—There appears to have been a heavy demand for tree-lighting outfits. Dealers were prepared and had good stocks. The shortage this season will be in Christmas trees, not lighting outfits.

ATLANTA

Manufacturers and jobbers are feeling the effect of the pre-inventory period, not to mention the hesitancy on the part of buyers due to expected decline in prices. Business as a whole has decreased decidedly during the last two weeks. Certain items, however, such as street lighting and meters, have shown up much better than was expected. Retailers and dealers are doing an excellent holiday business. Conclusions drawn from all sources of activity this week show that buying, on the whole, is light and that the retailers are cleaning up stocks as fast as possible before the first of the year. Practically all branches of the metal market are marking time, awaiting readjustments of prices incident to a return of peace conditions.

Assurances have been given Southeastern commercial interests that a fair proportion of the million tons of cargo tonnage to be turned over immediately will be available for the movement of cotton. Ports such as Newport News, Wilmington, Charleston, Savannah and Brunswick are certain to draw increased business under the new policy. At this time the South is especially interested in cotton, and federal assurances regarding the tonnage allocation will promote a more cheerful feeling in all lines of trade, as this section is still shackled by the single-crop idea. Ten additional buildings of steel and tile structure will be erected at the United States naval air station, Galveston, Tex. The Columbia-Panama Coal Company, Manchester, Ky., has purchased additional land, and an electric road will be built, together with a power plant.

An item of especial interest to the electrical industry at this time is the spirit of optimism that prevails throughout the textile field, as a large volume of business is transacted annually with this industry. The consensus of opinion gathered from a number of interviews indicates that textile men expect a slight slowing up in demand for their goods during the early part of 1919, but from then on the business will gradually come back to a pace nearly equal to the past two years.

TRANSFORMERS.—There is no apparent decrease in the call for distributing type. Stocks are in good condition, and replacement shipments are coming through nicely. Activity in large-power types has dropped away off.

METERS.—Some of the manufacturers state that orders for residence type have shown improvement of late. This increase is coming from the smaller central stations. Stocks are ample. Very few transactions are being handled in switchboard instruments.

STREET LIGHTING.—There is more activity noted in this line. The demand for fixtures is increasing from all quarters. Deliveries are good.

WIRE.—Pressure has not subsided for rubber-covered or weatherproof. No difficulty is experienced in getting weatherproof, but shipments of rubber-covered are slow. Heavy sizes and cables have slumped off considerably. This is to be expected, however, at this time of the year.

SEATTLE—PORTLAND

Wholesale and jobbing trade during the past week showed a slight decrease, but retail trade showed an enormous increase. Retail Christmas sales are exceptionally heavy and going strong. Domestic appliance sales for presents, according to prominent retailers, will, contrary to expectations, nearly equal last year's mark. Toasters, irons, curling irons and percolators are moving especially heavy, followed closely by washing and sewing machines. Wholesale business to shipyards, industrials and lumber mills has slowed up considerably. This decrease is natural at this period and will not be prolonged. Shipyards will be closed down for Christmas and New Year's, but mills and logging camps will remain idle for two weeks. Northwest lumbermen are optimistic over prospects, anticipating steady and increasing demands beginning shortly after the first of the year.

Spokane electrical dealers report good business, and the outlook is favorable. Retailers in Spokane and vicinity report good holiday business. Tacoma wholesale and retail trade is fair. Holiday sales are heavier than anticipated. Portland district reports trade as good in the aggregate, although individual purchases are small. Retail buying showed an increasing strength.

Some of the wooden shipbuilding plants in the Portland district are unable to secure other contracts and are compelled to go out of business. There will undoubtedly be a considerable amount of electrical equipment thrown on the market. It is very questionable whether this equipment will be picked up directly by dealers on account of price, owing to the uncertainty with regard to what effect future conditions will have on the matter of lowering prices of all machinery. This will probably necessitate the taking of this machinery on consignment by local dealers or sale by owners to new customers. At the present time manufacturers and jobbers are to a large extent overstocked on these lines owing to the sudden cessation of hostilities. The general feeling therefore is that for a period of six months to a year there will be considerable marking of time in all lines of work.

Seattle is the only Pacific Coast city to show an increase over the month of November of last year in building. During the past week the number of permits decreased slightly, but it is believed that December will exceed the same month of last year by a comfortable margin. The campaign to build 2000 residences in Portland is under way. Two shipyards in Portland plan an immediate expansion of their plants, and the Foundation Company, operating wooden shipyards in Tacoma and Portland, plans the conversion of its wooden plant to steel. According to present plans, the Tacoma plant will have eight ways and the Portland plant six. The French government is reported to have closed negotiations with the Foundation Company for the construction of 174 ships valued at $100,000,000.

SAN FRANCISCO

The demand for household electrical appliances in California increased by leaps and bounds during the past year, and now that the restriction of war time has been removed, this branch of the electrical trade has increased out of proportion to all others. Christmas buying of electrical merchandise in San Francisco has been heavier than for several years past. The threatened recurrence of the influenza epidemic last week helped to induce early shopping in order to avoid the rush. However, the influenza situation improved so much that it did not affect shopping during the last few days before Christmas. Christmas tree sets were sold out early last week and no more could be obtained. Otherwise stocks of Christmas electrical goods were generally in good condition. A notable difference in the demand is apparent this year and is ascribed to the change from a war to a peace basis. Appliances of the less necessary sort are called for, and high cost is apparently not a drawback with goods of high quality. Expensive appliances, such as percolators and chafing dishes, are moving well, although the demand for them has been light for a long time.

An electrical contractors' licensing bill is being prepared by the Industrial Accident Commission of California and will be presented at this session of the Legislature supported by the Electrical Contractors' Association. The bill is expected to eliminate an undesirable element in the contracting business and to improve the conditions under which electrical construction work is done, particularly on small jobs.

Camp Frémont at Palo Alto is being dismantled. This is exceptional, as there is remarkably little abandonment of war-time construction in California and such as there is will affect stocks rather than prices.

In a report made public last week Major Sever, Pacific Coast representative of the War Industries Board, power section, recommended the development each year in California of an additional 50,000 hp. of hydroelectric power. The report is the result of five months of investigation and states that the extensive development must begin immediately to take care of power demands that are resulting from normal growth.

Electrical accessories for automobiles is a branch of the industry that has gained prominence rapidly in California of late. Some electrical contractors have built up an attractive side line by specializing in repairs and supplies, including everything electrical about the automobile.

Credits and collections are very good. Credit departments report that small contractors and dealers seem to be doing a paying business and are now more prompt in meeting bills than they were a year ago.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61 00
No. 12 solid	71 00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115 00
No. 6 stranded	160 00
No. 4 stranded	205 00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104 00
No. 12 solid	135 00
No. 10 solid	185 00
No. 8 stranded	235 00
No. 6 stranded	370 00
No. 4 stranded	575 00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10%

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10%

	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+30% to +20%
Coil to 1000 ft	List

	No. 12 Solid
Less than coil	+30% to +20%
Coil to 1000 ft	List

Twin-Conductor

	No. 14 Solid
Less than coil	$115.00
Coil to 1000 ft	100.00

	No. 12 Solid
Less than coil	+30% to +20%
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to List
1/5 to std. pkg	+5% to 20%
Std. pkg	18% to 30%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0 45—$0 46	$0.45—$0 47
12 to 50	.40	.40— 41
50 to barrel	.35— .36	.36— .37
Barrel lots	32— .329	33— .339

BATTERIES, DRY—Continued

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40 to $0.45	$0.40 to $0.45
12 to 50	.35 to .38	.35 to .38
50 to barrel	.319 to .35	.329 to .35
Barrel lots	.289 to .32	.299 to .32

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
5/16	250	$5 00
3/8	250	7 50
1/2	100	10.00
3/4	50	13 00
1	50	21 00
1¼	50	26 00
1½	25–50	35 00
2	25–50	45 00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
3/8-in. single.trip.	$75 00	$63 75— 69 75
3/8-in. double strip	75 00— 82 50	72 00— 75 00
1/2-in. single strip	100 00	85 00— 93 00
1/2-in. double strip	100.00—110 00	96 00—100 00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75 00	$63 25 to $63 75
3/8-in. double strip	78 25 to $78.75	71.25
1/2-in. single strip	100 00	75 00 to 85 00
1/2-in. double strip	105.00	93 00 to 95 00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In	List per Foot	Size, In.	List per Foot
7/32	$0 05½	1	$0 25
1/4	.06	1¼	33
3/8	09	1½	.40
1/2	12	1¾	.47
5/8	.15	2	.55
3/4	18	2½	65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.—	$25 00–50.70	$24 00–35 20	$23 00–30 25
1/4-in.—	30.00–56.40	28.00–38 40	26 00–33 00

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List,
7/32-in.—	$60 00	$30 00	$26 00–29.15
1/4-in.—	65.00	33.50	29.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
1/4	$0.08½
3/8	.08½
1/2	.08½
3/4	.11½
1	.17
1¼	.23
1½	.27½
2	37½
2½	.58½
3	76½

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
1/4	$0.05	$0.19
3/8	.06	.19
1/2	.07	.19
3/4	.10	.25
1	.13	.37
1¼	.17	.45
1½	.21	.50
2	.28	1.10
2½	.40	1.80
3	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	7% to 7 1%	9% to 9.1%
2500 to 5000 lb.	10% to 10 1%	12% to 12.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 to 1/2 In.	3/4 to 3 In.
Less than 2500 lb.	+5.5% to 3.5%	+3.5% to +1.5%
2500 to 5000 lb.	+2.5% to +0.5%	+5% to 1.5%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$6.00 to $6.50
Discount	20% to 25%

CHICAGO

List price	$6.00 to $7.00
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	Lis
3-amp. to 30-amp	100	$0.25
35-amp. to 60-amp	100	.35
65-amp. to 100-amp	50	.90
110-amp. to 200-amp	25	2.00
225-amp. to 400-amp	25	3.60
450-amp. to 600-amp	10	5.50
600-Volt		
3-amp. to 30-amp	100	$0.40
35-amp. to 60-amp	100	.60
65-amp. to 100-amp	50	1.50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5 50
450-amp. to 600-amp	10	8 00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6 00 to $8 75
1/5 to std. pkg	5 50 to 7 00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8.00
1/5 to std. pkg	7 00

Standard packages, 500. List, each, $0.07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	85
75-watt—C	50	70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3⅛-in., Frosted:		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3¾-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4⅜-in., Frosted:		
100-watt—G 35	24	1 15

DISCOUNT—NEW YORK

Less than std. pkg	List
Std. pkg	10%

DISCOUNT—CHICAGO

Less than std. pkg	List
Std. pkg	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30 47—$40 77
Coil to 1000 ft	27 42— 32 98

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$38 00
Coil to 1000 ft	28 00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$24 00 to $33 00

CHICAGO

Net per 100	$23.93 to $30 00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%	20%
$10.00 to $50.00 list	36%	31%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20%	10%
$10.00 to $50.00 list	30%	20%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	5%
1/5 to std. pkg	15%
Std. pkg	25%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg	$20 00 to $21.00
1/5 to std. pkg	17.00 to 17.85

Standard package, 2200. List per 1000, $21 to $34

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg	$21 00
1/5 to std. pkg	17.85

Standard package, 2200. List per 1000, $20.00–21.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.	Std. Pkg. 4000 Solid Nail-it—N.C.
Less than 1/5 std. pkg	$16.00	$32 00
1/5 to std. pkg	13 60	27 20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500 5½ N.C.	Std. Pkg. 4000 Solid Nail-it—N.C.
Less than 1/5 std. pkg	$13 00	$32.00
1/5 to std. pkg	11 50	27 20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
¼-in. cap key and push sockets	500	$0.33
¼-in. cap keyless socket	500	.30
¼-in. cap pull socket	250	60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List
1/5 std. pkg	10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T	$0 80
60-amp. S. P. S. T	1.20
100-amp. S. P. S. T	2.25
200-amp. S. P. S. T	3.48
300-amp. S. P. S. T	5.34
30-amp. D. P. S. T	1.20
60-amp. D. P. S. T	1.78
100-amp. D. P. S. T	3.38
200-amp. D. P. S. T	5.20
300-amp. D. P. S. T	8 00
30-amp. 3 P. S. T	1 80
60-amp. 3 P. S. T	2.68
100-amp. 3 P. S. T	5.08
200-amp. 3 P. S. T	7 80
300-amp. 3 P. S. T	12.00
Low Grade:	
30-amp. S. P. S. T	$0.42
60-amp. S. P. S. T	.74
100-amp. S. P. S. T	1 50
200-amp. S. P. S. T	2.70
30-amp. D. P. S. T	.68
60-amp. D. P. S. T	1 22
100-amp. D. P. S. T	2 50
200-amp. D. P. S. T	4 50
30-amp. 3 P. S. T	1 02
60-amp. 3 P. S. T	1 84
100-amp. 3 P. S. T	3.76
200-amp. 3 P. S. T	6 76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15% to +10%
$10 to $25 list	2% to 5%
$25 to $50 list	5% to 10%
	Low Grade
Less than $10 list	+5% to list
$10 to $25 list	8% to 15%
$25 to $50 list	15% to 20%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+15%
$10 to $25 list	List to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5%
$10 to $25 list	8%
$25 to $50 list	15% to 16%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0 28
5-amp. single-pole, ind	250	32
10-amp. single-pole	100	.48
10-amp. single-pole, ind	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0 45
10-amp. three-way	50	70
10-amp. double-pole	50	70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	List to 10%
1/5 to std. pkg	10% to 16⅔%
Std. pkg	18% to 25%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 18%	Net
$2.00 to $10.00 list	10% to 28%	5%
$10.00 to $50.00 list	20% to 45%	10%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00 to $6.50
Discount	20% to 25%

CHICAGO

List price	$6.50 to $7.00
Discount	20% to 30%

WIRE, ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.55–$0.66
No. 18, full spools	.53– .56

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0 65 to $0.75
No. 18, full spools	.55 to .635

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$20.00–$25 00	$13.50–$17 00	$12.50–$15.00
12	25.00– 27 09	22 50– 23.22	18.75– 23.22
10	31.26– 32 40	28 66– 32.40	25.00– 27.45
8	43.92– 45 72	40.26– 45.72	35.14– 38 10
6	63 69– 72 36	57 90– 60 30	55.58– 57 88

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$25 00	$18.00–$25 00	$15 50
12	$29 46– 31 44	29 46– 31 44	$25 54– 31 44
10	41 10– 43.84	41 10– 43.84	34 62– 38 36
8	57 00– 61 76	57 00– 61 76	50.18– 54.04
6	85 31– 97 68	85 31– 85 47	77 21– 85 47

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb	$39 75
25 to 50 lb	39 75
50 to 100 lb	38 75

CHICAGO

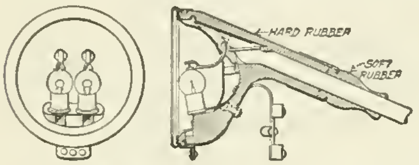
	Per 100 Lb. Net
Less than 25 lb	$39 76 to $41.00
25 to 50 lb	38 76 to 40.00
50 to 100 lb	37.76 to 39 00

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Mine Lamp of Sturdy Construction

The "Wheat" electric mine lamp for use wherever explosive mixtures of gas or dust and air are encountered, or where corrosive atmospheres are prevalent, will be shortly placed upon the market by the Koehler Manufacturing Company, Marlboro, Mass. Comprising a storage battery for belt carriage and a two-bulb reflector lamp fitting the lamp bracket on the customary miner's cap, the outfit weighs slightly over 4 lb. (1.8 kg.) and is strongly constructed to withstand severe service.



EXTRA LAMP PROVIDES FOR EMERGENCY

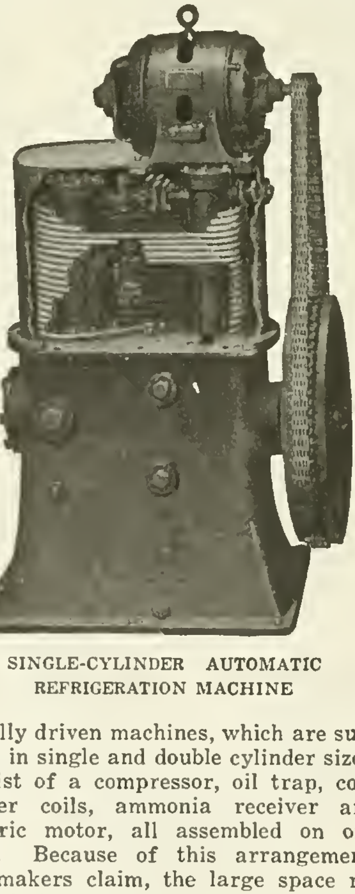
The battery, of the lead acid type, is composed of two cells which are placed in a heavy hard-rubber composition container. While the electrolyte is suitably vented, nevertheless it is claimed that even turning the battery upside down and shaking it violently will not permit so much as a drop to escape. The cells, which each have two positive and three negative plates and a rated capacity of 6 amp., have electrical connections to the cap-lamp cable in the upper position of the battery case. Though this part may be separated from the lower portion, its removal requires the use of a special key spanner. Being attached to the miner's belt at two widely separated points, the weight is evenly distributed.

A feature of the cap lamp is that the hemispherical reflector which spreads light rays over a 7-ft. (2.1-m.) circle at a distance of 20 ft. (12 m.) contains not one bulb but two. These are not both used at the same time, but a special switch allows using either of them so that should the filament of one burn out or the bulb be fractured, the current can be immediately switched on to the other lamp, thus eliminating any possibility of the miner being left in darkness. Should breakage occur, two springs which clamp the base of each bulb in position flip the bulb or its remains out of place and break the electrical contact. This is a safety advantage of no small importance.

The light strength of the lamp is 22 lumens, and the lamp and battery rating is twelve hours' continuous burning when a 4-volt, 0.5-amp. bulb is used. It is said that distilled water need be added to the electrolyte only about once in two weeks. In order to prevent unauthorized tampering with the battery the case is sealed with a small lead seal bearing the lamp inspector's mark and which, though readily cut to provide access to the battery, can be replaced only by him. Another feature pointed out is that the battery can be easily and safely used for firing mine shots.

Compact Unit-Type Automatic Refrigerators

Especially compact automatic refrigerating machines for refrigeration in hotels, stores, factories, large residences, etc., are being marketed by the Peerless Ice Machine Company, 120 Broadway, New York City. These electrically driven machines, which are supplied in single and double cylinder sizes, consist of a compressor, oil trap, condenser coils, ammonia receiver and electric motor, all assembled on one base. Because of this arrangement, the makers claim, the large space required, the multiplicity of parts and the numerous starting and stopping operations which characterize many such machines are improved upon.



SINGLE-CYLINDER AUTOMATIC REFRIGERATION MACHINE

In the smaller size the motor is mounted on top of the water jacket to conserve space and insure proper alignment, while in the double-cylinder type the motor is placed alongside the refrigerating machinery. Chain-belt drive is utilized in both cases to connect the motor to the flywheel of the compressor. Thermostatic control being used, it is said that the machines require no attention except an occasional oiling.

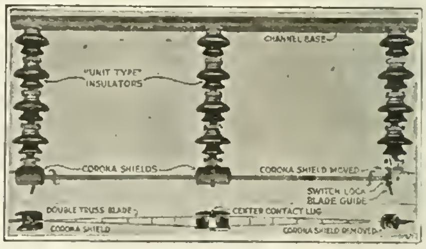
Panelboard Switches

The new panelboard push switch recently produced by the Hart & Hegeman Manufacturing Company, Hartford, Conn., features an unbreakable metal base which does away with breakage expense and inconvenience since no porcelain is used in constructing the switch. The switch mechanism is held in alignment by the base, this being separated from the contact plates by heavy strips of a special insulating composition said to be both unbreakable and unburnable. Because of the contact plates having forks instead of holes for the screws it is pointed out that considerable time and trouble are saved when inserting the screws for fastening the switches to the busbars. The switch cover is of black composition material mounting a card holder for indicating the circuit control.

The spacing of the holding screws on these new switches is 1½ in. (3.8 cm.) on centers each way to meet the standard spacing used by panelboard manufacturers. These spacings are also used in a panelboard switch of the rotary type made by this company.

110,000-Volt Selector Disconnecting Switches

For application to 110,000-volt systems a selector transfer disconnecting switch of the unit type is being manufactured by the Delta-Star Electric Company, 2433 Fulton Street, Chicago. Because the insulating pillars are built up in unit sections, any of them can be easily replaced in case of breakage. The blades are of double-truss form and provided with guides and safety locks, which are equipped with corona shields.



UNIT INSULATORS ARE EASILY REPLACED

Trade Notes

LITTLE PROSPECT OF LABOR SHORTAGE.—In a recent address on labor conditions Nathan A. Smyth, assistant director-general of the United States Employment Service, made the following remarks about the labor supply: "We have to-day a deficit of more than 2,281,000 workingmen. In addition, we must contemplate that an average of about a million men will remain in our army for about a year. About half a million will stay in our newly built shipyards. On the other hand, we have discovered in many places an indication of a widespread purpose among Europeans in this country to go back to the country of their origin as soon as they can. An abnormally high emigration is in sight. Any great inflow of immigrants during the next year does not seem likely. Where is there, then, any possibility of a surplus of labor and reduced wages, unless our industries are palsied and fail to respond with vigor to the unprecedented opportunities which await us?"

IMPORT RESTRICTIONS ON RUBBER LIFTED.—The War Trade Board announces, in a new ruling (W. T. B. R. 414), that all restrictions upon the quantity of crude rubber which may be imported from overseas have been removed. Applications for licenses to import this commodity will now be considered without limit as to quantity. It is also announced that the War Trade Board withdraws the government option price and will require no further undertaking relative to maximum values. Careful consideration has been given to the advisability of eliminating the requirement of guarantees, but it has been found necessary to require these undertakings for the present. This relaxation, however, will not authorize the importation of any shipments of rubber from any country other than the country of origin. Applications for import licenses for such shipments will not be considered until after Feb. 13, 1919. The same policy will be applied to applications for licenses to import shipments of rubber now in the United States which have been made in violation of the regulations.

A FURTHER AID TO AMERICAN INTERESTS IN FOREIGN TRADE.—The Bureau of Foreign and Domestic Commerce is organizing a special statistical-service section for the purpose of furnishing regular monthly tabulations of imports and exports in more detail than is contained in the monthly summary of foreign commerce of the United States. For example, where the monthly summary shows only the total exports of electric lamps, motors and other classes of electrical machinery and appliances, the new service section proposes to make compilations showing the various countries to which shipped. Statements will also be furnished showing details of imports by countries not included in the monthly summary. The demand for more detailed statistics of imports and exports than is possible to show in the publications is unusually heavy at this time, when American manufacturers are preparing to extend the sales of their products in the foreign markets of the world, and it is the aim of the bureau to expand this special service as far as the facilities at its disposal will permit. Trade organizations, trade papers and commercial firms are invited to submit requests for special statistical information, also to make suggestions for the extension of this service.

WESTERN ELECTRIC'S PLAN FOR ABSORBING FORMER EMPLOYEES NOW IN MILITARY SERVICE.—Following is an authorized statement of the plan of the Western Electric Company for reassignment to work of its former employees who are now in the military service: "Former employees who have been given a leave of absence for military service and who have been honorably discharged therefrom, and who desire to again take up work in the company, should make application within thirty days after being mustered out of service. If possible, they will be promptly assigned to work for which their previous experience qualified them, at the rate of pay which others are then being paid for similar work. If it is not possible to assign them to work immediately, they will be placed on a preferred list until such time as business conditions enable the company to place them. During their continuance on this preferred list they will enjoy the same rights with respect to the employees' benefit plan as they had while in the service of the United States, and they may take other employment. When they are notified of a vacancy they should present themselves for work at the time stated, and failing to present themselves for ten days thereafter their leave of absence shall terminate. Before assignment to any work their suitable physical condition for such work must be determined in accordance with the regular routine."

THE FARIES MANUFACTURING COMPANY, Decatur, Ill., has recently equipped the United States government arsenal at Rock Island, Ill., with 825 of its new patented adjustable electric brackets.

J. M. LYON, formerly city sales manager of the Manhattan Electric Supply Company, 17 Park Place, New York, resigned on Dec. 18. On that date the general sales and city sales departments of the Manhattan Electric Supply Company were consolidated, and they are now operated under the direction of K. S. Byrd as sales manager.

THE MILLIKEN BROTHERS MANUFACTURING COMPANY, INC., New York, is now stocking up at its new plant, 136th Street and the East River, preparatory to the installation of machinery and equipment to provide for the production of its various specialties, including electric transmission towers, steel poles, etc. The galvanizing plant will be erected on an adjoining plot.

THE SOLAR ELECTRIC COMPANY, 124-26 West Lake Street, Chicago, announces that it has purchased the entire Flasher business, good will and interest of the Phelps Manufacturing Company of Detroit, and from now on will be the sole manufacturer and distributor of the Phelps motorless flashers, which have been greatly improved. These flashers will be added to the company's line of solar canteen globes for electric advertising signs, special outdoor brackets and weatherproof shade holders.

H. W. CLARKE, who until Dec. 15 had been connected with the advertising service department of the McGraw-Hill Company at Chicago, has been appointed manager of advertising for the Chicago (Ill.) Pneumatic Tool Company. Mr. Clarke has been identified with the engineering advertising field for several years. Prior to his connection with the McGraw-Hill publications he spent eight years with the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., part of the time as a member of the sales and publicity departments and later as Western publicity representative with headquarters at Chicago.

THE FLETCHER ELECTRIC SUPPLY COMPANY, 15 West Seventeenth Street, New York City, has been purchased by Daniel C. Keefe, John M. Lyon and James D. Mills. The new firm was incorporated this month under the name of the Fletcher Supply Company and will occupy the same premises. Mr. Keefe, the president of the new company, and Mr. Lyon, the secretary, were formerly connected for about twenty years with the Manhattan Electric Supply Company, New York City. Mr. Mills, the treasurer of the new concern, was an associate of Mr. Fletcher, whose death was reported in the ELECTRICAL WORLD for Dec. 14. The Fletcher Supply Company will, as formerly, carry on a general electrical supply jobbing business.

Trade Publications

FACTORY BUILDINGS.—A booklet recently issued by the Austin Company of Cleveland has for its subject Austin standard wooden factory buildings.

ELECTRICAL SUPPLIES.—The Canton Engineering & Electric Company of Canton, Ohio, has prepared catalog No. 18, a 606-page publication dealing with electrical supplies.

WATER PUMPS.—Bulletin No. 4094, describing self-priming pumps and water systems for shallow wells, is being distributed by the Fort Wayne Engineering & Manufacturing Company of Fort Wayne, Ind.

POLISHING AND BUFFING LATHE.—Bulletin No. 28 from the Webster & Perks Tool Company, Springfield, Ohio, contains specifications and an illustration of the No. 15 electrically driven polishing and buffing lathe.

SOCKET.—The R-K socket marketed by the R-K Socket Company of Mineral Wells, Tex., is the topic of a folder from this company.

TROUBLE LOCATER.—Paul G. Niehoff & Company, 232 East Ohio Street, Chicago, describe their "Defectometer" in a recently issued folder.

VIBRATOR.—The "Star" vibrator for massaging is the subject of a new sixteen-page booklet of the Fitzgerald Manufacturing Company, Torrington, Conn.

VACUUM CLEANER.—A new folder about the "Thor" vacuum cleaner has been prepared by the Hurley Machine Company, 28 East Jackson Boulevard, Chicago.

WALL-BRACKET FIXTURE.—A folder having for its subject the new "Fifty-Fifty" wall bracket lighting fixture is being distributed by the Lightolier Company, 569 Broadway, New York City.

MOTORS.—Type "H" steel-frame direct-current motors and type "N" squirrel-cage alternating-current motors, which have identical dimensions in the same horsepower capacities, are described and illustrated in a folder published by the B. A. Wesche Electric Company of Cincinnati, Ohio, whose Eastern sales agent is the National Electric & Welding Company, 90 West Street, New York City.

LIGHTING.—The December issue of "Eye Comfort," the National X-Ray Reflector Company's publication, "to aid advocates of good lighting," issued from the company's main offices, 235 West Boulevard, Chicago, contains news of interest to dealers, pages on the Curtis portable adapter, showcase reflectors, floodlighting units and samples of advertisements in trade papers and dealers' literature.

DISH CONVEYOR.—Samuel Olson & Company, 2418 Bloomingdale Avenue, Chicago, have issued a twenty-two-page booklet telling about their "Subveyor," which is an automatic device for use in hotels and restaurants to carry soiled dishes to the dish-washing department and to return clean dishes to floors above. Installations of these elevators in various hotels and restaurants are shown, together with a number of testimonials.

New Incorporations

THE TOLINER ELECTRIC COMPANY of Brooklyn, N. Y., has been incorporated with a capital stock of $15,000, by J. D. Christie, D. W. von Bremen and J. D. Miller, 215 Montague Street, Brooklyn.

THE TIDEWATER TIRE & ELECTRIC CORPORATION of Norfolk, Va., has been chartered with a capital stock of $25,000 by J. W. H. Greene and Seemes Chapman. The company proposes to manufacture tires and other specialties.

THE ELECTRIC BRAZING & WELDING MACHINE COMPANY of New York, N. Y., has been incorporated by A. M. Sheard, J. M. Vincent and E. M. Simon, 1228 Halsey Street, Brooklyn, N. Y. The company is capitalized at $5,000.

THE SELSON ENGINEERING COMPANY of New York, N. Y., has been incorporated by O. Ruprecht, F. W. Wearin and G. Kohn, 24 Stone Street, New York, N. Y. The company is capitalized at $5,000 and proposes to deal in machinery and electrical equipment.

THE FAIRFIELD (ALA.) UTILITIES COMPANY has been organized with a capital stock of $50,000 for the purpose of operating electric and gas plants and street railway lines in Fairfield. George Gordon Crawford is president, N. C. Ryding vice president, and L. T. Beecher secretary and treasurer.

THE NEW YORK INSULATION COMPANY of Brooklyn, N. Y., has been incorporated by J. J. M. and J. Sullivan, 482 Tompkins Avenue, Brooklyn. The company is capitalized at $10,000, and proposes to manufacture machinery for the production of flange joints, asbestos specialties for insulation, etc.

THE SIMPLEX CLOTH CUTTING MACHINE COMPANY of New York, N. Y., has been chartered with a capital stock of $50,000 to manufacture electrical cloth-cutting machines. The incorporators are: M. Zawistowski, 422 East Third Street, Brooklyn, N. Y.; M. Finkelstein, 1153 Longfellow Avenue, and N. Obedin, 1145 Longfellow Avenue the Bronx

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

New England States

CAMBRIDGE, MASS. — Contract has been awarded by the Lever Brothers Company, 176 Broadway, for addition to its factory, to the Stone & Webster Company, 147 Milk Street, Boston. The cost is estimated at $500,000.

NEW BEDFORD, MASS.—Work has begun on the erection of a new transformer station at the plant of the Whitman Mill Corporation.

WEST DUDLEY, MASS.—The Burmus Paper Company is contemplating the construction of power house and dam, to cost about $50,000.

Middle Atlantic States

ALBANY, N. Y.—Bids will be received at the office of W. W. Wotherspoon, Superintendent of Public Works, Capitol, Albany, until Jan. 14, for furnishing and installing under terminal contract No. 102, two 3-ton electric semi-portal revolving jib cranes on Pier 6, East River, New York City. Plans may be seen and other information obtained at the above office, at the office of the assistant superintendent of public works for the Middle Division at Syracuse, N. Y., at the office of the assistant superintendent of the Western Division at Rochester, N. Y., and at the canal office, Spaulding's Exchange, Buffalo, N. Y.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company has been awarded a contract for lighting the streets and public buildings in Binghamton for a period of five years, at a minimum rate of $7,000 per year.

BROOKLYN, N. Y.—The stockholders of the Kings County Electric Light & Power Company have approved the proposition to change the name of the company to the Brooklyn Edison Company. The Edison Electric Illuminating Company of Brooklyn, the operating company controlled by the Kings County company, will be merged into the new company. The resolution passed by the directors to create a blanket mortgage, which is not to exceed $11,000,000 at any time, has also been approved. The company has asked the Public Service Commission for permission to issue $6,000,000 of bonds, the proceeds to be used to pay off outstanding indebtedness amounting to $4,000,000 for extensions and improvements already made to the property. Further improvements are contemplated with part of the balance.

BUFFALO, N. Y—The Marine Elevator Company, Chamber of Commerce Building, is reported to be considering plans for the construction of a new grain elevator on Buffalo River, to cost from $500,000 to $1,000,000.

NEW YORK, N. Y.—Steps have been taken by the Broadway Association for improvements to the street-lighting system.

NEW YORK, N. Y.—The contract for underground conduit work at the plant of the Pouch Terminal Company, Clifton, Staten Island, has been awarded to the Barney-Ahlers Construction Company, 110 West Fortieth Street, New York City.

NEW YORK, N. Y.—Plans are being prepared for the erection of a new hospital by the Diagnosis Clinics of the Academy of Diagnosis at 125 West Seventy-second Street, to cost about $250,000. Considerable electrical equipment and appliances will be installed.

NIAGARA FALLS, N. Y.—The Public Service Commission has granted the Niagara Falls Power Company permission to issue $2,000,000 in bonds, under a mortgage executed by the Hydraulic Power Company, the proceeds to be used for extensions and improvements. The company proposes to build an addition to power house No. 3 and install new electric generating and hydraulic machinery.

TROY, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 14, for additional conduit and wiring and lighting fixtures in the United States post office, courthouse building, etc., at Troy, N. Y. For details see Searchlight Section.

UTICA, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 14, for extensions to conduit and wiring, lighting fixtures, etc., in the United States post office, custom house and court house, Utica, N. Y. For details see Searchlight Section.

JERSEY CITY, N. J.—Bids will be received by the Boulevard Commissioners, Court House, Jersey City, until Jan. 3, for 100,000 ft. of copper-coated round carbons, ½ in. by 12 in. John J. O'Connor is acting clerk.

CARLISLE, PA.—Plans are under consideration by E. C. Beetam & Son for the erection of a power plant, 50 ft. by 70 ft., at their carpet manufacturing plant, to cost about $50,000.

FORTY FORT, PA.—Plans have been prepared by the International Fabricating Corporation of Wilkes-Barre for the construction of an addition to its works, 50 ft. by 160 ft., at Forty Fort, to cost about $60,000.

HARRISBURG, PA. — Application has been made to the Public Service Commission by various utility companies for permission to issue additional capital stock or bonds as follows: The Philadelphia Electric Company, $1,500,000 in bonds; the Metropolitan Edison Company of Reading, $119,000; the Mahoning & Shenango Railway & Light Company of New Castle, $550,000 in bonds; the Citizens' Light & Power Company of Oil City, $51,000 in bonds; the Citizens' Traction Company of Oil City, $43,000 in bonds; the Christiana & Coatesville Street Railway Company of Lancaster, $35,000 in stock, and the East Pennsylvania Gas & Electric Company of Scranton, $100,000 in capital stock.

PHILADELPHIA, PA. — Specifications recently isued by the Pennsylvania Railroad Company for cranes include one 5-ton, 28-ft.-lift, 44-ft.-span electric gantry crane for ash-pit service; one 10-ton, three-motor, 20-ft.-lift, 60-ft.-span overhead traveling crane; one 5-ton, three-motor, 20-ft., 28-ft. span crane, and one 5-ton, three-motor, 29-ft.-lift, 59½-ft.-span crane.

PITTSBURGH, PA.—Plans have been filed by the Carbon Steel Company of Pittsburgh for the erection of a machine shop and mill, one story, to cost about $89,300, and mill building, to cost $41,500. Arrangements are also being made by the company for construction of a third mill building, to cost about $31,300.

CHARLESTON, W. VA.—The Kanawha Collieries Company, National Bank Building, is planning to install additional power-plant equipment.

CHARLESTON, W. VA.—Improvements are contemplated by the Snow Hill Coal Company to its properties, including the installation of electrical machinery. W. T. George of Phillippi is president.

ELKINS, W. VA.—Plans are under consideration by the Elkins Box Company for rebuilding its plant, recently destroyed by fire. The loss is estimated at $150,000.

GILMERTON, VA.—The Virginian Railway Company is planning to install automatic block signals on its railway between Gilmerton and Sewall's Point, a distance of 12 miles. The plans call for two electric interlockings plants and one interlocking plant with power signals. H. Fernstrom of Norfolk is chief engineer.

NORFOLK, VA.—The Norfolk-Hampton Roads Dry Dock & Ship Repair Corporation, recently organized with a capital stock of $7,000,000, is reported to have purchased a site in this vicinity for its proposed plant. The buildings will include machine shops, foundry, general construction and repair shops as well as a large drydock of 15,000 tons capacity. A second drydock of the same capacity is also contemplated. J. B. Morgan is president and O. B. Woodridge is secretary and treasurer.

HAMPTON ROADS, VA.—The Port and Harbor Facilities Commission of Washington, D. C., is considering the installation of eleven coal-handling or bunkering machines, each with a capacity of 75 tons, at Hampton Roads.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 30, under Specification 3632, for construction of addition to the power plant at the navy yard at New York, to cost about $175,000.

WASHINGTON, D. C.—The construction of a new power plant at the naval magazine work, New York Harbor, to cost about $150,000, is under consideration by the Bureau of Yards and Docks, Navy Department. Plans are also being prepared by the Bureau of Yards and Docks for the erection of a naval aircraft station, with aëroplane shop and construction buildings on Long Island, N. Y., to cost about $800,000.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Eastern and Western yards, until Jan. 7, Schedule 3567—miscellaneous dry cells; Schedule 3572—miscellaneous insulating tape. Bids will also be received in the near future for the following: Eastern and Western yards, Schedule 3591—steel sockets. Philadelphia, Schedule 7526½—six single-phase transformers; Schedule 7544½—50 signaling searchlights; Schedule 7550½—15 gasoline generator sets, f.o.b. works; Schedule 7533½—miscellaneous gas engines and spares. Brooklyn, Schedule 7538½—lead-covered wire. Mare Island, Schedule 7555½—13,000 ft. conduit pipe and miscellaneous steel pipe. Puget Sound, Schedule 7583½—15,000 ft. incandescent lamp cord and a miscellaneous quantity of single-conductor wire. Applications for proposal blanks should designate the schedule by number.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Various, Schedule 3579—miscellaneous direct-current ammeters; miscellaneous fuse blocks, miscellaneous fuse terminal clips and blocks, carbon plate, 12 in. by 12 in., miscellaneous ferrule contact fuse clips, miscellaneous 4-amp. glass-tube fuses, link fuses, magneto testing generators, miscellaneous portable ventilating sets, miscellaneous back-connected knife switches; Schedule 3581—miscellaneous vibrating bells, portable firing salvo buzzers, watertight buzzers; Schedule 3585—540 repectacle caps, miscellaneous arc-lamp carbons, unglazed porcelain cleats, combination plug and switch cut-outs, plug-type inclosed fuses, shade holders, porcelain knobs, Edison base attachment plugs, fuseless cleat rosettes, incandescent lamp, sockets, indicating snap switches; Schedule 3577—round-rod white horn fiber, hard insulating fiber, yellow oiled insulating muslin, copper-covered insulated staples, varnished-cambric insulating tape, varnished silk taps, copper cable terminals. Schedule 3580—miscellaneous non-water-tight portable guards, desk-type electric heaters, electric soldering irons, lanterns, steel angle reflectors, telephone testing sets. Puget Sound, Wash., Schedule 3578—100 portable tube blinkers. Norfolk, Va., Schedule 3548—miscellaneous plain double-conductor telephone cord; Schedule 3578—searchlight mirrors. Charleston, S. C., Schedule 3585—wall-type receptacles. Philadelphia, Pa., Schedule 3585—1000 Hubbell receptacles or bases, miscellaneous reflectors, key and keyless brass sockets, porcelain base entrance switches, push-button switches; Schedule 3577—1000 rolls oiled muslin tape. Boston, Mass. Schedule 3580, 4000 rubber illuminating set socket rings. Eastern and Western navy yards, Schedule 3548—miscellaneous bell cord telephone cable, lighting and power and bell wire; Schedule 3551—miscellaneous hard-dawn copper; Schedule 3577—hard-rubber tubing, hard-rubber rod, insulating muslin, insulating fiber cable terminals, insulating fish paper, asbestos sleeving, insulated staples, insulating tape, silk and muslin, soldering paste and white horn fiber; Schedule 3578—searchlight strips, storage-battery testing outfits, searchlight mirrors, lantern lenses and 100 portable blinkers; Schedule 3579—knife switches, fuse blocks, two blink fuses, ventilating sets, ferrule fuse clips, plate carbon, blocks and clips, direct-current ammeters and testing generators; Schedule 3580—lanterns, soldering and flat, telephone testing sets, 4000 socket rings, steel reflectors, electric heaters and portable guards; Schedule 3581—vibrating bells and watertight buzzers; Schedule 3585—540 receptacle caps, miscellaneous arc-lamp carbons, porcelain cleats, combination cut-outs, shade holders, porcelain knobs, attachment plugs, 1200 wall-tight receptacles, 1000 receptacles in bases, miscellaneous reflectors, cleat rosettes, brass sockets, push-button entrance switches, indicating snaps, porcelain tubes, inclosed fuses, miscellaneous incandescent-lamp sockets and snap switches. Washington, Schedule 7440½—miscellaneous buzzer instruction sets. Norfolk, Schedule 7451½—miscellaneous motor-generators. Alexandria, Va., Schedule 7461½—two 3-ton cranes. Brooklyn, Schedule 7465½—30,000 ft. interior cable; Schedule 7488½—1000 porcelain insulators. Boston, Schedule 7466½—3,950,000 ft. antenna wire. Boston, Norfolk, and Mare Island, Schedule 7475½—searchlight carbons. Philadelphia, Schedule 7492½—2000 spools of copper wire. Applications for proposal blanks should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: Newport, Specification 3250—widening and lighting slips. Hampton Roads, Specification 3300—coal-handling machinery; Specification 3328—mechanical equipment; Specification 3645—automatic telephone extension. Pensacola, Fla., Specification 3389—power-plant improvements. Boston, Mass., Specification 3477—electric traveling crane for extension to machine shop and foundry building No. 2. Mare Island, Specification 3561—electric storehouse, bids to be opened at the yard. Brooklyn, N. Y., Specification 3599—elevator and dumbwaiter in building D. Montauk, L. I., Specification 3615—siren fire-alarm system, bids to be opened at the yard. Bay Shore, L. I., Specification 3616—siren fire-alarm system, bids to be opened at the yard. New York, Specification 3632—extension to power plant; Specification 3679—electric freight elevator; Specification 3680—electric crane for shipbuilding slip No. 2. New Orleans, La., Specification 3635—electric freight elevator. Bellevue, D. C., Specification 3640—electric traveling crane. Bay Ridge, N. Y., Specification 3695—fire-alarm system. Indian Head, Specification 3710—electric gantry crane. Rockaway, N. Y., Specification 3711—underground electric distributing system. Application for proposal blanks should designate the schedule desired by number.

North Central States

MARQUETTE, MICH.—The Cleveland-Cliffs Iron Works of Cleveland is contemplating the construction of a new hydroelectric power plant in connection with its properties in this vicinity.

AKRON, OHIO.—The B. F. Goodrich Company, Cherry and Canal Streets, has engaged Griggs & Meyers, engineers, 110 West Fortieth Street, New York, N. Y., to prepare plans for alterations to power plant, including the installation of new equipment, etc., to cost about $750,000.

GALESBURG, ILL.—Bids will be received by William L. Boutelle, city clerk, Galesburg, until Jan. 2, for a deep-well pumping unit. Further information may be obtained at the office of F. M. Connolly, city engineer.

JOLIET, ILL.—The local power house of the Public Service Company of Northern Illinois is reported to have been destroyed by fire recently.

NEENAH, WIS.—The Hewitt Machine Company of Neenah has acquired the Jamieson water-power property and, it is understood, will develop it further to supply power for the Hewitt plant.

RACINE, WIS.—Preparations are being made by the Perfex Radiator Company for the construction of a new plant at Eighteenth Street and Flett Avenue, to cost about $100,000. Contracts, it is reported, will be awarded immediately after Jan. 1. The company manufactures automobile, truck and tractor radiators and cooling systems.

WEST ALLIS, WIS.—Bids will soon be taken by Robert A. Messmer & Brother, Majestic Building, Milwaukee, architects, for the construction of a new high school building in West Allis. The building will cost about $280,000, and will contain an auditorium, swimming pool, gymnasium and manual training department.

WEGDAHL, MINN.—The farmers in the vicinity of Wegdahl have petitioned the Northern States Power Co. of Montevideo to furnish electrical service. They have offered to pay the cost if necessary.

ST. LOUIS, MO.—The War Department has issued orders for abandonment of work on construction of the ammunition plants of the Laclede Gas Light Company, at Broadway and Manchester Street.

SUMNER, MO.—The Sumner Electric Company, it is reported, contemplates the erection of a 12-mile electric transmission line next summer. The company is now building a line to Forker, a distance of 12 miles. A. Stobaugh is manager.

HILLSBORO, KAN.—Plans are being prepared for the erection of a college building at Tabor College, to cost about $100,000, for which bids will be asked about the middle of January. Heating, electric wiring and plumbing work has been postponed until spring.

PRATT, KAN.—Bids will be received by the Board of Education of Pratt until Jan. 6 (extension of date from Dec. 19) for construction of high-school building, including heating, electric wiring, fan ventilating, etc. The cost of the building is estimated at $175,000.

Southern States

CHARLESTON, S. C.—The contract for electric wiring of the Young Women's Association Building has been awarded to the Electric Supply Company of Charleston. The cost of the building is estimated at $91,000.

BUNNELL, FLA.—Contract has been awarded by the City Council to Fairbanks, Morse & Company of Atlanta, Ga., for the installation of an alternating-current street-lighting system to replace the present direct-current system.

CRESCENT CITY, FLA.—Fairbanks, Morse & Company of Atlanta, Ga., have been awarded contract by the City Council for the installation of a complete electric light plant, to include pole transformers. The cost is estimated at $12,000.

LITTLE ROCK, ARK.—The Little Rock Railway & Electric Company, it is understood, has purchased a 5000-kw. turbine for its power plant. C. J. Griffith is general manager.

KURTHWOOD, LA.—The Vernon Parish Lumber Company is planning to begin construction work in January on its proposed lumber plant to develop about 1700 acres of timber land, which will include saw and planing mills, single cutting band-saws for timbers, steam dry kilns, etc. The development of a townsite is also included in the project. The company is capitalized at $600,000. J. H. Kurthwood, Jr., of Kurthwood, is president and general manager. Post office address, Pawnee, La.

COVINGTON, OKLA.—Plans are under consideration by City Council for the installation of electric plant, waterworks and sewer systems in Covington. An election will probably be called soon to vote on an issue of $40,000 in bonds for the proposed work.

POTEAU, OKLA.—Bids will be received at the office of the city clerk, Poteau, until Jan. 31, 1919, for construction of waterworks system and filter plant, consisting of one pumping station, one filter house, one sedimentation basin, one pure-water reservoir, two 100-hp. boilers, two high-service pumping engines, three steam engines or turbine-driven centrifugal pumping units, two duplex boiler-feed pumps, steam and water piping, filter equipment for two tanks, one concrete overfall dam, 3½ miles of cast-iron pipe, valves and hydrants. Plans and specifications are on file at the office of the city clerk, Poteau, or may be obtained from J. E. Davis, engineer, Poteau, upon deposit of $10.

BROWNWOOD, TEX.—The construction of an irrigation system, including the construction of a dam across Canadian River and installing pumping plants to irrigate several thousand acres, is being promoted by the Dickerson-Tanner-Whaley Company.

DALLAS, TEX.—Plans are under consideration by the Dallas Motor Car Company for rebuilding its plant, recently destroyed by fire. The loss is estimated at about $150,000.

DALLAS, TEX.—Permission has been granted the Dallas Power & Light Company to purchase the property of the Carroll Electric Company, which operates a small local plant.

GALVESTON, TEX.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 30, for erection of shops and industrial building. The cost is estimated at $270,000.

Pacific and Mountain States

FOSSIL, ORE.—Steps have been taken by local business men for the installation of an electric lighting plant at Fossil. An option has been taken on the mill property and old light plant of J. A. Miller. A new 75-hp. engine will be purchased to replace the old steam engine.

ALAMEDA, CAL.—Application has been made by the Alameda Sugar Company and the Alameda Farms Company to the State Water Commission for permission to appropriate water from the Sacramento River in Sutter County for the irrigation of 7600 acres of land. It is proposed to install pumping plants at three different places and to connect the three plants. The cost of the work is estimated at $287,000.

BRANDY CITY, CAL.—The Brandy City Mining Company is contemplating the construction of a large dam on the North Yuba River, below Bullard's Bar. The proposed dam will be 150 ft. high and will back up water for a distance of several miles. A large power plant will be erected near the dam to supply electricity to operate the machinery in the mines.

FRESNO, CAL.—Surveys are being made in the mountains for the San Joaquin Light & Power Company with a view of preparing for after-war activity.

FRESNO, CAL.—The Pacific Gas & Electric Company of San Francisco is planning to erect a new forge and blacksmith shop at its local gas works, recently completed. A new pump house will also be built.

LOS ANGELES, CAL.—Arrangements have been made by the Water Department for an appropriation of $500,000 for extensions and improvements to the municipal water system. The proposed plans provide for the installation of two electrically operated pumping plants at the city stations; the completion of the Haiwee power plant at the Haiwee reservoir, to consist of a hydroelectric generating station, to cost $65,000; construction work at the San Fernando and Charsworth reservoirs, to cost about $140,000, and other extensions. William Mulholland is chief engineer.

PALO, ALTO., CAL.—The Board of Public Works has instructed the city engineer to proceed with the work of installing street lamps in South Palo Alto.

RIVERSIDE, CAL.—Plans are under consideration by the Southern Sierras Power Company of Riverside for extensions to its various hydroelectric plant at Birch Creek, Inyo Canyon, to cost about $85,000. The company operates five generating stations in this locality.

SAN FRANCISCO, CAL.—The Pitt River Power Company of San Francisco, recently incorporated with a capital stock of $2,500,000, has acquired rights on the Pitt River below the Big Bend, or the Pacific Gas & Electric Company's site, and is now making surveys and soundings. The proposed plans include the construction of two multiple-arch dams across the river about 12 miles apart, each 200 ft. high. The first dam will be located about a mile above Sheep Rocks at a site reported on in 1914 by the United States Reclamation Service. The power house will be built inside the dam and will be equipped with two 16,000-kw. generators. Generating units of the same rating are to be installed later at the other site, making the total development 64,000 kw. The use to which the power will be put has not yet been announced.

FLORENCE, ARIZ.—Plans are under consideration by the City Council for improvements to the waterworks and lighting systems, to cost about $80,000.

JULESBURG, COL.—Bonds to the amount of $100,000 have been sold for the installation of a municipal electric light plant. Bids, it is understood, will soon be asked for construction of same. The Henningson Engineering Company, 1122 Farnam Street, Omaha, Neb., is engineer.

Canada

VICTORIA, B. C.—Work, it is understood, will soon be started on the construction of shipyards and machine shop for the Victoria Machinery Depot, 343 Bay Street, Victoria, to cost about $350,000.

HALIFAX, N. S.—Contract has been awarded to the Bedford Construction Company of Halifax for the construction of a new power house for the Halifax Shipyards, Ltd., Barrington Street, to cost about $60,000.

ALVINSTON, ONT.—The Town Council is considering the purchase of the plant of the Alvinston Power Company. If taken over by the municipality, improvements will be made to the system.

SHAWINIGAN FALLS, QUE.—The plant of the Canadian Electric Products, Ltd., on Transmission Avenue, was recently destroyed by fire, causing a loss of about $150,000.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until Jan. 13, for furnishing steel, pipe, bronze, steel cable, copper wire, monel metal solder etc. Blanks and further information relating to this circular (1248) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York City; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal

Record of Electrical Patents

Notes on United States Patents

(Issued Nov. 19, 1918)

1,284,982. Process and Apparatus for Producing and Stimulating Rainfall; John G. Balsillie, Melbourne, Victoria, Australia. App. filed Dec. 23, 1916. The potential gradient between earth and atmospheric zones and clouds is diminished or canceled, producing or stimulating rainfall.

1,284,996. Semi-Automatic Telephone-Exchange System; Frank R. McBerry, Antwerp, Belgium. App. filed Sept. 13, 1912. The extension of the desired connection from a calling line to a called line is accomplished by automatic selector switches under the control of an operator at the central or switching station.

1,285,006. Section Insulator; Glenn H. Bolus, Mansfield, Ohio. App. filed Dec. 20, 1917. For dividing the overhead conductor or trolley wire of an electric railway into sections and insulating the sections one from the other.

1,285,012. Electric Conducting Cable or Wire; Carl P. Brodhun, Wilkes-Barre, Pa. App. filed April 16, 1917. To make it impossible for the insulating material to slip or work loose.

1,285,013. Electric Heater for Automobile Radiators; Jewell D. Browder, Jr., Canadian, Okla. App. filed Dec. 20, 1917. Also prevents water from freezing in elevated water tanks.

1,285,049. Machine Recorder; Peter A. Cooney, Chicago, Ill. App. filed Oct. 5, 1910. For indicating amount of time during which machines in a factory are occupied in productive work and the time they are idle.

1,285,052. Electric Traffic Indicator; Thomas W. Crisman and Alexander G. Brehm, Hastings, Neb. App. filed April 27, 1917. Signal is given both by signal lights and by a movable indicating member.

1,285,054. Electric Battery; Harry F. French and Raymond C. Benner, Fremont, Ohio. App. filed June 6, 1916. Consists of copper oxide and zinc electrodes and an electrolyte containing hydroxides of sodium and ammonium.

1,285,070. System of Control; John V. Dobson, Wilkinsburg, Pa. App. filed July 22, 1915. To be employed in connection with alternating-current motors of the compensated commutator type.

1,285,072. Push-Button Snap Switch; Harry A. Douglas, Bronson, Mich. App. filed April 4, 1917. Aims at simplified construction.

1,285,098. Means for Displaying Illuminated Words or Characters; John R. Flannery and Ethan L. Dodds, Pittsburgh, Pa. App. filed Oct. 5, 1917, Illuminated words or characters caused to appear in the dark and maintain their luminosity for an appreciable length of time without necessity for the employment of electrically controlled switch devices.

1,285,138. Flexible Electrical Conduit; Hans Hansen, Brooklyn, N. Y. App. filed March 9, 1916. Non-metallic yet non-collapsible and non-extensible, and having a smooth interior surface.

1,285,145. Indicator; Fred H. Harrington and Stephen E. Buck, Moline, Ill. App. filed July 26, 1917. For indicating the amount of liquid contained in receptacle.

1,285,160. Motor-Control System; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed June 11, 1915. For single-phase alternating-current motors of the compensated doubly fed type.

1,285,161. System of Control; Rudolf E Hellmund, Pittsburgh, Pa. App. filed Sept. 9, 1915. Relates to phase-advancing means for regulating the power factors of polyphase induction motors and distributing systems.

1,285,167. Electric Starter; William T. Hensley, Bound Brook, and Charles W. Urban, Westfield, N. J. App. filed April 13, 1914. For internal-combustion engines employed on automobiles, motorboats, etc.

1,285,172. Switch; James T. Hickey, Raritan, and John Schneider, Elizabeth, N. J. App. filed May 26, 1916. For control of high-tension electric currents and by means of which circuits carrying such currents may be broken in the open air and the ensuing spark harmlessly dissipated.

1,285,196. Sanitary Closure for Telephone Mouthpieces; Orion D. W. Inman, Beloit, Wis. App. filed May 3, 1917. To disinfect and fumigate mouthpiece.

1,285,199. Vacuum-Operated Make-and-Break Spark Plug; Herbert G. Irwin, Spur, Tex. App. filed Dec. 3, 1917. By the varying impulses imparted to the piston incident to the vacuum formed in the engine the sparking of the plug is regulated to the work required.

1,285,215. Method of and Apparatus for Controlling the Resistance of an X-Ray Tube; Edwin W. Kelly, Philadelphia, Pa. App. filed Dec. 26, 1913. Raising body with tube to a temperature causing emission of corpuscles for increasing the conductivity of main path.

1,285,223. Switch; Edward J. Kilmer, Corpus Christi, Tex. App. filed Jan. 3, 1918. A multiple-point switch for use in a lamp-socket plug that contains a number of bulbs.

1,285,243. Electric Pocket Lamp; Emil Kuhn-Frei, Zurich, Switzerland. App. filed April 7, 1916. A spring-driven dynamo replaces a galvanic battery.

1,285,246. Apparatus for Electrically Controlling Air Brakes; Eldridge I. La Count, Worcester, Mass. App. filed Oct. 11, 1916. One of the objects is to provide a manually operated valve for cutting out the automatic control system from the regular air-brake equipment.

1,285,264. Registering Device; George A. Long, Hartford, Conn. App. filed Feb. 24, 1916. Of special utility when used with a telephone for registering the calls transmitted from a subscriber's station.

1,285,278. Special-Service System for Machine-Telephone Switching Exchange; Frank R. McBerty and Lipa Polinkowsky, London, England. App. filed March 19, 1917. The repetition of busy calls may be provided for in an efficient and expeditious manner.

1,285,283. Roentgenoscope; Theodore B. McClintock, Chicago, Ill. App. filed Jan. 25, 1915. For facilitating fluroscopic examination of the human body.

1,285,293. Lamp Socket; William S. MacLewee, Yardley, Pa. App. filed Feb. 12, 1916. Having means for locking the two parts of the metal shell together.

1,285,303. Storage Battery; John P. Mentzer, Chicago, Ill. App. filed Jan. 14, 1918. Of "dry" type and having separaters composed of kieselguhr combined with calcium sulphate and fiber.

1,285,305. Electrolytic Apparatus Employing Filmed Electrodes; Ralph D. Bershon and John S. Riddile, New York, N. Y. App. filed Dec. 14, 1910. To minimize film deterioration.

1,285,319. Process and Apparatus for Charging Storage Batteries; Thomas Spencer, Philadelphia, Pa. App. filed Sept. 30, 1916. To charge batteries with minimum energy waste and attention.

1,285,349. Electric Switch; Henry T. Paiste, Philadelphia, Pa. App. filed Nov. 12, 1914. To reduce friction between moving parts.

1,285,359. Ignition Magneto for Four-Cylinder Internal-Combustion Engines; Raoul A. Persin, Villiers le Bel, France. App. filed July 25, 1917. Two sparking plugs into which current is passed simultaneously by the distributer are fed by two distinct secondary circuits, and the spark produced at each of these plugs has its maximum intensity.

1,285,361. Emergency Electric Lamp Socket; James E. Pettibone, St. Louis, Mo. App. filed June 15, 1917. To be easily and quickly applied to strands of current-carrying wires without removing the insulation and without involving use of insulating tape.

1,285,363. Carbon and Method of Recovering Same from the Waste Product of Oil-Cracking; Robert D. Pike, San Francisco, Cal. App. filed July 25, 1916. Impurities eliminated by washing and roasting, leaving carbon in powdered form.

1,285,369. Electroplating Apparatus; Louis Potthoff, Flushing, N. Y. App. filed Jan. 31, 1916. To confine plating currents to useful paths, avoiding current leakage and the undesirable plating of parts of the apparatus itself.

1,285,371. Traction Signal for Automobiles; Russell C. Powell and Olive R. Faith, New Kensington, Pa. App. filed Dec. 1, 1915. Electrically operated direction indicator.

1,285,398. Electrical Conductor and Mounting Same in Electrical Apparatus; Reinhold Rudenberg, Berling-Westend, Germany. App. filed Sept. 18, 1913. For cooling the stator of high-voltage dynamos by using hollow conductors.

1,285,427. Adjustable Lamp Socket; Oscar M. Sheck, Cleveland, Ohio. App. filed July 7, 1917. Lamp may be given a partial turn in the socket to bring the filament to the desired position and the operative contact retained.

1,285,459. Signal Apparatus; John E. Sullivan, Covington, Ky. App. filed Dec. 14, 1916. Audible and visible direction indicator illuminates license number and also roadway in backward movement of automobile.

1,285,498. Relay; Herbert A. Wallace, Pittsburgh, Pa. App. filed June 23, 1914. For use with railway signaling apparatus.

1,285,553. Illuminating Oil Can; William G. Bateman, Scranton, Pa. App. filed Aug. 19, 1918. Electric circuit is closed before opening valve permitting flow of oil.

(Issued Nov. 26, 1918)

1,285,576. Telephone Switchboard; Chester C. Aller and Ole Bekkedahl, Portal, N. D. App. filed Nov. 8, 1917. To provide a simple and effective circuit arrangement of the common-battery switchboard type adapted for use in small city and town systems to replace the usual magneto system.

1,285,596. Electric Burglar Alarm; Bernhardt Beck, Cut Bank, Mont. App. filed March 9, 1918. Will cause a signal to be given whenever a key is inserted in the door lock.

1,285,619. Electrical Heater for Carburetors; Wilbur A. Carter, Detroit, Mich. App. filed July 26, 1918. For heating by the generation of eddy currents electrically induced in an iron core surrounding the carburetor.

1,285,625. Protective Device for Motor Controllers and Starters; Allan J. Cline, Chicago, Ill. App. filed Jan. 8, 1917. To prevent damage from accidental grounding of control circuit in remote-contact systems.

1,285,653. Ignition Device; Albert Erickson, Chicago, Ill. App. filed Jan. 2, 1918. The rotor shaft and the actuating trip lever are both moved by a torsional spring.

1,285,658. Storage Battery; Bruce Ford, Philadelphia, Pa. App. filed May 19, 1915. Means to indicate when the jar or container has been sufficiently filled.

1,285,659. Storage Battery Ventilation for Submarines; Bruce Ford, Philadelphia, Pa. App. filed March 20, 1916. Interior of submarine is automatically kept free from battery vapors or gases.

1,285,660. Secondary or Storage Battery; Bruce Ford, Philadelphia, Pa. App. filed April 4, 1918. To minimize leakage between cells of a multiple voltage battery and at the same time to provide sufficient mechanical strength.

1,285,675. Electric Switch; Robert A. Gally, Cincinnati, Ohio. App. filed Sept. 7, 1917. A three-position switch control of one electric line.

1,285,690. Process for the Treatment of Ores and Solid Salts by Electrochemical Reduction; Adrien A. M. Hanriot, Paris, France. App. filed May 18, 1914. Treatment may be applied directly to the ore.

1,285,698. System of Control; Rudolf E. Hellmund, Swissvale, Pa. App. filed Sept. 13, 1916. For induction motors which may be employed from time to time as recuperative generators.

1,285,707. Trolley Support; Henry Holland, Cleveland, Ohio. App. filed Oct. 6, 1913. Employing an oscillatory frame to which the trolley pole is connected so as to be pivotal on alternative axes.

1,285,739. Switching Socket; George C. Knauff, Chicago, Ill. App. filed Jan. 15, 1917. For connecting and disconnecting the circuit in a double-pole socket or connector.

1,285,786. Contact Arm for Voltage Regulators; John D. Nies, St. Charles, Ill. App. filed Sept. 10, 1917. To prevent arm from bridging two adjacent contacts in alternating current rheostats.

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